Vehicular air pollution based on traffic density - A case study

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Abstract

Air pollution problems are the top environmental problems persisting. The urban transportation has drastically improved over the recent years contributing to more vehicular growth. Vehicular congestion and traffic has paved ways to increase in vehicular air pollution. This paper analyses the traffic volume data at three places in Chennai. From the study, comparing with the three locations, based on the vehicle count, among all other vehicles, motorcycles are the highest in count. The air pollutants carry significant risks for the people who live in the particular surroundings. This could be an evident that CO_2 and Particulate matter are high in the cases of motor cycles when compared to the passenger cars. The centralizations of toxins near streets are all around connected to transportation, so these markers can be utilized as a pointer of density of residents and also they signify as the metropolitan toxic wastes which pollute the surroundings.

Introduction

Rapid growth of contaminants in the air, we must focus on the measurements to be

taken to maintain the air quality. The need of the study is to describe the air pollutant concentrations with respect to the total traffic volume for one hour. A one hour real time traffic data has been analyzed and compared with different places of the city.

It is observed from the data of last 3 decades that the number of vehicles are doubled once in ten years especially in Asian countries while there are 2–5 percent annual growth in other developing and developed countries. This could be estimated that developing countries like our nation will consume more vehicles in the forth coming years [5], [6], [7]. It is considered that the development of automobile industry has become a cause for major issues like economic inequality, health and welfare, environmental issues etc., in developing countries. [3], [4].

The motor industry has become the major consumer of petroleum products. According to the World Energy outlook [14], [16],it is assumed that the major income for the development of economy will be brought from the motor industry in the developing countries since the demand for oil has raised from 87 million barrels per day (mb/d) in 2010 to 99 (mb/d) in 2035. All the nations may adopt a new system from the remaining inefficient, which is considered as a high carbon energy system pushing CO_2 emissions. We should focus on air toxic wastes since the drastic development in the usage of motor vehicles and consumption of fuel especially in the developing countries. It is mandatory for controlling the air pollution in the environment that air pollution emission by the traffic to be found out in regular basis [12]. Vehicular congestion has drastically increased in the developing countries since the rise in individual's revenue and the expansion of many metropolitan cities [13], [17]. Air pollutants like Nitrogen Oxides (NO_X), Carbon Monoxide (CO), and Volatile Organic Compounds (VOC) are emitted in the traffic especially in the metropolitan areas [14], [15].

An effective measurement to be taken to avoid air pollutants by doing a research on the emission rate of contaminated toxic wastes in the traffic at both local and national levels. Gathering details about rate of air toxic waste emitted by vehicles Information at metropolitan areas only will not help to reduce the rate of air pollutants but strict policies to be adopted. Contaminated air is dangerous to human being since they have inhale the unpurified air which will be the reason for many chronic diseases. Polluted air supply has become a threatening issue for both developed and developing nations. "Important materials cause for air pollution are CO, NO_X, HC, and SO_2 [1], [2]. Contaminated fuels especially used for transport has become the reason for more emissions especially in the new engines [23].

In the Asian countries, there is a tremendous production of light vehicles and heavy vehicles in recent years mainly in the metropolitan areas [[8], [9], [10]]. Exhaust

emission from automobiles like passengers' travel or moving goods has become main reason for contaminated oxygen supply. Motor industry cause for polluting air especially in the cosmopolitan cities [21]. On an average, all vehicle categories as well as the total vehicular population appear to follow an exponential growth pattern [10]. It is reported that more emitting of pollutants are available in most of the cities [13]. Most motor vehicles are concentrated within metropolitan areas. A fast migration of people and the increase in the number of vehicles in Delhi cause for contaminated air and urban mobilization [18], [19].

Discharge of Carbon monoxide (CO), Carbon dioxide (CO_2), Hydrocarbon (HC) and Oxides of Nitrogen (NOx) cause for contaminated air supply and it has become for the atmospheric change [20]. Rapid emissions of air pollutants cause for increased ambient concentrations and exposure rates for travelers [21]. Using more number of vehicles cause for the contaminated air and they play a major role for contaminated air in cosmopolitan cities. Emissions have become the major issue which to be reduced for the better environment [14] The motor industry is the main cause for contaminated air [19]. Motor transport has become the main problem for the decrease in air quality and air pollution in Delhi [19]. Rapid emissions of air pollutants cause for increased ambient concentrations and exposure rates for travelers [21], [22], [27]. The transport industry is the main reason for the contaminated air in major metropolitan cities [11].

Emission from motor vehicles in the vehicular congestion areas has increased remarkably in the past few years [24], [25], [26], [27]. Motor vehicles always run on roadways and emit more CO_2. Subsequently vehicle traffic may help to reduce the problems of vehicle related contaminants since vehicle-induced turbulence which is based on acceleration of motor vehicles. Accumulation of vehicles drives the speed of vehicles, which may cause for rising of acceleration of vehicles; various stopping and starts emit air pollutants which depends on engines used in the vehicles [13], [28]. Metropolitan cities suffer from heavy toxic wastes since there are heavy traffic occurs and it also extends travelling time [3].It is observed from the data that the emission of Carbon di-oxide occurs especially in the morning and evening peak travelling time. [14]. A heavy traffic congestion in bigger cities cause for the emission of air pollutants like the level of 90–95% of Carbon Dioxide, 80–90% of NOx and hydrocarbons which are dangerous to the environment and human being. It is not able to predict the pollutant level of an area by calculating the counts of vehicles used in the particular area, but the nature of the environment and traffic flow in the particular region also to be monitored. In the heavy traffic areas, the counts of vehicles may misguide to find out the pollutant level.

Section snippets

Study area

The study area includes Rajiv Gandhi Salai, which connects the capital of Tamilnadu with Mahabalipuram. It is 45 km long and was identified as the Old Mahabalipuram Road (OMR) in the eastern coastal side of South India, Fig. 1. It is a shelter to many multinational companies which deal with foreign companies projects and jobs, reputed colleges and universities, many national research laboratories are available on this road. A study has been done to find out traffic congestion and its effects on

Methodolgy

As of now, Madhya Kailash, Kottivakkam and at Indira Nagar real time traffic flow for one hour duration was taken from 8am to 9am. A video camera was installed on the land bridge to record traffic flow. The average vehicle speed was calculated using the time to travel a distance of 70 m as recorded by the video camera. These sites have been selected as they have more vehicle movement. Information for the research to calculate traffic congestion can be done manually; similarly the observation is

Results and discussion

The Traffic volume count for all the locations at Perungudi, Kottivakkam and Madhya Kailash are tabulated in Table 1. Emission factor prescribed by the Automotive Research Association of India ARAI, Pune are given in Table 2. From the results, it is evident that the motor cycles are higher when compared to the other type of vehicles.

Quantification of emission using Emission factors were calculated using Eq. (1) and results are listed.

From the results taken at Perungudi site Fig. 2., the CO_2

Conclusion

The consolidated results from the study have provided a detailed knowledge of the spatial distribution of emissions. From this study, it is evident that CO % is higher in motorcycles when compared to other vehicles in all the 3 sites. 65%, 72% and 80% of emissions was due to motor cycles in Perungudi, Kottivakkam and Madhya Kailash respectively. NOx 40% was generated mainly due to motorcycles and 32% by heavy commercial vehicles. CO_2 emissions whereas high as 64 % at Madhya Kailash, 47% at

CRediT authorship contribution statement

G. Sharmilaa: Conceptualization. **T. Ilango:** Validation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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