

Issue of Vehicular Pollution with Rapid Increase in the Vehicles Load at Panjab University Campus, Chandigarh

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Abstract: With the fast growth of urbanization and industrialization, the numbers of vehicles on the road are rapidly increasing. As the number of vehicles continue to grow and the consequent congestion increases. Vehicles are now becoming the main source of air pollution. Polluted air quality has negative effect on environmental, public health, plants and animals. The air quality can be improved by adopting a combination of technical and non-technical measures, formulation of necessary legislation, institutional approaches, improved traffic planning and management, improvement in the fuel quality and market-based instruments. There are certain unique challenges which the country has to face in tackling the problem of urban air pollution. This paper has made an attempt to study the development of vehicular pollution with respect to the vehicle density at Panjab University, Chandigarh by identify the traffic flow from all the three main gates of Panjab University campus.

Index Terms: Air pollution, A.Q.I (Air Quality Index), P.U (Panjab University), PRSD (Pollution Remote Sensing Device) RSPM (Respirable Suspended Particulate Matter), WHO (World Health Organization)

I. INTRODUCTION

At the global level, the rapid growth in motor vehicle activity has serious energy security and climate change implications. It is estimated that the transport sector already consumes nearly half of the world's oil. Transportation involves the combustion of fossil fuels to produce energy that is translated into motion. Pollution is created from incomplete carbon reactions, unburned hydrocarbons or other elements present in the fuel or air during combustion. The other sources of pollutants include emissions from the industrial processes, heavy transport vehicles, energy production, domestic cooking and heating, high dust levels due to local construction, smoking, unpaved roads, sweeping, hotels and restaurants. All these pollutants are leading to decrease in breathing air quality. Global Burden of Disease estimated by 450 scientists from 300 global organizations including WHO found that Air pollution related deaths have increased by 300 per cent since 2000[1]. About 65 per cent of these deaths occur in Asia. Chandigarh is also among such cities which are no more untouched by the effect of air pollution resulting from emissions from the vehicles.

Air pollution is one of the serious environmental concerns of the urban areas. Air pollution is a phenomenon by which particles (solid or liquid and gases) contaminate the earth's environment. Such contamination can result in health relating problems such as respiratory diseases, risk of developing cancers and other serious ailments, due to poor air quality. Other effects of pollution include damage materials (e.g., the marble statues), agricultural damage (such as reduced crop yields and tree growth), impairment of visibility (tiny particles scatter light very efficiently), and even climate change (certain gases absorb energy emitted by the earth, leading to global warming) [2].

Apart from air, pollution is evident in many different forms, such as, water, sound, light, radioactive, and land. One of the ways to reduce the problem of air pollution is the elimination or reduction of fossil fuels used by vehicles. But the increases in population, migration, uncontrolled urban expansion, income, economic growth, energy consumption and mobility have created a serious problem like air pollution, throughout the world. The air quality can be improved by adopting a combination of technical and non-technical measures, legislative reforms, institutional approaches and market-based instruments. Moreover, an Air quality index is one of the significant tool used for investigating and representing air quality position uniformly. Table 1 shows Air Quality Index proposed for India and this table is used to calculate the value of Air Quality Index [2].

Table 1: AQI Proposed for India

S.No	Index	Category	SO ₂ (24-hr avg.) (µg/m ³)	NO ₂ (1- hr avg.) (µg/m ³)	SPM (24-hr avg.) (µg/m ³)	PM ₁₀ (24-hr avg.) (µg/m ³)
1	0-100	Good	0-80	0-80	0-200	0-100
2	101-200	Moderate	81-367	81-180	201-260	101-150
3	201-300	Poor	367-786	181-564	261-400	151-350
4	301-400	Very poor	787-1572	565-1272	401-800	351-420
5	401-500	Severe	>1572	>1272	>800	>420

II. THE STUDY AREA

This study is to find the effect/impact of emissions from the vehicles on the environment and human health in Panjab University Campus. This deals with the present scenario of air pollution and the effects on environment. The worst thing about vehicular pollution is that it cannot be avoided, as the vehicular emissions are emitted near ground level where we breathe. The paper is depending upon the data available with the university authorities. With increase in number of courses, infrastructure, students as well as induction of employees at the Panjab University campus in last several years has lead to the rapid increase in vehicular movement to the campus. This excessive movement of the vehicles from tricity as well as from other parts of the state has not only lead to increase in air pollution (due to unburned hydrocarbons, noise pollution), sanitation degradation, accidents, lack of security but also results in traffic congestion, and parking problem as well.

Based on Statistics of the Panjab University offices the increase in the mobility of motor vehicles in campus has gone up to 45238 in just two days. Panjab University is situated in the vicinity of the nature, surrounded by the forest area, which is full of various species of

insects, plants etc. Polluting such a natural biodiversity by various human activities will substantially change the composition of air. This may lead to many short term and long term implications on the life of plants and animals. Besides the change in composition, the pollution may directly add some poisonous and harmful gases - which may cause series of health complications. Though, transportation is one of the important economic activities for beneficial social interactions. While the transportation sector is also a major source of air pollution. The latest report by the Chandigarh Pollution Control Committee (Published on June 5, 2017 in Indian Express) shows that in some areas, the RSPM (Respirable Suspended Particulate Matter) level is double the permissible limit, which is 60 microgram per cubic meter (mpcm) [3]. Also, there is a steady increase in the level of mono-nitrogen oxides (NO_x). To check air quality, the Chandigarh Pollution Control Committee has divided the city into five zones like Sector 17, Industrial Area, Punjab Engineering College, IMTECH-Sector 39 and Kaimbwala village. The data collected over the years indicates high level of RSPM and steady increase of NO_x in all zones. Of the five zones, the Industrial Area was the most affected, followed by Kaimbwala village. In 2017, RSPM was found to be 114 mpcm (nearly double the permissible limit) in Industrial Area, 91 mpcm in Kaimbwala, 89 mpcm in IMTECH, 80 mpcm in PEC and 79 mpcm in Sector 17. As far as mono-nitrogen oxide is concerned, its level is increasing steadily in the city. The permissible limit for No_x is 40 mpcm. In the city, its level is recorded anywhere between 19 and 25 mpcm. For instance, it was 20 mpcm in the Industrial Area in 2010 but increased to 25 mpcm in 2016. It was evident from the existing information that air pollution controls are not only important and a current priority in the local context, but also can present a significant potential to control greenhouse gas emissions. Thus, with an ultimate goal of greenhouse gas reduction, the present study has chosen air pollution control as a strategic target from the movement of vehicles in a specified area.

III. MOVEMENT OF THE VEHICLES IN THE CAMPUS

As already discussed that increase in the number of various courses in the campus, has increase the number of vehicles on the roads of the campus. This mobility definitely leads to drastic increase in air pollution. The number of vehicles in campus is increasing day by day. We have analyzed the data of traffic movements available on all the 3-gates of P.U. campus. As per the statistics shown in table 2, the movement of the vehicles on campus for two working days from 8.00am to 5.00pm is recorded 29936 where as total number of vehicles entering from all gates is 45238 (including petrol and diesel based vehicle). The data shows the number of vehicles is share of various modes of vehicles i.e. two wheelers, three wheelers, four wheelers and other vehicles (School bus/van, bus/trucks). Statistics also depicts that out of all 45238 vehicles, moving in and out of the all three gates, only 15693 are the vehicles which are bearing the stickers provided by university authorities. It implies that 29545 vehicles moving in the campus are not registered with any of the department of the Panjab University.

We can judge from the given figures that movement of vehicles (including 2-wheelers, 3-wheelers, 4-wheelers and heavy vehicles) inside this area is quite high which ultimately leads to air pollution. From the table 2 it is clear that maximum air pollution is contributed by the two wheelers. Percentage movement of vehicles has being depicted with the help of pie chart below in fig 2. From fig 2, it is evident that vehicular movement in campus comprise of 54%, 2-wheelers, 42%, 4-wheelers (cars/taxis), 3%, 3-wheelers and 1%, buses/trucks.

Table 2: Distribution of vehicular movement in Panjab University

	2 wheeler			3 wheeler	4 wheeler			Bus/Truck		Total vehicles	Total vehicles (8.00am to 5.00pm)
	Sticker	No sticker	Total	---	Sticker	No sticker	Total	School	Other		
Gate1	1154	2614	3768	272	888	2909	3797	66	36	7939	5710
Gate2	3489	5654	9143	591	3661	4445	8058	92	33	17917	10535
Gate3	2705	8683	11388	522	3796	3446	7242	96	86	19334	13691
Sub Total	7348	16951	---	1385	8345	10800	---	254	155	45238	29936
Grand Total	24299			1385	19145			409		45238	29936

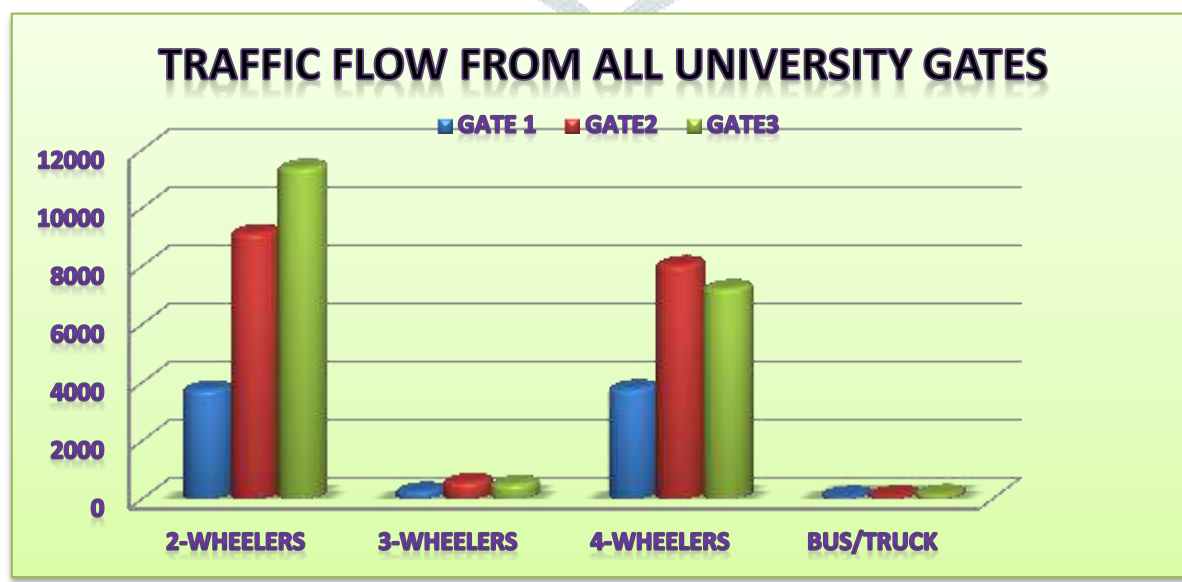


Fig 1: Vehicular entry to P. U. from all the three gates

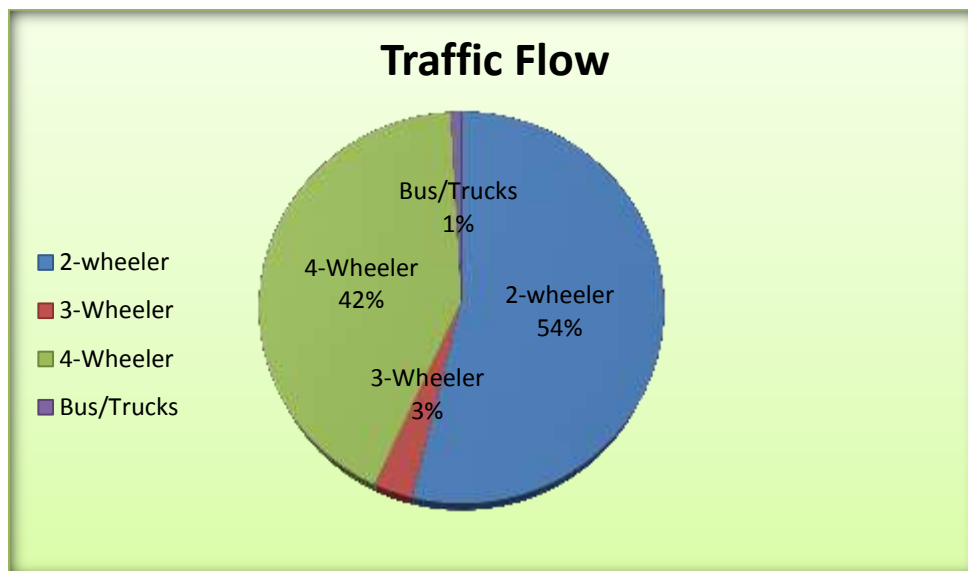


Fig 2: Percentage Share of vehicle's movement in P.U., Chandigarh

IV. MAIN SOURCES OF POLLUTION

The following vehicles are mainly responsible for pollution in the Panjab University campus

a) **Pollution from 2-wheelers:** Two-wheelers contribute for about 54% (7% diesel +47% petrol) of the total vehicular population. Because of inherent drawbacks in the design of 2- stroke engines, 2-wheelers emit about 20-40% of the fuel un-burnt or partially burnt. At present, studies of various cities (like Bangalore) show that two-wheelers contribute for more than 65% hydrocarbons and nearly 50% carbon monoxide [1] [4]. Due to less visibility of this emission, the general public is not aware of the role of 2-wheelers in deteriorating air quality in the campus. Despite of R&D efforts towards improving its design, the 2-stroke engines are still emitting hydrocarbons and carbon monoxides[5]. Therefore, Government should phase out 2-stroke two and three wheelers.

b) **Pollution from 4-wheelers:** About 45238 vehicles have been recorded in P.U. campus for two days which contains both petrol and diesel driven vehicles. Fig 3 shows the density of vehicles on the campus. It excludes the floating vehicles from the city area. These vehicles are also high emitters of carbon monoxide and hydrocarbons which pollutes the air. These consist of old as well as new vehicles in the city. The city is having major percent of 4-wheelers (965 vehicles per 1000 persons in 2014) which occupies maximum space on the road; it is one of the air pollutants in the city. It is widely believed that petrol is adulterated with kerosene, which results in emissions of thick black smoke. Therefore, urban structure has a strong influence over CO₂ emissions. Chandigarh has 441,284 vehicles per 1000 km of road length [6]. Delhi has 243,783 vehicles per 1000 km of road length. Nearly 73% of travel trips carried by personal transport -cars and two-wheelers.



(a)



(b)

Fig 3: Picture showing the density of vehicles on the campus (a) Density of Cars parked near student centre (b) Parking in front of a Department.

V. Measures for Emission Control

Following are the some of the measures that can be adopted to control the air pollution in the PU campus.

- Use of Remote Sensing technology:** Use of concept of the Pollution lock or the pollution remote sensing device (PRSD) in the moving vehicles could prove to be very beneficial for continuous monitoring of the pollution.
- Pollution check gate (PCG):** Pollution check gate way concept is similar to the toll tax on highways and smart card system.

- c) **Day without Vehicle:** To implement ideas such as a car-free day in order to ensure less traffic congestion, pollution and contribute our small bit in solving the environmental problems.
- d) **Car Pooling:** Employees coming from far of places can pool a car/ van to contribute to society.
- e) **Commitment:** Every resident should have commitment for the society as it helps in solving the problems related to pollution and the human health. Every citizen should considered the problem of pollution as it's own house problem rather than the problem of general public. That affects the mankind. This unwanted emission from vehicles makes the public unhealthy
- f) **Celebration of Bus Day:** This can be introduced on a fixed day every month and everybody should use public transport. As an individual we should not use our cars for the day, and only use public transport as it reduces the traffic. The Bus Day will be success if the roads are not congested, polluted.

VI. CONCLUSION

Though rapid growth of any institution is very important but it comes at some cost. Here our concern is the increase of vehicular movement that results in the emission of gases to environment leading to air pollution. The consequences of air pollution to this beautiful environment of Panjab University may affect biodiversity present in the campus as well as the health of the residents and workers. To improve the quality of air and water in the campus, there is a need of strict enforcement and monitoring programs. Besides this, traffic regulations, efficient public transportation system in the campus and heavy penalty should be imposed in case of violation of rules. For the protection of environment more emphasis should be laid on compulsory environmental education for the awareness of people in the campus. Moreover, repeated checking of Pollution Under Control Certificates requires to be commenced by the public authorities to make sure that vehicles are discharging gases within allowable limits. People require to be knowledgeable to switch-off their motor vehicles when to come at traffic intersections. The Governmental efforts alone are not enough, participation of the society is crucial in order to make the environment healthy.

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