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A STUDY ON AIR POLLUTION BY AUTOMOBILES IN BANGALORE CITY

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Abstract
This Paper has made an attempt to study on urban air pollution in Bangalore city by emission of gases by vehicles which emit from them. The present day environment crisis demands a change in attitude, which initiatives can be taken to rescue environment from destruction in the city of Bangalore. But the urban areas have a big share in the present day environmental problems from the automobiles throughout the world. This will finally focus on the attempt on the effects due to increase in the vehicle ratio in the city. Based on the facts and data obtained, the scenarios regarding future vehicle growth and their impact for travel is discussed to over come emissions problems. The main objective is based on the emission of vehicles and their problems. In future vehicle-based emissions testing should be conducted for at least once in three months in Bangalore to gain a more accurate picture of the emissions that Occur from the specific vehicles in this city. The results posed by important issues on transport and facts of existing situation will be used for the recommendations.

Keywords*:* Ambient ,Dependency , Emissions , Processes, Scenario

1. INTRODUCTION

At the global level, the rapid growth in motor vehicle activity has serious energy security and climate change implications. The transport sector already consumes nearly half of the world's oil. But in urban areas – both developing and developed countries, it is predominately mobile or vehicular pollution that contributes to air quality problem.

The sources of pollutants includes 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. By this the quality of air has become so poor that, Bangalore is the result of both high emissions from the vehicles and unfavorable conditions.

The rapid growth in motor vehicle activity is the challenges to overcome in urban areas in Bangalore during the last and this decade. This has brought a serious range of socio-economic, environmental, health, and welfare impacts on environmental degradation. The rapid growth in motor vehicles in Bangalore 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 study of air pollution caused by the automobiles in the city of Bangalore

Management Research and Practice
Volume 4, Issue 3 / September 2012
ISSN
2067- 2462

The problem:

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.

Thus, the increases in population, migration, uncontrolled urban expansion, income, economic growth, energy consumption and mobility have created a serious for air pollution problems, in cities throughout the world. The study is to find the emissions from the vehicles and their impact on the environment. This deals with the present scenario of air pollution and the effects on environment in Bangalore city. The worst thing about vehicular pollution is that it cannot be avoided as the vehicular emissions are emitted at the near-ground level where we breathe. The problem of vehicular air pollution especially relates to Bangalore. This paper depends on the data of registered vehicles and the emission factors of vehicles.

Objectives:

1. To identify the number of vehicles in Bangalore city.
2. To identify the types of pollutants released from vehicles in Bangalore city.
3. To forecast and suggestion for controlling measures of air pollution in Bangalore.

The Study Area:

Bangalore is a rapid development in urban area either in demography, migration, transportation, or industrial sector since last two decades. The Bangalore 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 Bangalore 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 Bangalore 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 Bangalore 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 Bangalore is affected by transportation activities.

ISSN
2067- 2462

Based on Statistics of the department of road transport offices in Bangalore (2010) the increasing of motor vehicle in Bangalore has gone up by 18 per cent every year. While the transportation activities could effect on positive impact like the increasing on Bangalore 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.

2. 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 Bangalore, 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 Bangalore city. Given current trends, by 2020 the Bangalore 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

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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.

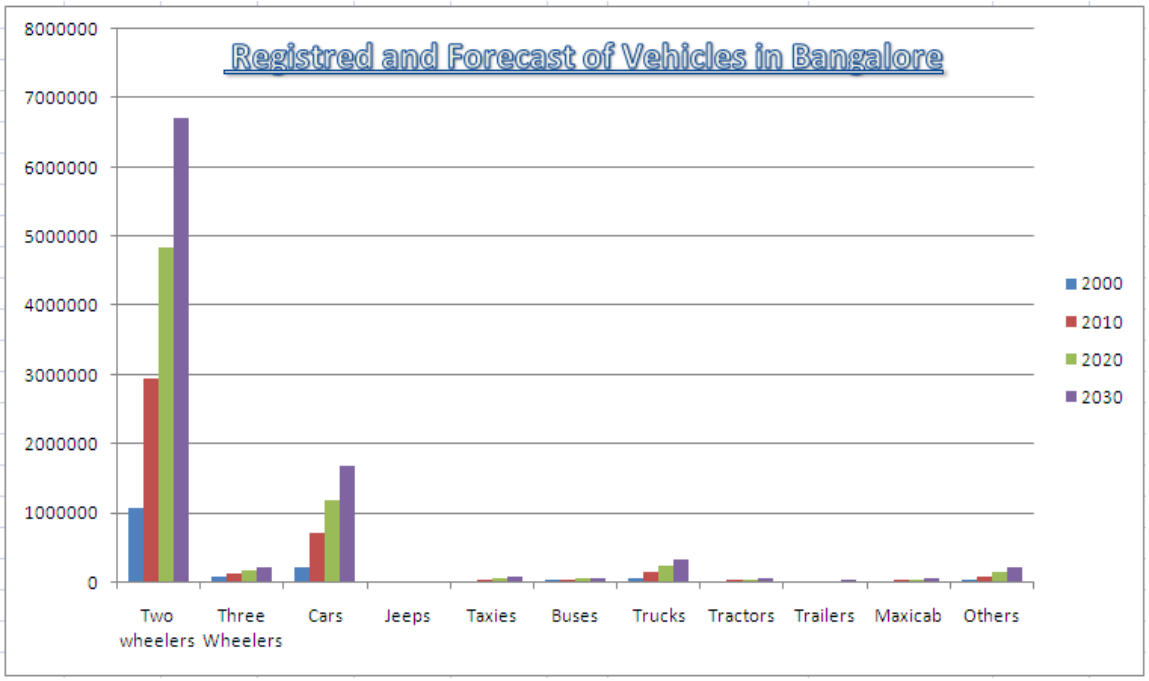

FIGURE 1 - SHOWS THE DATA OF REGISTERED VEHICLES IN BANGALORE IN 2010.

3. 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 Bangalore, it is estimated that the 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 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 Bangalore 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 Bangalore have also shifted dramatically by using private vehicles: The number of private vehicles increased drastically, due to decentralization, globalization, economic development, standardization by most

ISSN
2067- 2462

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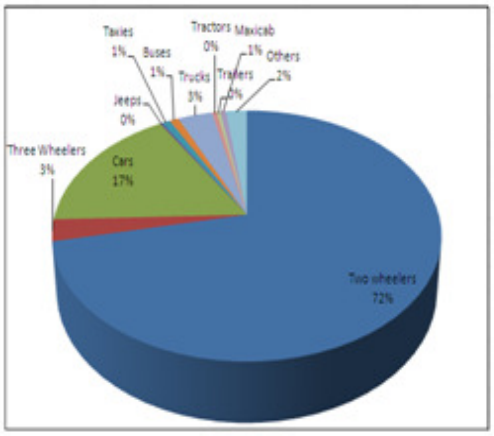
estimates at a rate of 18 percent annually in recent years. This could mean a higher number of vehicles in Bangalore, a higher ratio of vehicles per persons, possibility of trips and the distances traveled will increase even more for coming years.

TABLE1 - DATA OF REGISTERED VEHICLES FROM RTO'S, AND DISTRICT CENSUS HAND BOOK. BANGALORE REGISTERED VEHICLES AND THEIR FORECAST

Type of Vehicles	1980	1990	2000	2010	2020	2030
Two Wheelers	111750	458860	1067430	2951520	4835610	6719700
Three wheelers	10044	17379	61424	115401	169378	223355
Cars	31738	82205	201052	697745	1194438	1691131
Jeeps	3554	6376	6827	9104	11381	13658
Taxi	1120	2511	6299	32818	59337	85856
Buses	4671	4516	20656	35723	50790	65857
Trucks	8236	19149	41887	139573	237259	334945
Tractors	1929	1993	6158	20555	34952	49349
Trailers	1734	1723	5544	12487	19430	26373
Maxi cab	*	*	4238	23153	42068	60983
Others	549	3574	16542	84018	151494	218970
Total	**175325**	**598286**	**1438057**	**4122097**	**6806137**	**9490177**

The data shows the number of registered and share of different modes of vehicles in Bangalore 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.



Type of Vehicles	Year-2010
Two Wheelers	2951520
Three Wheelers	115401
Cars	697745
Jeeps	9104
Taxis	32818
Buses	35723
Trucks	139573
Tractors	20555
Trailers	12487
Maxi cab	23153
Others	84018
Total	**4122097**

Source: Praia website

FIGURE 2 - SHOWS THE MODAL SPLIT AND SHARE OF VEHICLES IN BANGALORE CITY IN 2010

4. SOURCES OF POLLUTION

Pollution from 2-wheelers: Two-wheelers account for about 72 percent of the total vehicular population in Bangalore. 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 Bangalore. 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

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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 3-wheelers: Of the 1, 15,401 three-wheelers in Bangalore nearly 3 percent of the total population of vehicles, they are petrol-driven, powered by 2-stroke engines. These vehicles are also high emitters of carbon monoxide and hydrocarbons. A pollution check conducted by Regional Transport Department has revealed that in some instances the levels are so high that they go beyond the measurable scale of test instruments. In addition, it is widely believed that petrol is adulterated with kerosene which results in emissions of thick black smoke.

Pollution from 4-wheelers: The Bangalore city is having 7, 39,667 vehicles on the roads (Jeep-9104, Taxi-32818 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 Bangalore 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.

Overloading at peak hours: The buses, particularly during peak hours, carry more than recommended load of passengers. These buses will stops near the junctions and signal lights due to congestion of vehicles. This results in higher smoke emissions during the peak hours. While high capacity buses require to be inducted for carrying more passengers. The worst polluters should be taken off the heavy traffic corridors and high density areas. Similarly, for trucks, enforcement of laws related to overloading requires to be enforced vigorously to BMTC and other state owned buses etc.

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.

Impact of air Pollution on Health Human health is the major concern over air pollution in the urban areas. However, the Bangalore City Study considers effects of air pollution in and its impact on ecosystems, and with the linkage with global warming. The Bangalore city like other countries in the world, contributes to global warming and is likely to be affected by it. In this paper, we will discuss only the impact on health.

Air pollution caused by the automobiles has impacts on health and imposes potentially substantial economic costs to society. Most of the health effects from air pollution come from respiratory symptoms in the levels of pollution in Bangalore City and other cities throughout the world. The time-series have revealed the effects of various pollutants (generally PM10= particulate matter smaller than 10 μm in diameter, ozone, CO=Carbon Monoxide, NO2=Nitrogen dioxide, and SO2=Sulpher dioxide.).The Harvard school of public health has assessed health risks found in current and anticipated levels of air pollution Mexico city Metropolitan Area implications of air quality focused on pollutants, mainly by PM10 (particulate matter smaller than 10 μm in diameter) and ozone. The Studies in various cities around the world, including Bangalore City, shows that there is a daily fluctuations in air pollution levels in different parts of the world. It is estimated that for each 10 μg/m3 increase in daily levels 4 of PM10. So, due to increase in particulate matter of air cardiovascular, coronary heart diseases and even premature deaths among the infants will take place. This can be done by reducing 10 percent reduction in PM10 may reduce the death of infants. Several studies revealed that the effect could be several times larger if one considers longer-term responses to particulate matter exposure PM10 concentrations have also been associated with health outcomes including increased cases of chronic bronchitis, respiratory or cardiovascular problems, asthma attacks, symptoms etc.

The ozone has significant effects on respiratory function and on respiratory conditions such as asthma. So for this recent research suggests that important factor for human health involves the presence of fine particles (PM2.5). So for the monitoring PM2.5 and to develop an emission in inventory should be given more importance.

So for this the government or the pollution control board has to set up 8 to 10 air pollution monitoring centers in and around the Bangalore. The collected data will be useful for control of pollutant in a spatial manner. The corporation or Karnataka Government and other agencies has to contribute to the understanding of the air quality problem in Bangalore by conducting measurements and modeling studies of atmospheric pollutants within the city. Such an understanding will helps to provide a scientific base for devising effective emissions control strategies to reduce exposure to harmful pollutants in Bangalore and also provide insights to air pollution science in other cities in Karnataka.

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5. MEASURES FOR EMISSION CONTROL

1. Use of Remote Sensing Technology: Remote sensing technology measures the pollutant level during the vehicle's exhaust while vehicle is traveling down the road. Unlike the conventional methods, the remote sensing devices are not physically connected to the vehicle. The paper highlights how to achieve almost zero percent pollution and prevent the environment from vehicle emission.
2. Modification on cost effective: Due to today's strict emissions and fuel economy standards to which manufacturers have to conform, most new cars bought these days are actually capable of performing far better than they are advertised. Cost effective depends on these factors
   a. Turbo Charger: The turbo Charger works as compresses air which is driven through the exhaust system,
   b. Nitrous helps in cooling effect as it rapidly changes from a liquid to a Gas.
   c. Sway bars and control arms: It works components of car suspensions that work to counteract body roll and keep the car firmly planted in turns. Adding stronger sway bars and control arms to a car stiffens the suspension, minimizing body roll and allowing it to take corners at higher speeds.
   d. Ceramic brakes: is used instead of mottled brakes as they get very hot and when brakes get hot, they lose a lot of their stopping power. One way around this is to switch to ceramic disc brakes.
   e. Spoiler: is the addition of air rushing overhead to push down on the car, stabilizing it and making sure that more of the engine's power hits the road. And for even more grip a splitter can be added which has much the same effect but at the front of the vehicle,
   f. Chipping and ECU remapping: Chipping is basically the same as ECU remapping but instead of re-programming the unit you're bypassing it completely. This is often less effective than remapping because every engine runs slightly differently, and mass produced pre-programmed chips don't take into account an engines subtle differences.,
   g. Reboring the engine: it's important to check that you can get a gasket, piston with rings and other components to match your chosen bore capacity. A rebore is irreversible and you'll certainly not want to have to do it again. Another thing to consider is that after reboring your engine, it will be necessary to run the engine in again.

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h. Additional cylinder heads: A good way to get more power out of your car is to upgrade your cylinder heads to a set that has four valves per cylinder. The additional intake valve allows more air to enter the cylinder, resulting in stronger combustion, while the extra exhaust valve clears out the engine's waste faster.

i. Exhaust: A good way to get more power out of your car is to let more air into the engine which results in stronger combustion. An often-overlooked way to improve performance is to help the exhaust gasses get out of the engine. The exhaust is an engine's way of exhaling.

3. Curtile use of private Vehicles: Reducing vehicles use across the globe can cut carbon dioxide emissions by thousands of tones. As mention before, efficiency is unquestionably the largest, cheapest, and cleanest wedge among the many we need to rid carbon from our energy economy. Avoiding unnecessary driving is the most effective way to reduce vehicle emissions; however, traffic trends indicate more vehicles are being driven more frequently due to urban sprawl. The options we have available to reduce the number of vehicles being driven on our roads.

4. Day without car/ 2 wheeler: This is a new idea which has been accepted in different countries and to accept and implement ideas such as a car-free day in order to ensure less traffic congestion, stem pollution and contribute our small bit in solving the environmental problems that confront us today.

5. Car Pooling: The employers, or groups of employers, find it convenient to have one or more cars or vans that are readily available for business use by a number of employees. The cars or vans are not allocated to any one employee and are only available for genuine business use. Such cars and vans are usually known as pooled cars and vans. As it has to be started in the corporations ex: BEML, Vikrant, Universities, Institutions and corporate sectors such as Infosys, L&T etc.

6. Staged Working Scheme: will be different times for the people employed state Government, Central Government, Corporate, Banks and Financial institutions, Educational institutions, and Public sector etc. This should be introduced in the developed and developing countries based on the congestion and the level of pollution. This will help the citizens or employer will be healthy and can drive his vehicle during their office timings within the city based on their convenience as per the city.

7. Commitment: The citizens should have commitment for the society as it helps in solving the problems related to pollution and the human health in Mysore. The people has to think in a manner that, the pollution is a problem of our house rather than the society which effects mankind and poisoning the environment by unwanted emissions from vehicles and make them unhealthy.

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8. Traffic Management side: The present day traffic has to be maintained and planned in such as way that the junctions, intersections, should be made as a traffic free corridor as it emits smoke in these places which will effects the human health and harms the environment.

9. Emission test by RTO: To mitigate transport emissions, stringent emission norms are being introduced for new vehicles. However, this effort would be futile without an improvement in the emissions performance of the large number of in use vehicles. Hence, an effective inspection and maintenance program for in use vehicles is essential for mitigating transport emissions the Regional Transport offices with environment experts.

10. Ban of 2 stroke vehicles: Emissions from 2-stroke engines can be reduced by rigorous inspection and maintenance programs and used of lubricating oil of correct quality and quantity. But the best option is to ban the use of 2-stroke engines in new motorcycles in favour of 4-stroke engines. The 4-stroke engines may be slightly more expensive, but are cheaper to run as they are more fuel efficient and last longer

11. Ban of vehicles more than 15 years of age: The Supreme court has banned the Commercial vehicles of 15 years of age, but we should think of banning all the vehicles of same age .The law should be made that imports of heavy vehicles (Trucks etc) older than seven years from the date of manufacture and light vehicles (Cars, Pickups) older than five years from the date of manufacture should also be banned. While the transfer of ownership of a vehicle over 10 years old should also be illegal, in other words you cannot sell the vehicle on. This leaves two options scrap the vehicle or export it to another, more lenient, country.

12. Celebration of Bus Day: This has been introduced BMTC on 4th of every month 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. If we can see a change in the traffic around us like smoke rings or fog around street lights in the night, winter fog instead of pollution fog, in the night sky.

Urban Planning: Studies of advanced urban-engineering concepts for cities to evaluate alternatives to urban sprawl. Such engineering analysis would consider the co-location of activities with complementary needs for energy, water, and other resources and would enable evaluation of alternative configurations that could significantly reduce vehicle-miles travelled and GHG emissions. The city transport systems has to provide faster and cheaper movement of passengers than the urban automobile such as (ELRTS) elevated rail system, Bus route priority system, (BRTS) Metro rail, Mono rail, commuter rail, Sky Bus etc. for the public transport modes.

Freight Transport: Strategies and technologies are needed to address congestion in urban areas and freight gateways by increasing freight transfer and movement efficiency among ships, trucks, rail and ports

6. CONCLUDING REMARKS

The rapid population growth of vehicles in multiple ratios continues to be a matter of concern for the Bangalore city as it has manifold effects since the last decade, one of the most important being environment degradation. The unprecedented speed of urbanization of Bangalore has resulted in enormous pressure on the environment with severe adverse impacts in terms of pollution, and today city is considered as one of the most polluted city in the country.

While the projected rate of population increase may be reduced, even moderate population growth is likely to lead to substantial increases due to passenger and freight travel demand in the city, due to introduction of Metro, Monorail, BRTS, fuel price etc. The increasing geographic dispersion of metropolitan 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.

So to improve the quality of air and water there is a need of strict enforcement and monitoring program by the Karnataka Pollution Control Board. There is also a need traffic regulations; efficient public transportation system in the city and heavy penalties and seizure of vehicles during violation of rules should be imposed on public. For the protection of environment more emphasis should be laid on compulsory environmental education at school level for the awareness to people know about how and why we need to save environment.

Our Future

For this carbon wedge era we should work together in reducing global warming and other efficiencies by reducing vehicle use across all transport sectors .

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ISSN

2067- 2462