"STUDY OF AIR QUALITY ON KATRAJ CHOWK TO NAVALE BRIDGE: THE OLD DEHU KATRAJ STRETCH"

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Abstract- *Outdoor air pollution is attributed to 3.2 million premature deaths worldwide and is one of the top ten health threats. Outdoor air pollution is primarily caused by motorised transportation. The sum of sulphur and nitrogen oxides, carbon dioxide and monoxide, ozone gases, and dust up to 2.5 microns in size are all used to assess air quality. For the entire month of March 2020, the PM10 concentration was above 100g/m3 at all of the tracked locations for a period of 24 hours. For the entire 24 hour period, the concentration of SO2 and NO2 pollutants is less than 80 G/m 3. Pune is located on a high ridge, and it has a unique natural beauty and a diverse biodiversity. Pune is located on the lower side of the Sahyadri mountain range and the Western Ghats, at 560 metres above sea level.*

Keywords- AIR QUALITY, NAVALE BRIDGE, vehicular density, High Volume Sampler

I. INTRODUCTION

Exposure to outdoor air pollution is related with 3.2 million early deaths globally and is among the top ten health risks worldwide. Motorized transportation is a major source of outdoor airpollution. The impact of global air pollution on climate and the environment is a new concern in atmospheric science. Pune is an important city in the state of Maharashtra in the western part of Maharashtra on the banks of two rivers, Mula and Mutha and is the administrative headquarters of Pune district. After Mumbai, Pune in Maharashtra is a leader in Maharashtra in terms of civic amenities and development.

Geographical information of Pune city

Pune city is 560 m above sea level on the lower side of Sahyadri mountain range and Western Ghats. The city of Pune is situated on a high place and the city has a unique natural beauty and rich biodiversity. The two rivers of the city are Pavana and Indrayani these two rivers flow through the northwestern boundary of the city, while on the southern boundary of the city are the Sinhagad-Katraj-Dive Ghat mountain ranges. The city of Pune is situated between 18^0 25' and 18^0 37' north latitude and $73^0$44' and 73^0 57' east longitude.
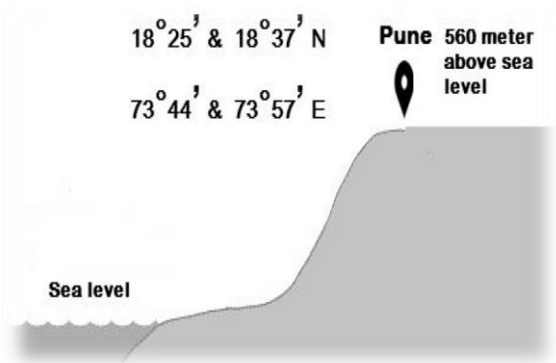
According to 2011 census, the total population of Pune city was 31.24 lakhs. With the addition of 11 new villages to the Corporation in 2017, the population has increased by 2.78 lakhs to 34.02 lakhs . Air quality is determined by the amount of sulfur and nitrogen oxides, carbon dioxide and monoxide, ozone gases, and dust up to 2.5 microns in size. Air pollution is a major cause of air pollution from polluted gases and naturally occurring dust storms.

Problem Statement

As per the data of Regional transport office Pune region from the year 2016-2017 to 2017-2018 total no. of vehicles registered in Pune city increases by 10.7%. Increase in vehicles due to migration of people from sub-urban and urban area due to employment opportunities. 'Navale bridge' to 'Katraj chowk' is the major road of about 3.8 kms connecting highway and other major adjoining job sector areas. Due to this, heavy congestion in the areas ultimately expose the people in such areas to pollutants released from the vehicles. Long term and continuous exposure ultimately leads to several air-borne related health issues as also affecting the surroundings.

Objectives

1. To study the vehicular density in the study stretch.

2. To monitor the intensity of air pollutants by High Volume Sampler/Fine Dust Sampler.

3. To identify the air pollutants emitted from the exhausts of vehicles by analyzing air samples.

4. To address the impact of pollutants on surroundings.

II. IDENTIFY, RESEARCH AND COLLECTIDEA

Total no. of vehicles registered in Pune city increased by 10.7% from the year 2016-17 to 2017-2018. This study will address the major air pollutants and its consequences due to exposure on humans. The intensity of the pollutants is more and can be understood is above the set standard of limits.
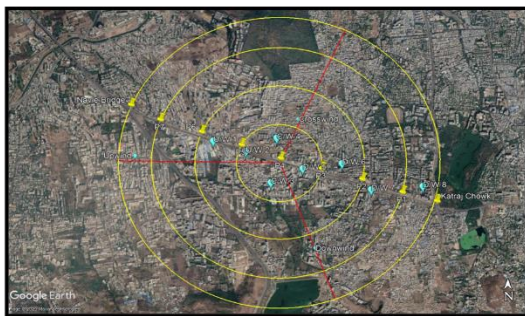
This is the Google image of the study area from Katraj Chowk to Navale Bridge. The plotting and selection of the locations to be monitored is done on this map based on the wind directions in the particular months when monitoring was carried out. The monitoring of the selected locations is basically in the upwind and crosswind directions.

(i) Background Data: In order to generate background data, air quality monitoring is conducted to assess existing level of contamination and to asses possible effects of air contamination occurring in future.

(ii) Status and Trend Evaluation: The objective is to determine air pollution status and trend information from any continuous air quality monitoring programme. The information is used to determine, whether pollution control strategies as advised by implementing authority are giving acceptable values that is lowering of pollution levels or new or additional control are required to achieve acceptable levels.

(iii) Environment Exposure Level Determination: The air quality monitoring and survey concern itself with systematic study of considerable segment of environment to define inter-relationship of source of pollution, atmospheric parameter and measurable manifestations in order to evaluate the character and magnitude of existing problem.

(iv) Scavenging Behaviour of Environment: To understand natural scavenging or cleansing process undergoing in the environment through pollution dilution, dispersion, wind movement, dry deposition, precipitation and chemical transformation of pollutants generated.

(v) Air Quality Management: To assess the present status to judge effectiveness of air pollution control strategies and long term management of air quality.

The following graph shows that the number of vehicles in the city has been steadily increasing and has more than doubled in the last 10 years.

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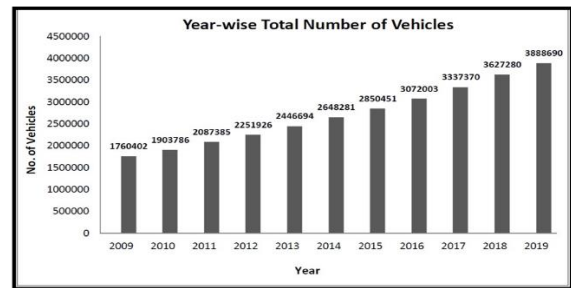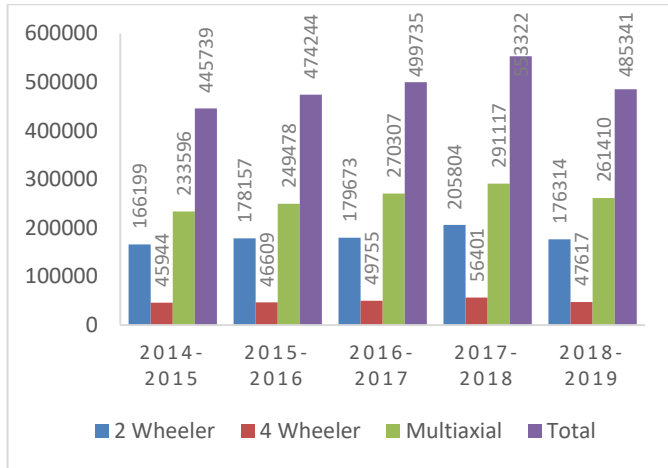

The number of vehicles in Pune city has increased in the last 10 years.
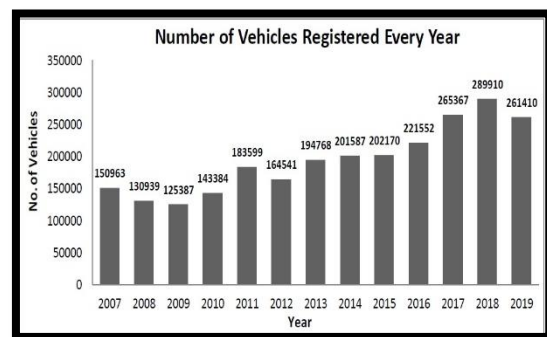
(Pune ESR 2018-19)

Data collection of registered vehicle population of Pune region and total PMC population

Category wise and Year wise Motor Vehicles Registration Number

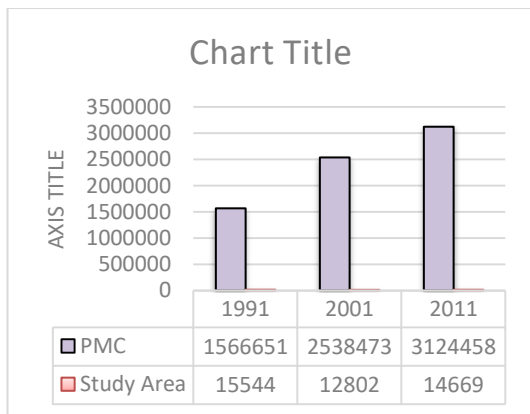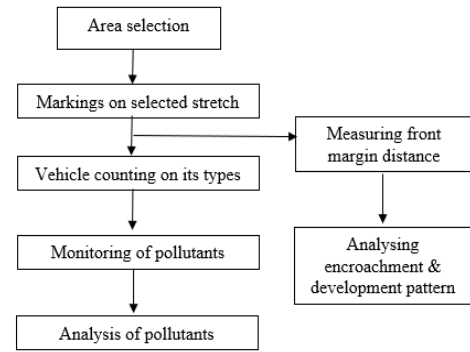**(As per Regional Transport Office, Pune Region, Pune)**

Chart of Total PMC Population and Study Area Population (As per Data of census 1991, 2001 and 2011 of Pune Municipal Corporation Published by CENSUS OF INDIA)

III. Methodological Activity

Flow Chart of Methodological Activity during Experimentation

The above flowchart is followed to complete the Experimental Work, from identifying the major air pollutants of concern in the study stretch till monitoring and analysis of the pollutants from the line source vehicles and the resettlement of the particulate matter.

1. Collection of meteorological and topographical data according to season.

2. Survey of vehicles i.e. number of vehicles, type of vehicles, criterion pollutants release and its intensity.

3. Two seasonal analysis for air, on site and adjoining site, will be conducted viz. a spring/winter analysis and a summer analysis.

4. After each site analysis and sampling, a lab analysis will be conducted for determining the pollutants and gases present in the air.

IV. RESULT AND DISCUSSION

Based on the monitoring done with the Fine Dust Sampler instrument, following values of major air pollutants are obtained:

A. Month: January 2020

Location	Parameters			
	M_{10}	$M_{2.5}$	O_2	O_2
A1	25.23	4.78	8.49	5.76
A2	19.86	1.02	6.75	3.1
A3	31.33	4.26	3.3	1.29
A4	05.73	8.51	5.92	0.14

A5	12.36	0.82	7.15	6.05
A6	17.66	2.26	8.43	7.17
A7	29.57	5.21	9.25	6.89
A8	23.85	0.26	2.84	0.12

In the month of January 2020, the PM10 concentration was above 100µg/m3 for the duration of 24 hours on all the monitored locations; whereas PM2.5 concentration was below 60µg/m3. Also, the concentration of SO2 and NO2 pollutants is below 80µg/m3 for the 24 hours duration.

B. Month: February 2020

Parameters

Location	Parameters			
	M10	**M2.5**	**O2**	**O2**
A1	**21.86**	**2.16**	**4.82**	**9.84**
A2	**19.36**	**9.21**	**7.15**	**5.75**
A3	**08.66**	**4.36**	**6.78**	**4.13**
A4	**35.23**	**4.17**	**8.2**	**7.49**
A5	**28.36**	**3.95**	**5.15**	**9.24**
A6	**21.56**	**0.28**	**7.05**	**3.15**
A7	**18.32**	**8.1**	**0.85**	**9.52**
A8	**34.86**	**4.02**	**2.94**	**2.84**

In the month of February 2020, the PM10 concentration was above 100µg/m3 for the duration of 24 hours on all the monitored locations; whereas PM2.5 concentration was below 60µg/m3. Also, the concentration of SO2 and NO2 pollutants is below 80µg/m3 for the 24 hours duration.

C. Month: March 2020

Parameters

Location	Parameters			
	M10	M2.5	O2	O2
A1	18.33	0.58	1.43	0.15
A2	15.86	8.41	7.53	3.78
A3	05.23	0.27	0.2	8.44
A4	07.35	4.12	1.75	2.72
A5	21.36	1.23	4.51	2.59
A6	25.23	3.78	9.84	8.41
A7	19.66	9.29	8.32	0.89
A8	12.32	5.71	3.49	5.7

V. Conclusions

Findings

Graph 2. shows the graphical representation of number of vehicles register for five years. Vehicle registration is increasing year by year from year 2014-2018 including all category of vehicles. Up to year 2017-2018 vehicle registration are increasing but during year 2018-2019 there is decrease in registering number of vehicles All data collected from regional transport office Pune.

B. Graph 3. shows the graphical representation of total PMC population and study area population in which comparison are seen in last 30 years which shows population is increasing every year. All data are collected from www.censusindia.gov.in

Conclusions

In the month of March 2020, the PM10 concentration was above 100µg/m3 for the duration of 24 hours on all the monitored locations; whereas PM2.5 concentration was below 60µg/m3. Also, the concentration of SO2 and NO2 pollutants is below 80µg/m3 for the 24 hours duration.

From the above measured parameters in the vicinity area of Katraj chowk to Navale bridge, it is found that the concentration of PM10 is more in all the three months i.e. January, February and March and at all the locations selected. However, the concentration of PM2.5, SO2 and NO2 is within

the limits of the standards given by Central Pollution Control Board. It is found that the concentration of PM10 is due the re-suspension of the particulate matter on the roads due to the dryness in the atmosphere. The problem of re-suspension of the particulate matter is observed less in rainy season as compared to the winter and summer time.

REFERENCES

1) ESR PMC. (2019). Environment Status Report 2018-19.

2) Laxen, D., Kirk-Lloyd, F., & Beattie, C. (2018). Health Impacts of Air Pollution in Bristol. July, 1–29. https://www.bristol.gov.uk/documents/20182/3267 5/Health+Impacts+of+Air+Pollution+in+Bristol+Febr uary+2017/4df2fce5-e2fc-4c22-b5c7-5e7a5ae56701

3) Gordon, T., Balakrishnan, K., Dey, S., Rajagopalan, S., Thornburg, J., Thurston, G., Agrawal, A., Collman, G., Guleria, R., Limaye, S., Salvi, S., Kilaru, V., & Nadadur, S. (2018). Air pollution health research priorities for India: Perspectives of the Indo-U.S. Communities of Researchers. Environment International, 119(March), 100–108. https://doi.org/10.1016/j.envint.2018.06.013

4) Adeyanju, A. A., & Manohar, K. (2017). Effects of Vehicular Emission on Environmental Pollution in Lagos. October.

5) Hooftman, N., Oliveira, L., Messagie, M., Coosemans, T., & Van Mierlo, J. (2016). Environmental analysis of petrol, diesel and electric passenger cars in a Belgian urban setting. Energies, 9(2), 1–24. https://doi.org/10.3390/en9020084

6) Canada, N. R. (2016). Learn the facts: Fuel consumption and CO2. Auto$mart, 2, 1–2. http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/ oee/pdf/transportation/fuel-efficient-technologies/autosmart_factsheet_6_e.pdf

7) Ghorani-Azam, A., Riahi-Zanjani, B., & Balali-Mood, M. (2016). Effects of air pollution on human health and practical measures for prevention in Iran. Journal of Research in Medical Sciences, 21(5). https://doi.org/10.4103/1735-1995.189646

8) Pfeiffer, R. L. (2015). Sampling For PM10 and PM2.5 Particulates. 227–245. https://doi.org/10.2134/agronmonogr47.c11

9) College, H. M., Chinsura, P. O., Hooghly, D., & Bengal, W. (2015). RESEARCH ARTICLE AIR POLLUTION AND INDIA : CURRENT SCENARIO * 1 Debosree. May 2014, 5–7.

10) Choudhary, M. P. (2015). Causes, Consequences and Control of Air Pollution. Control of Air Pollution, 1(August 2013), 9–11. https://www.researchgate.net/publication/279202084

11) Reşitoḡlu, I. A., Altiniṣik, K., & Keskin, A. (2015). The pollutant emissions from diesel-engine vehicles and exhaust aftertreatment systems. Clean Technologies and Environmental Policy, 17(1), 15–27. https://doi.org/10.1007/s10098-014-0793-9

12) Gawai, A., Khan, A., & Mehta, V. (2015). Ambient Air Quality Monitoring in Pune City. International Journal of Science and Research, 4(02), 489–499.

13) Mangalekar, S. B., Jadhav, A. S., & Raut, P. D. (2015). Studies on Ambient Air Quality Status of Kolhapur City, Maharashtra, India during Year 2013. Asian Journal of Water, Environment and Pollution, 12(3), 15–22. https://doi.org/10.3233/AJW-150003

14) Admassu, M., & Wubeshet, M. (2014). Evolution of cities and territories in Air Air Pollution. Built Environment, 40(1), 85–100.

15) Yannawar, D. V., B Bhosle, A., & Balaji Yannawar, S. (2014). Prediction of Air Pollution Concentration Using a Fixed Box Model. Researcher, 6(May), 89–92.

16) Sarah Chambliss, Josh Miller, Cristiano Façanha, Ray Minjares, K. B. (2013). the Impact of Stringent Fuel and Vehicle Standards on Premature Mortality and Emissions. Report, ICCT'S GLO, 89.

17) Bansal, G., & Bandivadekar, A. (2013). Overview of India'S Vehicle Emissions Control Program Past Successes and Future Prospects. International Council on Clean Transportation, 1–180. http://www.theicct.org/sites/default/files/publications/ ICCT_IndiaRetrospective_2013.pdf

18) Sierra-Vargas, M. P., & Teran, L. M. (2012). Air pollution: Impact and prevention. Respirology, 17(7), 1031–1038. https://doi.org/10.1111/j.1440-1843.2012.02213.x

19) Pollution, C., & Board, C. (2011). Guidelines for Manual Sampling & Analyses.

20) Engg, A. (2010). ENGINE & WORKING PRINCIPLES Spark Ignition (Carburettor Type) IC Engine.

21) CPCB. (2009). Guidelines for the Measurement of Ambient Air Pollutants (NAAQS). Central Pollution Control Board, Government of India. http://www.cpcb.nic.in

22) Baldauf, R., Watkins, N., Heist, D., Bailey, C., Rowley, P., & Shores, R. (2009). Near-road air quality monitoring: Factors affecting network design and interpretation of data. Air Quality, Atmosphere and Health, 2(1), 1–9. https://doi.org/10.1007/s11869-009-0028-0

23) Hodan, W. M., & Barnard, W. R. (2004). Evaluating the Contribution of PM2. 5 Precursor Gases and Re-entrained Road Emissions to Mobile Source PM2. 5 Particulate Matter Emissions. MACTEC Under Contract to the Federal Highway Administration. MACTEC Federal Programs, Research Triangle Park, NC, 58 pp. https://www3.epa.gov/ttnchie1/conference/ei13/mobile/hodan.pdf

24) Akimoto, H. (2003). Global Air Quality and Pollution. Science, 302(5651), 1716–1719. https://doi.org/10.1126/science.1092666

25) Rinki Jain, K. P. (2002). Air Pollution and Health Discussion. Electronic Journal of Differential Equations, 2002.

26) Watson, A. Y., Bates, R. R., & Kennedy, D. (1988). Assessment of Human Exposure to Air Pollution: Methods, Measurements, and Models. In Air Pollution, the Automobile, and Public Health. http://www.ncbi.nlm.nih.gov/books/NBK218147/