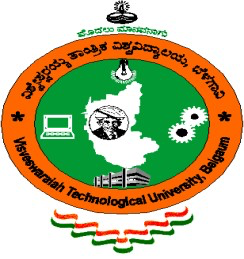
**VISVESVARAYA TECHNOLOGICAL UNIVERSITY**

JNANA SANGAMA, BELAGAVI -590018



**“PROJECT REPORT”**

**ON**

**“STUDY AND CONTROL OF AIR POLLUTION DUE TO AUTOMOBILES IN URBAN AREA"**

Submitted to Visvesvaraya Technological University in partial

fulfillment of requirement for the award of

**BACHELOR OF ENGINEERING**

**IN**

**CIVIL ENGINEERING**

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**2021-2022**

**SRI TARALABALU JAGADGURU INSTITUTE OF TECHNOLOGY**

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CERTIFICATE

Certified that the “STUDY AND CONTROL OF AIR POLLUTION DUE TO AUTOMOBILES IN URBAN AREAS” **is** a Bonafide carried Out by **SHANMUKHAPPA M TOTAGER (2SR18CV037) UDAY M (2SR18CV042) VIDYASHRI E HIREMATH (2SR18CV044) RASHMI D S (2SR19CV428) in** partial fulfillment of requirement for theaward of degree of **Bachelor of Engineering** in **Civil Engineering** of **VisvesvarayaTechnology University**, Belgaum during the year of 2021 - 2022. It is certified that allcorrection / suggestion for internal assessment have been incorporated in the report depositedin the department library. The Project report has been approved as it satisfies the academic requirements in respect of seminar work prescribed for the Bachelor Engineering degree.

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**Project Associates**

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**DECLARATION**

We the students of final semester of Civil Engineering, **STJ Institute of Technology Ranebennur-581115** declare that the work entitled **“PROJECT REPORT”** has been successfully completed under the guidanceof **Sudha P H Assistant Professor** of Civil Engineering Department, **STJ Institute of Technology Ranebennur**. This Technical Seminar report is submitted to Visvesvaraya Technological University in partial fulfillment of the requirements for the award of Degree of Bachelor of Engineering in Civil Engineering during the academic year 2021 - 2022. Further the matter embodiedin the report has not been submitted previously by anybody for the award of anydegree or diploma to any university.

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**ABSTRACT**

Air pollution in Davanagere has increased rapidly due to population growth, increase in the numbers of vehicles, use of fuels , bad transportation systems , poor land use pattern, industrialization, and above all, ineffective environmental regulations. Sulphur Dioxide, Nitrogen Dioxide, Particulate Matter are some of the pollutants which are contributing to environmental pollution.

Purpose of this paper is to review the literature relating to the analysis of ambient air quality of Davanagere city. Also discuss of the use of Air Quality Index (AQI), seasonal variation in concentration of air pollutants. Assessment of health impacts due to increase in the concentration of air pollutants in Davanagere city.

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**CHAPTER 1**

**INTRODUCTION**

**1.1 GENERAL**

Air is composed of ~78% nitrogen, 21% oxygen, 0.9% argon. The remaining elements include carbon dioxide, water vapour, hydrogen, and other trace elements. Although gases like carbon dioxide and methane may only exist in small absolute concentrations, their outsized heat-trapping potential as [greenhouse gases](https://studentenergy.org/other/greenhouse-gas-emissions/) makes them the major factor in accelerating [climate change](https://studentenergy.org/influencer/climate-change/). Air pollution occurs when there is an alteration to the composition of air, either by volume, or in the chemical, physical, or biological properties. The atmosphere is a delicate balance of elements and particles. Any imbalance, even in small proportions can be detrimental to living organisms including animals and crops.

Air pollution is caused by a combination of gaseous and particulate pollutants such as carbon dioxide, methane, and nitrogen dioxide emitted from point sources such as factories and motor vehicles that burn fuel. Some gaseous emissions are visible to the eye and sometimes may even diffuse into the atmosphere and become invisible. Particulate pollution, on the other hand, such as soot and black carbon, is always visible.

Air Pollution is one of the serious problems in the world especially in urban areas of developing countries due rapid growth of population, increase in number of vehicle and industrialization. Motor vehicle have been regarded as the primary cause of air pollution in the urban areas and account for 60 to 70% of the pollution found in the urban environment.

SO2, NO2, SPM and RSPM are major air pollutants in India. The studies on air pollution in large city of Davanagere showed that ambient air pollution concentrations are at such levels where serious health effects are possible. Continuous rise of population along with the lack of suitable measures for air pollution control means that there is a great potential that conditions may worsen in future in Davanagere city. These all pollutants may pose harmful effect on human health such as cardiovascular and respiratory disease, Neurological impairments, increased risk of preterm birth and even mortality and morbidity. Various studies conducted in Davanagere at various locations suggests that pollution levels varies significantly in different areas with respect to its location, time, period of sampling and climatic conditions.

Air pollution is a significant [risk factor](https://en.wikipedia.org/wiki/Risk_factor" \o "Risk factor) for a number of [pollution-related diseases](https://en.wikipedia.org/wiki/List_of_pollution-related_diseases" \o "List of pollution-related diseases), including [respiratory infections](https://en.wikipedia.org/wiki/Respiratory_infection" \o "Respiratory infection), [heart disease](https://en.wikipedia.org/wiki/Heart_disease" \o "Heart disease), [COPD](https://en.wikipedia.org/wiki/Chronic_obstructive_pulmonary_disease" \o "Chronic obstructive pulmonary disease), [stroke](https://en.wikipedia.org/wiki/Stroke" \o "Stroke) and [lung cancer](https://en.wikipedia.org/wiki/Lung_cancer" \o "Lung cancer). Growing evidence suggests that air pollution exposure may be associated with reduced IQ scores, impaired cognition, increased risk for psychiatric disorders such as [depression](https://en.wikipedia.org/wiki/Depression_(mood)" \o "Depression (mood)) and detrimental [perinatal](https://en.wikipedia.org/wiki/Perinatal" \o "Perinatal) health.The human health effects of [poor air quality](https://en.wikipedia.org/wiki/Air_quality_index" \o "Air quality index) are far reaching, but principally affect the body's respiratory system and the [cardiovascular system](https://en.wikipedia.org/wiki/Circulatory_system" \o "Circulatory system). Individual reactions to air pollutants depend on the type of pollutant a person is exposed to, the degree of exposure, and the individual's health status and genetics.

Outdoor air pollution attributable to fossil fuel use alone causes 3.61 million deaths annually, making it one [of the top contributors to human death](https://en.wikipedia.org/wiki/List_of_causes_of_death_by_rate" \o "List of causes of death by rate), with anthropogenic ozone and PM causing 2.1 million. Overall, air pollution causes the deaths of around 7 million people worldwide each year, or a global mean loss of life expectancy (LLE) of 2.9 years,and is the world's largest single environmental health risk, which has not shown significant [progress](https://en.wikipedia.org/wiki/Progress" \o "Progress) since at least 2015.Indoor air pollution and poor urban air quality are listed as two of the world's worst [toxic](https://en.wikipedia.org/wiki/Toxic" \o "Toxic) pollution problems in the 2008 [Blacksmith Institute](https://en.wikipedia.org/wiki/Blacksmith_Institute" \o "Blacksmith Institute) World's Worst Polluted Places report.The scope of the air pollution crisis is large: 90% of the world's population breathes dirty air to some degree. Although the health consequences are extensive, the way the problem is handled is considered largely haphazard or neglected.

**CHAPTER 2**

**LITERATURE REVIEW**

**Author Harish M :** This paper reviews the Air Quality Analysis at following locations in Urban area: Urban area is surrounded by industrial and commercial zones and rapid increase in urbanization results in increase gaseous pollutants SO2, NO2, SPM and RSPM. The average ambient air concentration of SO2 was found below the permissible limits of NAAQS at all the sites. Comparatively somewhat higher concentration of SO2 was observed during these months.

**Author Prashanth Gargavava:**A paper presentsa case study on the health survey was also carried out which showed the symptoms were developed such as sore throat, shortness of breath, skin irritation, wheezing, sneezing, chest tightness, nausea etc. An assessment for people (aged 10 to 60 years) was carried out to find health problems due to vehicular pollution between the months of November-2013 to May-2014 (winter). Average concentration of SO2 at residential area Kampoo was found 11.800 µg/m³ which is less as compared to other sites and also the health effects are minimum because this area is not so congested and traffic is less.

At commercial area Thatipur average concentration of SO2 was found 13.300 µg/m³ which is lower that of Railway Station and Gola Ka Mandir and higher than Kampoo may be due to the fact that this area is highly congested as compared to other sites because it is the commercial area of Gwalior and also traffic is found less as compared to Railway Station and Gola Ka Mandir but higher that of Kampoo.

**Author : Mahadevappa Harish** This paper has made an attempt to study on The average ambient air concentration of SO2 was found below the permissible limits of NAAQS of CPCB at all the sites. Comparatively somewhat higher concentration of SO2 was observed during November2013 to May-2014. In this study, an assessment of people (aged 10 to 60 years) suffering from health problems due to vehicular pollution between the months of November2013 to May-2014 (winter) and showing these symptoms (sneezing, sore throat, shortness of breath, wheezing, chest tightness, skin irritation, nausea etc.) was developed. The people in Thatipur were mainly suffering from sneezing and skin irritation which may be due to the heavy emissions from Tempos. These vehicles are mainly run by diesel fuel and in most cases, are not frequently serviced. Wheezing is rare in all areas, but traders in Thatipur

**Author: Chetan Khandar and Sharda Kosankar** showed the highest complaints. Shortness of breath and skin irritation is mainly shown by the tempo drivers and other people in Thatipur. Since this is a commercial area of Gwalior. The percentage of people affected by sneezing, sore throat and shortness of breath was the highest in Railway Station and Gola ka Mandir. This may be due to the fact that Tempos, Buses, Trucks, Trains and privet cars are more common and they are not well maintained. Shortness of breath is very common in these areas. The health effects in Kampoo were found rear this may be due to the fact that this area is not so congested and the fleet of traffic is found less in this area. The people were mainly affected by skin irritation, this may be due to the fact that the spent most of their time with their vehicles which are not well maintained.

**CHAPTER 3**

**OBJECTIVES**

1. To identify the number of vehicles in davangere city.

2. To identify the types of pollutants released from vehicles in davangere city.

3. To forecast and suggestion for controlling measures of air pollution in davangere.

4. To suggestion for controlling measures of air pollution in urban areas.

5. Describe sources and hazards of air pollution in urban areas.

**CHAPTER 4**

**AIR POLLUTION**

****Air pollution**** is one of the biggest threats for the environment and affects everyone: humans, animals, crops, cities, forests, aquatic ecosystems.

## 4.1 What is air pollution?

Air pollution can be defined as an alteration of air quality that can be characterized by measurements of chemical, biological or physical pollutants in the air. Therefore, air pollution means the undesirable presence of impurities or the abnormal rise in the proportion of some constituents of the atmosphere. It can be classified in 2 sections: ****visible**** and ****invisible**** air pollution.

* ****Local****

this concerns the quality of ambient air within a radius of a few kilometers

* ****Regional****

pollution like acid rain, photochemical reactions and degradation of water quality at distances of a few kilometers to a thousand kilometers

* ****Global****

depletion of the ozone layer and global warming caused by the emission of greenhouse gases, mainly carbon dioxide (CO2)

Air pollution is caused by a variety of sources including but not limited to transportation, factory emissions, biomass combustion, and agricultural production. The air pollution emitted from point sources is somewhat easy to quantify. However, the cost of air pollution is much more challenging to quantify because each product and material has a different impact embedded within it. When air pollutants are released into the atmosphere, they have adverse effects on humans and the environment. A notable feature of air pollution is that the effects are compounding, indicating that it can trigger a chain reaction of other environmental effects.

**4.1.1 Causes of Air pollution**

### Air pollution is caused by the presence in the atmosphere of toxic substances, mainly produced by human activities, even though sometimes it can result from natural phenomena such as volcanic eruptions, dust storms and wildfires, also depleting the air quality. ****1. The Burning of Fossil Fuels****

Most of the air pollution takes place due to the burning of fossil fuels such as coal, oil, and gasoline to produce energy for electricity or transportation. The release of carbon monoxide at a high level indicates how much fossil fuel is burned. This also emits other toxic pollutants into the air. Inhaling air induced with pollutants due to the burning of natural gas and fossil fuel [reduces heart’s ability to pump](https://www.aqi.in/blog/5-things-how-air-pollution-affects-you-and-your-family/) enough oxygen causing one to suffer from respiratory illness.

### ****2. Industrial Emission****

Industrial activities emit several pollutants in the air that affects the air quality more than we can even imagine. Particulate matter 2.5 and 10, Nitrogen dioxide, Sulfur dioxide, and carbon monoxide are [key pollutants that are emitted](https://www.aqi.in/blog/how-monitoring-air-quality-data-has-become-an-absolute-necessity/) from industries that use coal and wood as their primary energy source for the production of their goods. Industrial pollution effects associated with your health can range from irritation in your eyes and throat to breathing issues, which at times can even lead to chronic illness.

### ****3. Indoor Air Pollution****

Use of toxic products also called Volatile Organic Compounds (VOCs), inadequate ventilation, uneven temperature, and humidity level [can cause indoor air pollution](https://www.aqi.in/blog/how-your-in-house-air-quality-is-worse-than-the-outdoor-one/), whether you are in an office, school, or at your comfortable home. House air pollution can take place due to ignorant factors, for instance, [smoking tobacco inside a room](https://www.aqi.in/blog/cigarettes-smoke-air-pollution/) or leaving mold-infected walls untreated. The use of wood stoves or space heaters is capable to increase the humidity level which can directly affect the health of a person in no time.

### ****4. Transportation****

There is no denying that vehicle pollution is the major contributor to air pollution, especially in urban cities. When the car burns gasoline, it emits pollutants in the air which is as harmful as smoking 10 cigarettes a day. Your vehicle emits carbon monoxide, hydrocarbons, nitrogen oxide, and particulate matter. When vehicle pollution is high in the atmosphere, it creates a hole in the ozone layer contributing to smog and causing various health issues.

### ****5. Open Burning of Garbage Waste****

Open burning of garbage is much more harmful to your health and the environment than one may think. As per Engage EPW, Delhi Air Pollution is choking public health. [Delhi generates](https://www.aqi.in/blog/diwali-fireworks-badly-affect-delhi-air-quality/) a whopping 9500 tons of waste every day, which makes it India’s second waste dumping city. Exposure to open burning of garbage waste can pose serious health risks including cancer, liver issues, impairment of the immune system, and reproductive functions; can also affect the developing nervous system.

### ****6. Construction and Demolition****

During the clean air act movement, the Central Pollution Control Board (CPCB) registered the highest number of air pollution complaints in the [Delhi NCR due to construction pollution](https://www.pranaair.com/solutions-by-industry/pm2-5-monitoring-air-pollution-by-construction-sites/) and demolition activities. With the rise of population in the city, construction and demolition is a part of the ever-going development phase of the national capital. Several construction sites and raw materials such as bricks and concrete cause haze and foul air which is hazardous for people especially, children and elderly citizens.

### ****7. Use of chemical and synthetic products****

Talking about air pollution, we always consider outdoor air pollution dangerous for our lives but never talk about indoor air pollution. [Household products cause indoor air pollution](https://www.aqi.in/blog/household-cleaning-products-indoor-air-pollution/) which is 10 times more harmful than outdoor air pollution. Volatile Organic Compounds (VOCs) found in paints, cleaners and personal care products such as perfume and deodorants are a reason for common heath issues. Risks like asthma or other respiratory issues and lung disease are other issues caused by inhaling poor house air quality.

**4.1.2 Effects of Air pollution**

It is impossible to describe the whole extent of potential and actual damage caused by all forms of air pollution. But here are the main consequences:

**ON THE ENVIRONMENT**



Fig 1 Effect of air pollution on the Environment

Air pollution has a major impact on the process of plant evolution by preventing photosynthesis in many cases, with serious consequences for the purification of the air we breathe. It also contributes to the formation of acid rain, atmospheric precipitations in the form of rain, frost, snow or fog, which are released during the combustion of fossil fuels and transformed by contact with water steam in the atmosphere.

**GLOBAL WARMING**

Fig 2 Global Warming

On top of that, air pollution is a major contributor to **[global warming and climate change](https://solarimpulse.com/global-warming-solutions)**. In fact, the abundance of carbon dioxide in the air is one of the causes of the greenhouse effect. Normally, the presence of greenhouse gases should be beneficial for the planet because they absorb the infra-red radiation produced by the surface of the earth. But the excessive concentration of these gases in the atmosphere is the cause of the recent climate change.

**ON HUMAN HEALTH**



Fig 3 Effect of air pollution on human health

Our continual exposure to air pollutants is responsible for the deterioration of human health. Air pollution is indeed a significant risk factor for human health conditions, causing allergies, respiratory and cardiovascular diseases as well as lung damage.

### 4.1.3 Controlling Air Pollution

In the United States, the Clean Air Act has been a crucial tool for reducing air pollution since its passage in 1970, although fossil-fuel interests aided by industry-friendly lawmakers have frequently attempted to weaken its many protections. Ensuring that this bedrock environmental law remains intact and properly enforced will always be key to maintaining and improving our air quality.

But the best, most effective way to control air pollution is to speed up our transition to cleaner fuels and industrial processes. By switching over to renewable energy sources (such as wind and solar power), maximizing fuel efficiency in our vehicles, and replacing more and more of our gasoline-powered cars and trucks with electric versions, we'll be limiting air pollution at its source while also curbing the global warming that heightens so many of its worst health impacts.

And what about the economic costs of controlling air pollution? According to a report on the Clean Air Act commissioned by NRDC, the annual [benefits of cleaner air](https://www.nrdc.org/resources/clean-air-acts-benefits-map) are up to 32 times greater than the cost of clean-air regulations. Those benefits include up to 370,000 avoided premature deaths, 189,000 fewer hospital admissions for cardiac and respiratory illnesses, and net economic benefits of up to $3.8 trillion for the U.S. economy every year.

**4.2 Pollutant Effects**

**Carbon monoxide**

Affects the cardiovascular system, exacerbating cardiovascular disease symptoms, particularly angina; may also particularly affect fetuses, sick, anemic and young children, affects the nervous system, impairing physical coordination, vision and judgments, creating nausea and headaches, reducing productivity and increasing personal discomfort.

**Nitrogen Oxides**

Increased susceptibility to infections, pulmonary diseases, impairment of lung function and eye, nose and throat irritations. Sulphur Dioxide Affect lung function adversely. Particulate Matter and Respirable Particulate Matter (SPM & RPM) Fine particulate matter may be toxic in itself or may carry toxic (including carcinogenic) trace substance, and can alter the immune system. Fine particulates penetrate deep into the respiratory system irritating lung tissue and causing long-term disorders.

**Lead**

Impairs liver and kidney, causes brain damage in children resulting in lower I.Q., hyperactivity and reduced ability to concentrate. Benzene Both toxic and carcinogenic. Excessive incidence of leukemia (blood cancer) in high exposure areas. Hydrocarbons Potential to cause cancer (Source: Central Pollution Control Board Status of the vehicular pollution control program in India (2010), program objective series PROBES/136/2010).

**4.2.1 Pollutants specific health effects**

**Pollutant specific health effects of vehicular emissions are as below**:

1. **Carbon monoxide:**

Carbon monoxide (CO) is an odorless, invisible gas created when fuels containing carbon are burned incompletely—poses a serious threat to human health. CO is known to cause death at high levels of exposure. The affinity of blood hemoglobin is 200 times greater for carbon monoxide than for oxygen, CO hinders oxygen transport from the blood into the tissues. The effects of this gas on human have been shown even at low levels of exposure. The low level of exposure accelerates and angina (chest pain) in people having coronary artery diseases. Healthy individuals are also affected, but only at higher levels. Exposure to elevated CO levels is associated with the impairment of visual perception, work capacity, manual dexterity, learning ability and the performance of complex tasks.

1. **Nitrogen Oxides:**

Nitrogen dioxide (NO2) has been linked to increased susceptibility to respiratory infection, increased airway resistance in asthmatics, and decreased pulmonary function. It has been shown that even short-term NO2 exposures have resulted in a wide range of respiratory problems in school children; cough, runny nose and sore throat are among the most common. The oxides of nitrogen also contribute to acid deposition on plants and surface water resulting in damages of trees and aquatic life. NOx emissions also increase the levels of particulate matter by changing into nitric acid in the atmosphere and forming particulate nitrate.

1. **Photochemical Oxides (Ozone):**

There is no release of ozone as such from the vehicles, but it is formed as a result of chemical reactions of volatile compound and NOx in the presence of heat and sunlight. In other words, the pollutant release from vehicles also results in the formation of ozone through chemical reactions. The ground level ozone, which is the main part of the smoke, can cause respiratory problems such as chest pain, cuffing etc. The ozone gas is known to cause inflammation respiratory tracks, reduction in the ability to breath (lung function), increase in asthma and other lung diseases. In addition to, effects on human health, ozone is also known to adversely affect the environment in many ways, including reducing yield for crops, fruits, commercial forests, ecosystem etc. It also damages urban grass, flowers, shrubs and trees etc.

1. **Oxides of Sulphur:**

High concentrations of sulfur dioxide (SO2) can result in temporary breathing impairment in asthmatic children and adults who are active outdoors. Short-term exposures of asthmatic individuals to elevated SO2 levels while on moderate exertion may result in reduced lung function that may be accompanied by such symptoms as wheezing, chest tightness, or shortness of breath. Other effects that have been associated with longer-term exposures to high concentrations of SO2, in conjunction with high levels of PM, include respiratory illness, alterations in the lungs’ defenses, and aggravation of existing cardiovascular disease

1. **Gaseous Air Toxic:**

The hydrocarbon emissions release from vehicles also contained toxic air pollutants that may have a significant effect on public health.

1. **Benzene:**

Benzene is a known human carcinogen by all routes of exposure. Low term respiratory exposure to high level of ambient benzene has been shown to cause cancer all the tissues that formed white blood cells. Exposure to benzene or its metabolites have also been linked with genetic changes in human and animals. The occurrence of certain chromosomal changes in individuals with known exposure to benzene may serve as a marker for those at risk of contracting leukemia.

1. **Formaldehyde:**

Formaldehyde has been classified as a probable human. Epidemiological studies suggest that long-term inhalation of formaldehyde may be associated with tumors of the nasopharyngeal cavity (generally the area at the back of the mouth near the nose), nasal cavity and sinuses. Formaldehyde is also known to produce mutagenic activity.

1. **1,3-Butadiene:**

1,3-Butadiene has also been classified as a Group B2 (probable human) carcinogen based on evidence from two species of rodents and epidemiologic data (CPCB, 2010).

1. **Lead:**

Lead affects many organs and organ systems in the human body, with sub cellular changes and Neuro developmental effects appearing to be the most sensitive. Lead also causes impaired sensory motor function and renal functions. A small increase in blood pressure has also been associated with lead exposure. Airborne lead can be deposited on soil and water, thus reaching humans through the food chain and drinking water (CPCB, 2010). Atmospheric lead is also a major source of lead in household dust. Ingested, inhaled or absorbed through skin. 86% of atmospheric lead – auto exhaust, leaded petrol, water pipes, paint, battery storage, crystal glass, ceramic glaze, enamel jewelry, etc. Lead concentration in dust is directly proportional to the volume of traffic. central nervous system, decreased IQ, convulsions, coma, death (H. Paramesh, 2003).

1. **Particulate Matter:**

represents a broad class of chemically and physically diverse substances that exist as discrete particles (liquid droplets or solids) over a wide range of sizes. Particles may be emitted directly to the atmosphere or may be formed by transformations of gaseous emissions such as sulfur dioxide or nitrogen oxides. The key health effects associated with PM include premature death, aggravation of respiratory and cardiovascular disease, as indicated by increased hospital admissions and emergency room visits, school absences, work loss days, and restricted activity days; changes in lung function and increased respiratory symptoms; changes in lung tissues and structure; and altered respiratory defense mechanisms. Exposure to coarse fraction particles is primarily associated with the aggravation of respiratory conditions such as asthma. Fine particles are most closely associated with health effects such as premature death by cardiopulmonary diseases.

1. **Suspended particulate matter (SPM):**

In particular, high levels of sulphur dioxide and suspended particulate matter (SPM) are associated with increased mortality, morbidity and impaired pulmonary function. Environmentalists claim that living in an Indian metropolitan city is like smoking 10-20 cigarettes every day. More than 40,000 people die prematurely every year because of air pollution, says a World Bank report, of which Delhi’s share is the highest i.e. 19% (Tahir et al., 2012). Table 7 presents total deaths by cause. Out of all causes of death, 16% and 27% deaths are due to respiratory infections and respiratory diseases and cardiovascular problems in India respectively. Table 8 shows age specific death by cause. It reports which age groups affect more due to pollution led diseases and how acute the diseases related to pollution are. The table shows that population belonging to the age group of 60+ are suffering more from Asthma and Bronchitis (82.9%), heart attack (60.7%) and Tuberculosis of lungs (32.4%) while children under 1 year are from pneumonia (54%).

If we compare the past data of 1984, 1988 and 1998 it is seen that the respiratory problem and related diseases like asthma and bronchitis among the different age groups are increasing; especially the senior citizens are most affected (Mukhopadhyay, 2009).

## 4.2.2 Air pollution prevention

There are ****ways to prevent, control and eventually reduce air pollution****:

**1.**Renewable fuel and clean energy production****  
 The most basic ****solution for air pollution**** is to move away from fossil fuels, replacing them with alternative energies like solar, wind and geothermal.

**2.**Energy conservation and efficiency****  
 Producing clean energy is crucial. But equally important is to reduce our consumption of energy by adopting responsible habits and using more efficient devices.

**3.**Eco-friendly transportation****  
 Shifting to electric vehicles and **[hydrogen vehicles](https://solarimpulse.com/hydrogen-mobility-solutions)**, and promoting shared mobility (i.e carpooling, and public transports) could reduce air pollution.

**4.**Green building****  
 From planning to demolition, green building aims to create environmentally responsible and resource-efficient structures to reduce their carbon footprint.

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**4.3 The Study Area**

Davangere is a rapid development in urban area either in demography, migration, transportation, or industrial sector since last two decades. The davangere has the highest demography and the only metropolitan city, of Karnataka, which it has 94 lacks of population as per the 2011 census. The intensity, quantity, and frequency of both urban, suburban and movement with other cities are same factor of increasing transportation problem in the davangere area; particularly in transportation utility development could not comply with the demand. The dependency of urban population on transportation systems on fossil fuels is quite high.

The davangere is one of the cities having 41 lacks registered vehicles apart from other vehicles of neighboring city and towns. The vehicle with poor environmental quality continues to grow in multiple ratios... There is an urgent need to address the interrelated problems and obstacles experienced by the people of davangere regarding air pollution through the vehicles.

The traffic congestion resulting from transportation changes contributes even greater to deteriorating environment in urban communities. In the last few years, about 70% of ambient-air quality degradation in davangere is affected by transportation activities. Based on Statistics of the department of road transport offices in davangere (2010) the increasing of motor vehicle in davangere has gone up by 18 per cent every year. While the transportation activities could effect on positive impact like the increasing on davangere economic activity, or negative impact like the increasing of street capacity in surrounding downtown area. This could effect in decreasing ambient air quality and also decreasing on public health quality either pedestrian or local communities.

|  |  |  |  |
| --- | --- | --- | --- |
| Ambient air quality Data at Mothi Talkies, Davanagere 2012-18 |  |  |  |
|  | **SO2 µg/m3** | **NO2 µg/m3** | **PM10 µg/m3** |
| 2012-13 | 6.0 | 9.0 | 134.0 |
| 2013-14 | 7`0 | 10.4 | 147.0 |
| 2014-15 | 4.8 | 7`2 | 167.0 |
| 2015-16 | 5.7 | 10.7 | 216.0 |
| 2016-17 | 5.1 | 9.8 | 145.0 |
| 2017-18 | 5.3 | 10.0 | 164.6 |
| **Standards** | **50.0** | **40.0** | **60.0** |

**Table 1** Ambient air quality Data from Davangere RTO office 2012 - 18

**4.3.1 AIR POLLUTION FROM TRANSPORT SOURCES**

Air pollution is addition of any harmful gaseous, liquid or solid particles or substances to the atmosphere, which causes the damaging of the environment, human health on quality of life in urban area that can endanger the health of human beings, plants animals, or damage materials reduce visibility or release undesirable odors. By this one of the great problems faced in urban areas throughout the world is the increase in vehicles due to imbalance between the public transport and the increase in population, mobility and last mile connectivity. This increase in the number of vehicles has lead to increase in congestion and the increase in pollution by the private vehicles Polluting such a natural resource 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.

Transportation is one of the important of economic activity and beneficial social interactions. While the transportation sector is also a major source of air pollution in davangere, estimated to account for nearly all of carbon monoxide (CO), more than 80% of nitrogen oxides (NOx), 40% of volatile organic compounds (VOC), 20% of sulfur dioxide (SO2), and 35% of PM10 in 1998. The growing problems related to traffic are congestion, accidents, pollution and lacks of security are also very worrisome. The key question is how to reduce the adverse environmental impacts and other negative effects of transportation without giving up the benefits of transportation.

This is due to increase in the automobiles and the mobility of people, rapid urban growth, which is likely to increase travel demand significantly in davangere city. Given current trends, by 2020 the davangere city will have a 1.3 crore population will reach 2 largest city including the nearby cities of other states capital such as, Hyderabad, Chennai, Tiruvananthapuram in south India by 2030.

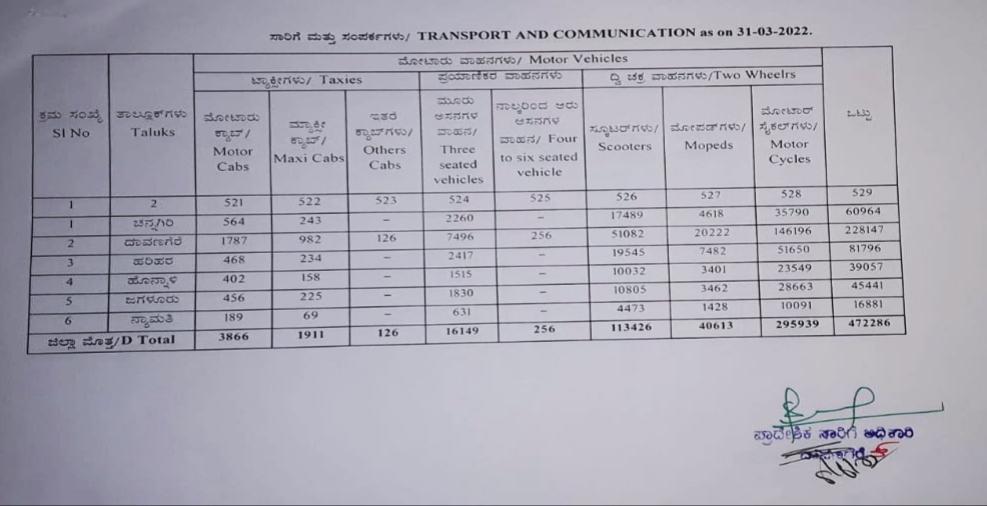
The increase in the number of vehicles from transportation sector presents a wide range of issues viz. air pollution, noise, congestion, accidents and increased travel time and delays. It was evident from the existing information that air pollution controls are not only important and a current priority 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 transport sector due to its high greenhouse gas co-benefits.

**4.3.2 MOBILITY AND AIR POLLUTION**

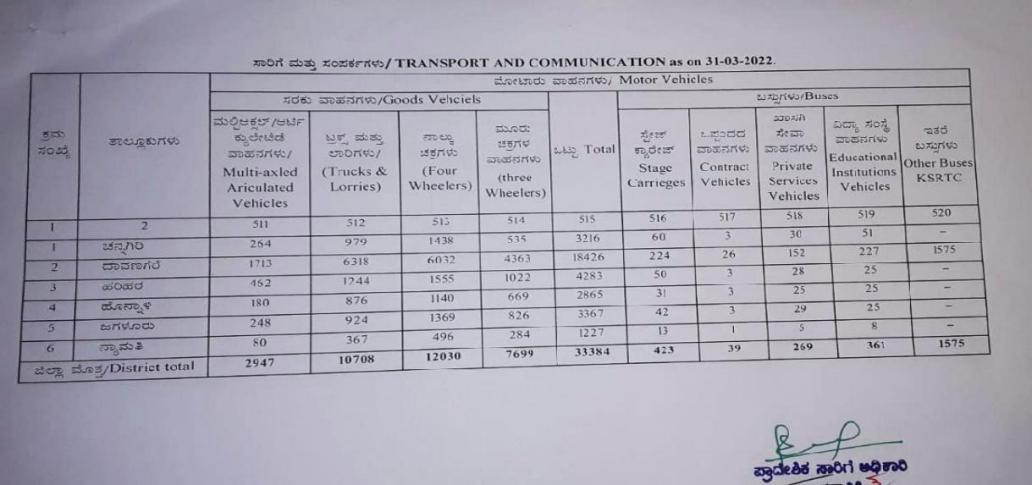
In recent years due to increase in the number of vehicles has shown drastically in, levels of air, noise, and sight pollution were much higher in all urban centers today. Due to increase in automobiles on the road today we experience higher levels of pollution than before.

The automobile is one of the major sources, probably the leading contributor pollution in the cities. The transportation is of the major source for the economic activity and redistribution of resources among people. But transportation sector is a major source of air pollution in davangere, it is estimated that the account for nearly all of carbon monoxide (CO), more than 80% of nitrogen oxides (NOx),and 35% of PM10 in 1998. The growing automobiles have lead to problems of congestion, accidents, and lack of security due to automobiles are worrisome. Therefore to reduce adverse environmental impacts and other negative effects of transportation without giving up the benefits of mobility. As the increasing geographic dispersion of davangere population is also likely to increase aggregate transportation demand, since the greater number of trips will also be longer and public transport will be less efficient and universal.

As the population increased in residential areas where decentralized, patterns of passenger trip mode choice in davangere have also shifted dramatically by using private vehicles: The number of private vehicles increased drastically, due to decentralization, globalization, economic development, standardization by most estimates at a rate of 18 percent annually in recent years. This could mean a higher number of vehicles in davangere, a higher ratio of vehicles per persons, possibility of trips and the distances traveled will increase even more for coming years.

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**Table 2** Transport And Communication Data collected from RTO Office Davangere

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**TABLE 3 - DATA OF REGISTERED VEHICLES FROM RTO’S, AND DISTRICT CENSUS HAND BOOK. DAVANGERE REGISTERED VEHICLES AND THEIR FORECAST**

The data shows the number of registered and share of different modes of vehicles in davangere city for the year 2011 (projected and estimated). The share of percentage of vehicles is shown with a pie diagram shown below; but the number of vehicles data is shown in numbers in the form of tables in the left side below.

**4.3.3 SOURCES OF POLLUTION**

**Pollution from 2-wheelers**: Two-wheelers account for about 72 percent of the total vehicular population in davangere. Because of inherent drawbacks in the design of 2- stroke engines, 2-wheelers emit about 20-40% of the fuel un-burnt/partially burnt. Presently, two-wheelers account for more than 65% of the hydrocarbons and nearly 50% of the carbon monoxide in davangere. As these emissions are less visible, the general public is not aware of the role of 2-wheelers in the deteriorating air quality in the city. The 2-stroke engine, in spite of R&D efforts towards improving its design, will continue to be a high emitter of hydrocarbons and carbon monoxide. While the absence of a technological breakthrough on the conventional 2-stroke engine and its high pollution potential, it is for consideration that Government considers the phasing out of two-stroke two and three wheelers.

**Pollution from 4-wheelers:** The davangere city is having 7, 39,667 vehicles on the roads (Jeep-9104, Taxi32818 and Cars-697745) as it consist of both petrol and diesel driven vehicles. It excludes the floating vehicles in 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 18 percent of 4 wheelers 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.

**Pollution from BMTC and other privately operated buses:** There are about 3,500 privately operated BMTC buses of about 6077 buses in davangere Metropolitan transport Corporation consists of 1 percent of the total population. About two thirds of the BMTC fleet is beyond the recommended age of 4-5 years, some even beyond 8-10 years. Most of these buses require phasing out as their condition is beyond normal maintenance measures. Their continued use has resulted in emissions of very high levels of smoke and particulates from this the KSRTC, NWKSRTC, other State owned buses, and the private and industrial busses. If such vehicles continue to function beyond the recommended age and carry more than the permitted load of passengers.

**Pollution from diesel trucks:**The diesel trucks consists of 3 percent in population, similar to buses, emit high levels of smoke and particulate matter. An age limit needs to be specified for all commercial diesel trucks 15 years but still it had remained in the paper. But still so many BBMP, BESCOM and other Government vehicles is running on the streets. Renewal of permits must be done only if the vehicle conforms to satisfactory inspection and maintenance measures for pollution control for the state owned and private buses.

**4.4 AIR PURIFIER**

An **air purifier** or **air cleaner** is a device which removes [contaminants](https://en.wikipedia.org/wiki/Contaminant" \o "Contaminant) from the air in a room to improve [indoor air quality](https://en.wikipedia.org/wiki/Indoor_air_quality" \o "Indoor air quality). These devices are commonly marketed as being beneficial to [allergy](https://en.wikipedia.org/wiki/Allergy" \o "Allergy) sufferers and [asthmatics](https://en.wikipedia.org/wiki/Asthma" \o "Asthma), and at reducing or eliminating [second-hand tobacco smoke](https://en.wikipedia.org/wiki/Passive_smoking" \o "Passive smoking).

The commercially graded air purifiers are manufactured as either small stand-alone units or larger units that can be affixed to an [air handler unit](https://en.wikipedia.org/wiki/Air_handler" \o "Air handler) (AHU) or to an [HVAC](https://en.wikipedia.org/wiki/HVAC" \o "HVAC) unit found in the medical, industrial, and commercial industries. Air purifiers may also be used in industry to remove impurities from air before processing. [Pressure swing adsorbers](https://en.wikipedia.org/wiki/Pressure_swing_adsorption" \o "Pressure swing adsorption) or other adsorption techniques are typically used for this.

[Dust](https://en.wikipedia.org/wiki/Dust" \o "Dust), [pollen](https://en.wikipedia.org/wiki/Pollen" \o "Pollen), pet [dander](https://en.wikipedia.org/wiki/Dander" \o "Dander), [mold](https://en.wikipedia.org/wiki/Mold_(fungus)" \o "Mold (fungus)) [spores](https://en.wikipedia.org/wiki/Spore" \o "Spore), and [dust mite](https://en.wikipedia.org/wiki/Dust_mite" \o "Dust mite) [feces](https://en.wikipedia.org/wiki/Feces" \o "Feces) can act as [allergens](https://en.wikipedia.org/wiki/Allergens" \o "Allergens), triggering [allergies](https://en.wikipedia.org/wiki/Allergies" \o "Allergies) in sensitive people. Smoke [particles](https://en.wikipedia.org/wiki/Particulate" \o "Particulate) and [volatile organic compounds](https://en.wikipedia.org/wiki/Volatile_organic_compound" \o "Volatile organic compound) (VOCs) can pose a risk to health. Exposure to various components such as VOCs increases the likelihood of experiencing symptoms of [sick building syndrome](https://en.wikipedia.org/wiki/Sick_building_syndrome" \o "Sick building syndrome).

## **Bike air filter**



## Fig 4 Bike Air Filter

## Bike air filters are just like your nose. They filter out all the unwanted particles in the air before it enters the engine, allowing only clean and pure air inside for better combustion, which results in better efficiency and smooth power delivery.

## **12 VOLT ADOPTER**

## IMG_256 Fig 5 Volt Adopter

## WhatsApp ImageAn adapter or adaptor is a device that converts attributes of one electrical device or system to those of an otherwise incompatible device or system. Some modify power or signal attributes, while others merely adapt the physical form of one connector to another.

## Fig 6 Air Purifier model

## **4.4.1 Working Principle**

## The Air Purifier Model is use to control air pollution which is come from automobiles in an urban areas. Installing an air filter in public is more like avoiding attention away than solving it. It is one of the major thing which can use to avoid air pollution.

## The Air Purifier model contains Bike Air Filter,CPU Air Blowers, 12V Adopter with Connecter, model box. This model is working under the power. Which is placed in between divides on traffic signals.

## The polluted air comes from the automobiles will only pass through Air filters that will collect only the pure air and the dust particles are stick on outside the air filter that purified air will be comes out from the purified air will be comes out from the CPU Air blower. Once the air filter is get distroyed we shoutel enchange it with new air filter. This air purifier model should be away from the rain, so we need to protect it by putting shelter on it.

## **4.4.2 ADVANTAGES OF AIR PURIFIER**

## It will control the Air pollution from the Automobiles.

## [Dust](https://en.wikipedia.org/wiki/Dust" \o "Dust), [pollen](https://en.wikipedia.org/wiki/Pollen" \o "Pollen), pet [dander](https://en.wikipedia.org/wiki/Dander" \o "Dander), [mold](https://en.wikipedia.org/wiki/Mold_(fungus)" \o "Mold (fungus)) [spores](https://en.wikipedia.org/wiki/Spore" \o "Spore), and [dust mite](https://en.wikipedia.org/wiki/Dust_mite" \o "Dust mite) [feces](https://en.wikipedia.org/wiki/Feces" \o "Feces) can act as [allergens](https://en.wikipedia.org/wiki/Allergens" \o "Allergens), triggering [allergies](https://en.wikipedia.org/wiki/Allergies" \o "Allergies) in sensitive people.

## Less expensive

## Easily Control Diseases.

## Power consumption is less.

## Smoke [particles](https://en.wikipedia.org/wiki/Particulate" \o "Particulate) and [volatile organic compounds](https://en.wikipedia.org/wiki/Volatile_organic_compound" \o "Volatile organic compound) (VOCs) can pose a risk to health

## **DISADVANTAGES OF AIR PURIFIER**

## Attract high moisture content.

## Easily destroy from the rain.

## Hard to maintain.

## Regular maintenance is required

## Old filters worsen air quality

## An air purifier needs free space around it

## Some air purifiers produce ozone

**Conclusion**

Various studies revealed that motor vehicle emissions are the combination of various pollutants which have the potential to result in adverse health effects, including carcinogenicity, mutagenicity, cardiovascular mortality and the aggravation of the health of the vulnerable group such as people with compromised health conditions like the asthmatics, children and elders. The acute exposures have resulted in hospitalization due to respiratory conditions while health effects such as carcinogenicity, mutagenicity, cardiovascular health conditions lead to chronic exposures. Therefore, it is recommended that effective vehicle emission control strategies should be developed and implemented. Vehicle maintenance and inspection program should be developed to ensure the effectiveness of the vehicle emissions-control systems. Proper maintenance, inspection, clean car, use of clean fuel is the ways to reduce emissions.

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