



Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/10231

DOI URL: <http://dx.doi.org/10.21474/IJAR01/10231>



RESEARCH ARTICLE

HARMFUL IMPACTS OF URBAN TRAFFIC ON AIR POLLUTION

Raidy Gul Hamdard¹, Naqib Ahmad Naeemi² and Mohammad Noor Jan Ahmadi²

1. Professor, Dept of Civil, Engineering Faculty, Shaikh Zayed University, Khost, Afghanistan.
2. Assistant Professor, Dept of Civil, Engineering Faculty, Shaikh Zayed University, Khost, Afghanistan.

Manuscript Info

Manuscript History

Received: 12 October 2019

Final Accepted: 14 November 2019

Published: December 2019

Key words:-

Air Pollution, Emission, Eco-Friendly,
Traffic, Health Effects, Atmospheric
Particulate

Abstract

Air pollution has become a major worldwide problem, it has effected millions of life. Traffic has contributed significantly to the development of human civilization, on the other hand it has been great impact on the environment in several ways. The most important impact due to traffic operation is air pollution. It is a need to understand air pollution, methods to quantify and measures to control and mitigate them. Transportation and Traffic plays a major role in contemporary society. But we must also admit that motor vehicles have a major impact on the environment and health. This why it is crucial that we need to quantify air pollution in busiest places like signalized intersections, work places and residential buildings. There are various reasons for this unregulated rise in the pollution levels of the air, one of the major reasons is vehicular pollution which is affecting the life of numerous people who use roads as the major transportation facility which is nearly everyone in the world. This paper deals with the harmful effects of air pollution caused by traffic present in the urban areas. The pollutants that are found in vehicle exhausts significantly affect the health of the people living in urban areas. High levels of nitrogen oxide, carbon di oxide are toxic to humans. Sulphur dioxide causes acid rain. Carbon dioxide contributes to climate change causing global warming. Due this there needs to be change, a change that can help to save the environment. There are various methods that can applied to save on our fossil fuels, reduce pollution and also improve our traffic conditions and improve road safety.

Copy Right, IJAR, 2019,. All rights reserved.

Introduction:-

The effects on health of transport-related air pollution are one of the leading concerns about transport. There is a rapid growth in motor vehicle activity at a global level and has resulted in serious energy security and climate change implications. The transport sector consumes nearly half of the world's fuel supply. In urban areas in both developing and developed countries, it is predominately mobile or vehicular pollution that use the roadways as there transportation facility that contributes to air pollution. The major sources of contaminants include emissions from the combustion of fossil fuels in motor vehicles and for industrial processes, energy production, domestic cooking and heating, and high dust levels due to local construction, smoking, unpaved roads, sweeping, hotels, restaurants and long-range transport. Due to all this the quality of air has become very poor that, it has started to

Corresponding Author:- Raidy Gul Hamdard

Address:- Professor, Dept of Civil, Engineering Faculty, Shaikh Zayed University, Khost, Afghanistan.

affect every individual present. The rapid growth in motor vehicle activity has become a challenge to overcome in urban areas. This has brought a serious range of socio-economic, road safety, environmental, health, and welfare effects on environmental degradation. The rapid evolution in motor vehicles in urban areas is important not only because of their locally harmful air pollution effects, but also because of their regional and global impacts. So the paper deals with the harmful effects of air pollution caused by traffic present in the urban areas.

Research in recent decades consistently indicates that outdoor air pollution harms human health, and the evidence points to air pollution stemming from transport as an important contributor to the adverse effects. The review focuses on air pollution related to road transport (mostly from urban and suburban passenger and freight transport) and the risks to human health. It considers the entire chain of relevant issues:

1. The present understanding of the effects of transport-related air pollution on health;
2. The patterns of human exposure to this pollution;
3. How this exposure is determined by the emission of pollution from transport sources; and
4. How patterns and trends of human activities influence the intensity of emissions.

Problems:

One of the main problems that is overlooked across the globe is pollution. The Pollution is evident in many different forms, such as, water, sound, light, radioactive, land, and air. The only way is to reduce the problem of air pollution is the elimination or reduction of fossil fuels used by vehicles.

Literature Review:-

Vehicle exhaust smokes have played a major role in the deterioration of air quality in urban areas since 1950s and as a result the Clean Air Act (CAA) was passed in 1970. The CAA gives the Environmental Protection Agency (EPA) the authority to set limits on emission standards. The EPA estimates that over 5000 tons of VOCs from transportation sources were produced in 1999 and that approximately 62 million people living in areas that do not meet health-based standards. EPA also assessed that in 1999 the transportation sector, including on-road and non-road vehicles, contributed to 47% of HC emissions, 55% of NOX emissions, 77% of CO emissions, and 25% of PM emissions (National Air Quality and Emissions Trends Report, 2001).

As stated in an article by the Insurance Institute for Highway Safety (IIHS) they reduce fuel consumption and vehicular emissions by reducing stopping at intersections, and also reduce noise levels by making the traffic flow orderly. Modern roundabouts (Traffic Circles) can enhance the aesthetics of the place and create visual gateways to communities or neighbourhoods. Vehicles stopping at traffic signals and stop signs emit more CO₂ when compared to vehicles at roundabouts as the delay and queuing are greater. Even if the delays are similar to that of roundabout, traffic signals always queue traffic at a red light and hence releases are usually greater. The average delays at roundabouts have to be significantly larger than at traffic signals for the emissions to be equal. When traffic volumes are low, traffic rarely stops at a roundabout and the emissions are very small (Barry, 2001; Mutasem et al., 2000).

When roundabouts become very congested with large queues, the emissions equal those at traffic signals. During off-peak hours junctions do not experience long queues and delays and the emissions are low. Traffic signals and stop signs halt vehicles even during off-peak hours creating higher delays and emissions. United Kingdom (UK) engineers believe that traffic signals have lower emissions only in exceptional cases (Barry, 2001; Mutasem et al. 2000).

As stated by Barry Crown, a roundabout expert from the UK: “when vehicles are idle in a line they emit about 7 times as much CO as vehicles traveling at 10 mph. The emissions from a stopped vehicle are about 4.5 times greater than a vehicle moving at 5 mph” (Barry, 2001). The Baⁿ renkreuzung/Zollikofen project undertaken in Bern, Switzerland, replaced two important signalized intersections by roundabouts and the result was a reduction of emissions and fuel savings by about 17%.

In a study conducted by (Mustafa et al., 1993), the authors concluded that there exists a direct relationship between vehicle emissions and traffic volumes at urban intersections regardless of traffic control. Their simulation results showed that traffic signals generate more emissions (almost 50% higher) than a roundabout. In case of higher traffic volumes the HC generated by traffic signals is twice as high as that generated at roundabouts (Mustafa et al., 1993).

In another study conducted by Varhelyi in Sweden, he found that replacing a signalized intersection with a roundabout resulted in an average decrease in CO emissions by 29% and NOX emissions by 21% and fuel consumption by 28% per car within the influence of the junction (Varhelyi, 2002).

Summary:-

The result indicates that the optimization of the traffic signal control plan can effectively improve the operation of road traffic and reduce vehicle pollution. When the traffic demand decreased by 20%, the average speed improved by 28.29%, and the emission factors significantly decreased respectively, as much as over 50%. The maximum reduction is NO_x, up to 78.32%, which indicates that the decreasing traffic demands can significantly reduce vehicle emissions. Therefore, when selecting traffic management and control strategies to control emissions on roads, traffic managers can consider implementing the optimization of signal timing, and at the same time try to control traffic demands

The modern roundabouts in Kansas operated more effectively than the before intersection control (AWSC/ TWSC) in reducing vehicular emissions at all locations studied. There was a (21–42%) decrease in the carbon monoxide (CO) emissions (kg/h) for the AM and PM periods after the installation of modern roundabout. The decrease was observed to be statistically significant for both periods. There was a (16–59%) decrease in the carbon dioxide (CO₂) emissions (kg/h) for the AM and PM periods after the installation of modern roundabout. The decrease was observed to be statistically significant for both periods. There was a (20–48%) decrease in the Oxides of Nitrogen (NO_x) emissions (kg/h) for the AM and PM periods after the installation of modern roundabout. The decrease was observed to be statistically significant for both periods. There was a (17–65%) decrease in the hydrocarbons (HC) emissions (kg/h) for the AM and PM periods after the installation of modern roundabout.

The study of pollution in residential building nearby expressway clearly showed that PM_{2.5} mean particle mass concentration was highest at the mid floors of both buildings when compared to those at upper and lower floors during a typical day. Although the lower floors were closest to traffic emissions, the mean particle mass concentration was lower there than that at the mid floors, which could presumably be due to the interception of PM_{2.5} particles by tree leaves or the inflow of clean and drier air from higher altitude with lower aerosol burden mixing with the traffic-polluted air at the lower levels or both. The upper floors had the least fine particulate matter mass concentration due to dilution following pronounced mixing of traffic-polluted air with ambient air. Microclimatic conditions of the selected site such as the influence of trees could have had an influence on the vertical distribution profile of particulate matter.

Other pollution sources include fuel leakage into the passenger compartments and infiltration of pollutants from ambient air. Overall, the low-end cars had higher pollutant concentrations than the high-end and mid-range cars, suggesting that high-emitting materials are more frequently used in less expensive cars. All the target compounds had higher concentrations in the new vehicles than in the old ones, which would be caused by in-vehicle ornament that newer material released much more than older one. Overall, the mean concentrations of formaldehyde and aromatic compounds are much higher than those reported in similar studies. The results show that material emissions from inside the passenger compartments contribute significantly to the air pollution in the many compact cars sold in China. Measures should be taken to mitigate the air pollution problems caused mainly by the materials emissions inside the cabin.

Result and Discussion:-**Smoking:**

Smoking contributes in respiratory, cardiovascular, and other health problems, if a person live in an air polluted area and also a chain smoker than smoking habit increases the effect of air pollution. In this study a total of 31 percent respondents were smokers and 69 percent were nonsmokers. Tobacco smoke similar to vehicular exhaust is a complex mixture of air pollutants. Several studies suggest that early-life exposure is more strongly associated with increased risk of respiratory problems than is exposure at a later age. Respondents which have asthma were all have smoking habit and respondents which have lung problem only three persons were smokers and which have lung cancer only two persons were smokers.

Exposure Time:

The exposure time of all respondents who participated in this study was 10–14 hours per day. Exposure time was approximately same for each signal and traffic police station. Prolonged exposure time is a main factor affecting the health of respondents.

Age Group:

Results of questionnaire survey were divided into four age groups which include four categories, i.e., age group 15–24 stands for category-1, age group 25–34 stands for category-2, age group 35–44 stands for category-3, and age group 45-above stands for category-4. Figure 1 indicates the age group of traffic police persons.

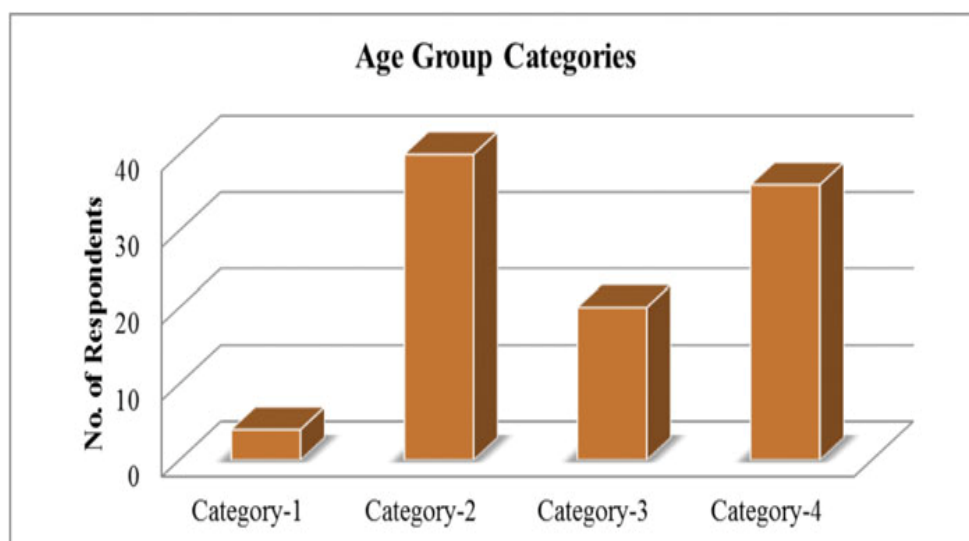


Figure 1:- Age groups Categories of Respondents.

The age group of category-2 was found in largest number in the study and the age group of category-4 was in second largest number. Overall 40 percent of respondents were in the age group of 25–34 years and age groups 45-above, 35–44, and 15–24 cover 36 percent, 20 percent, and 4 percent of respondents respectively. Survey exhibits not only old age respondents were affected by air pollution but also respondents of young age.

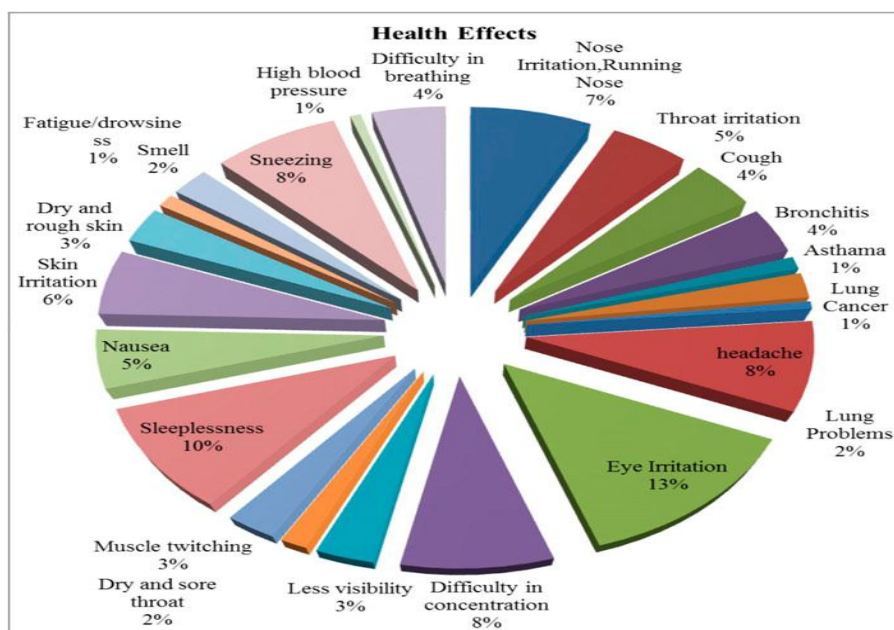


Figure 2:- Different Health Effects in Respondents.

Health Effects:

Multiple options were marked by the respondents, which means the respondents were affected by multiple health effects. Figure 2 depicts the data of health effects of air pollution in traffic police persons that reveals six major health effects were observed in the survey such as eye irritation, sleeplessness, difficulty in concentration, headache, sneezing, and nose irritation. Eye irritation was observed in 13 percent respondents, sleeplessness in 10 percent respondents, difficulty in concentration in 8 percent respondents, headache in 8 percent respondents, sneezing in 8 percent respondents, and nose irritation in 7 percent respondents.

Atmospheric particulate has harmful effects on human health. Predicting dust and aerosol emission from transport would be helpful to reduce harmful effects but, despite numerous studies, prediction of dust events and contaminant transport in soil remains challenging.

Roads traffic has long been distributed as one of the most significant sources of air pollution in urban areas. Cheap vehicle speeds, high traffic volumes, and complex topographical features (i.e., tall building and closely spaced streets) all contribute to elevated levels of particulate matter. In Kabul city, suspended particulate pollution contributes to an estimated 3000 deaths each year. The many health and environmental impacts associated with particulate matter underscore the importance of understanding particulate emissions and concentrations.

Conclusion:-

There are various methods that one can employ in their individual lives in order to reduce air pollution caused due to traffic like switch off cars during a long red light signals, long traffic jams. One should approach the use of more eco-friendly ways, also the government should encourage public to follow such practices which will help us save our ecosystem majorly atmosphere as breathing fresh air is not only a right of every organism but a compulsory requirement.

To conclude this piece, Kabul city is over-polluted and there are several factors that contribute to this problem.

1. Low quality roads, increasing number of vehicles in the city, low quality fuel, illegal settlements, and higher prices of oil has increased this problem.
2. Moreover, there is a lack of implementation of environmental laws of Afghanistan. This problem is due to lack of support to the Environmental Protection Agency.
3. Corruption in different levels of administration adds to this problem.
4. Because of the bowl-shaped topography of the Kabul city, high elevation, and weak prevailing winds during the late fall and winter months, especially during the evening and early morning hours, Kabul is strongly affected by the thermal and topographical stagnation regime and high levels of air pollution.
5. Due to paving roads air pollution is drastically reducing about 81%.
6. To determine particulate matter concentrations near roadways, engineers must currently rely on generic emission factors that are highly uncertain.

Recommendations:-

In this paper, we have worked to provide recommendations for solving this problem. The recommendations are quite feasible and can be achieved within a short period of time.

1. Decreasing the number of cars and increasing the quality of fuel will add to a better quality air and hence, controlling the prices of oil and gas.
2. Controlling the prices of oil would allow people to replace coal and other polluting materials with old and gas to warm their homes.
3. And finally, illegal settlements should be decreased to avoid wastes in the city.

References:-

1. Afghan National Standard Authority. (2011). Air Quality Standard. Kabul, Afghanistan.
2. Asian Development Bank. (2006). Country synthesis report on urban air quality management: Afghanistan. Retrieved 22 May, 2016, from, <http://cleanairasia.org/wp-content/uploads/portal/files/documents/afghanistan>.
3. Cesaroni G, Badaloni C, Porta D, Forastiere F, Perucci C A, Comparison between various indices of exposure to traffic-related air pollution and their impact on respiratory health in adults, *Occup Environ Med*: first published as 10.1136/oem.2007.037846 on 18 January 2008. Downloaded from <http://oem.bmj.com/> on 6 August 2019 by guest. Protected by copyright.

4. Guang-Shan Zhanga, Tian-Tian Lia, Ming Luoa, Jin-Feng Liub, Zhao-Rong Liub, Yu-Hua Bai, “Air Pollution in the Microenvironment of Parked New Cars”, *Building and Environment* 43 (2008) 315–319.
5. Harendra K. Sharma, Banwari Dandotiya & Nimisha Jadon, Exposure of Air Pollution and Its Health Effects in Traffic Police Persons of Gwalior City, India, *Environmental Claims Journal*, and ISSN: 1040-6026 (Print) 1547 657X (Online) Journal homepage.
6. Jain, Akanksha, Harmful Effects of Air Pollution Caused Due to Traffic in the Urban Areas, *International Journal of Innovative Technology and Research*, Volume No.4, Issue No.6, October – November 2016, 5080-5082.
7. Kai Zhang, Exposures and Health Risks Due to Traffic Congestion, A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy (Environmental Health Sciences) in the University of Michigan 2010.
8. Liu Gang-Jun, Fu Er-Jiang, Wang Yun-Jia, Zhang Ke-Fei¹, Han Bao-Ping, Arrowsmith Colin, “Sources of Urban Air Pollution”, *Journal of China University of Mining & Technology*, 2007, 17(2): 0172-0178.
9. M. Kalaiarasan, R. Balasubramanian, K.W.D. Cheong, K.W. Tham, “Traffic-Generated Airborne Particles in Naturally Ventilated Multi-Storey Residential Buildings of Singapore: Vertical Distribution and Potential Health Risks”, *Building and Environment* 44 (2009) 1493–1500.
10. Srinivas Mandavilli, Margaret, J. Rys, Eugene R. Russell, “Environmental Impact of Modern Roundabouts”, *International Journal of Industrial Ergonomics* 38 (2008) 135–142
11. Torabi, Esmatullah and Nogami, Atsushi, Environmental Assessment of Suspended Particulate Matter over the Kabul City, Afghanistan, Apan Society of Civil Engineers, Proceedings of 44rd Annual Meeting of Environmental Systems Research 2016, Issn 1345 9589.
12. Zhang Yingying¹, Chen Xumei¹, Zhang Xiao, Song Guohua, Hao Yanzhao, Yu Lei¹, “Assessing Effect of Traffic Signal Control Strategies on Vehicle Emissions”, *Journal of Transportation Systems Engineering And Information Technology*, Volume 9, Issue 1, February 2009.