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Feasible Mitigation Options for Air Pollution and Traffic Congestion in Metro Cities

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ABSTRACT

Increasing needs of urban population and exploitation of natural resources are the major concerns for environmental degradation. Growing urbanization and unplanned expansion of large cities, especially in developing countries have led to high levels of air pollution. It has been realized that the megacities are the hot spots of air pollution. The Asian and African megacities such as Cairo, Beijing, Delhi, Mumbai, Bengaluru and Kolkata are some of the examples showing alarming levels of air pollutants. Hence, it is the high time for the policy makers to take urgent and apt initiatives that can mitigate urban traffic congestion and air pollution. This paper highlights the possible options such as introduction of bullet train, more intensive network of metro trains, Odd-Even scheme, work from home, flying cars, transit elevated bus, electric vehicles, bi-cycles, compulsory use of public transport along some highly congested roads and restriction in owning more than one car per family, for congestion reduction and air pollution prevention & control in metro cities.

Key words: Environmental degradation, Air pollution, Traffic congestion, Hydrocarbon emission, Greenbelt

INTRODUCTION

Increasing population and associated needs are the rising concerns of the present era. The extent of increase in number of industries and vehicles is much higher compared to the appropriate infrastructure. In urban areas, the number of vehicles is increasing at much faster rate than the road length, resulting in severe road congestion and air pollution. It leads to wastage of time and money and inconvenience while traveling, resulting in health problems. Sao Paulo faces world's worst daily traffic jams (Downie, 2008). According to the Time Magazine, Sao Paulo is known for record breaking 344 km long cumulative queues in the evening peak hours. In 2010, China experienced world's worst traffic jam ever, famously called as "Great Chinese Gridlock of 2010", which was 100 km long and lasted for 11 days. Indian cities such as Delhi, Bengaluru and Mumbai also have frequent traffic jams (Mishra and Chaturvedi, 2017). During the 19th Century, non-motorized modes of transport like walking, bullock carts and cycling were very common. Unfortunately, with the advent of modern technology based vehicles, commuters have variety of alternatives such as motorbikes, cars, trucks and other modes of fast moving vehicles in order to save time and to have enhanced safety over the non-motorized modes. The scenario of traffic congestion and air pollution was the worst in Delhi during 1990's. Later on, the construction of flyovers, introduction of Metro trains and CNG buses provided some relief to the citizens of the capital. The causes of congestion and the feasible options to reduce the congestion and air pollution in the metro cities, especially in India are detailed in this paper.

TRAFFIC CONGESTION AND AIR POLLUTION

According to Central Pollution Control Board (CPCB, 2006), approximately 70% of CO, 30-40% of NOx and 50% of hydrocarbons are being contributed by the vehicles in metropolitan cities in India. Now, this percentage greatly varies with the type and engine of vehicle, fuel type, road geometry, time of the day (peak or off-peak hours), idling time, vehicle weight, number and duration of stops, flow speed, vehicle operating mode, etc. (Durbin et al., 1998; Beydoun and Guldmann, 2006; Faiz et al., 1996). On-road emissions from urban traffic during interrupted and congested flow conditions are too high as compared to free-flow condition and often influenced by accelerating and decelerating speed due to frequent stop-and-go. According to the Pollution reports, the higher emissions have been noticed at very specific times e.g.: (i) during acceleration stage, which depends on road quality and geometry (Shukla and Alam, 2010; Pandian et al., 2009; Gokhale, 2012), (ii) during the transitional phase, the flow of traffic changes from free to congested condition (Zhang et al., 2011) and (iii) when heavy duty diesel vehicles are moving with low speed and having frequent acceleration and deceleration cycles, especially that of CO and hydrocarbons (Chen et al., 2007). Hydrocarbon emissions can come not only from a vehicle's engine buts also directly from the fuel tank and lines, making emission free environment a difficult proposition. In addition to these, vehicles with 2-stroke engines (autos or two-wheelers), which do not have catalytic convertor emit higher (approximately 20% more) CO and hydrocarbons than passenger cars having 4-stroke engines (Choudhary and Gokhale, 2016; Reynolds et al., 2011).

Table 1. Comparison of population and motor vehicles per 1000 people in various countries.

S.No.	Country	Population in 1996 (in millions)	Population in 2016 (in millions)	Motor Vehicles per 1000 people
1	San Marino	0.025	0.031	1263
2	Monaco	0.030	0.037	899
3	USA	269.4	324.5	797
4	Australia	18.31	24.36	736
5	Canada	26.97	36.28	662
6	Japan	125.8	126.28	591
7	UK	58.17	65.18	519
8	Russia	148.2	143.4	293
9	China	1218.0	1383.4	128
10	India	973.1	1329.5	18

(Source: Real time world index: www.worldometers.info/).

Although, the usage of cars and taxis is much higher than the two-wheelers, it outweighs the pollution caused by the later (Ramachandra, 2009; Singh, 2006).

CHALLENGES POSED

The urban transport also includes public and non-motorized transport with badly managed road facilities. On top of this, political decisions make the whole process lengthy and inefficient (Ahmad and Puppim de Oliveira, 2016). The concept of lane driving, footpaths, crossings, etc. which are very common in developed countries are almost non existing in India. Hence, there is mixed traffic on roads usually such as cars, trucks, pedestrians, animal-driven carts, two-wheelers, cycles, rickshaws and auto-rickshaws (in addition to cattle).The quixotic nature of these mixed traffic increases the chances of accidents, leading to further traffic jams.

According to the Eddington Transport Study, traffic congestion leads to a loss of £11 bn every year and for approximately 90% of businesses it is a significant problem (Eddington, 2006). On one hand, the number of vehicles per family in developed countries is increasing at an alarming rate, while on the other hand, developing countries are still struck in the problems of poor quality of roads, fuel adulteration, illegal parking, wrong-way driving, overloading, mixed traffic, lack of traffic lights, flooding of the roads due to improper drainage, ill-managed diversions during on-road constructions, narrow one-ways, weak implementing of pollution check, etc. The lack of coordination between PWD and/or R&B and various departments such as telephone and electricity (cable laying), water, gas lines, and sewerage (pipe lines) is leading to frequent excavation of roads, adding to more traffic problems.

STATISTICS OF TRANSPORTATION

Table 1 gives the number of motor vehicles per 1000 people in various countries. It is surprising to note that small countries such as San Marino and Monaco in Europe with land areas of 6100 hectare and 202 hectare respectively, are having very high number of motor vehicles per 1000 people, and yet hardly any significant incident of traffic congestion has occurred. On the other hand, countries like China and India, ranking first and second respectively in the world's population index, are having very low number of motor vehicles per 1000 people but frequently face extremely bad traffic congestion. Major cities ranked as per their congestion levels based on Tom Tom Traffic Index (www.tomtom.com/en_gb/trafficindex/list) have been shown in Table 2.

Various Methods to Estimate Traffic Congestion:

(i). Horn-OK Project: Under this project, speed of the moving vehicle is detected by capturing the horn blown by vehicles (by a pair of road-side microphones), as they will show Doppler shift and hence traffic congestion can be estimated.

(ii). GPS based sensing: This is the most popular and frequently used technique to get the updates about traffic density scenario and alternate routes. Because of telecommunication network failure especially during adverse weather, people get stuck up in the traffic, having taken the wrong route and unavailability of alternate route. If the whole city is provided with the facility of high speed Wi-Fi network, automatic traffic and alternate route updating can eventually become fast and reduce the traffic congestion.

(iii). Sensors on Roads: Roads with usual events of traffic congestion can be rebuilt with a layer of sensors,

Table 2. Comparison of congestion levels of major cities in the world.

World Rank	City	Country	Congestion Level (Extra Travel Time)	Morning Peak	Evening Peak
1	Mexico City	Mexico	59%	97%	94%
2	Bangkok	Thailand	57%	85%	114%
3	Istanbul	Turkey	50%	62%	94%
4	Rio De Janeiro	Brazil	47%	66%	79%
5	Moscow	Russia	44%	71%	91%
6	Bucharest	Romania	43%	83%	87%
7	Salvador	Brazil	43%	67%	74%
8	Recife	Brazil	43%	72%	75%
9	Chengdu	China	41%	73%	81%
10	Los Angeles	United States	41%	60%	81%
14	Beijing	China	38%	62%	78%
16	London	United Kingdom	38%	63%	66%
39	New York	United States	33%	49%	61%

(Source: www.tomtom.com/en_gb/trafficindex/list).

which will monitor the number of vehicles on it and when the number is tending to congestion then it will automatically block the road to avoid further use by other vehicles.

FEASIBLE MITIGATION OPTIONS FOR REDUCING TRAFFIC CONGESTION

In order to reduce the road traffic volume and air pollution in urban areas, a proper planning towards development of whole transportation system and land use management have to be opted, which will be governed and controlled by public authorities for its proper functioning (Tennoy, 2010). The various approaches and strategies to be adopted to reduce the problem of traffic congestion and air pollution would be specific to the region of the country. These should include: reducing Green House Gas (GHG) emissions from the vehicle per km, total travel length of the trip, frequency of the trips, shift from public and non motorized transport to private transport (Tennoy, 2010). Hence, the problem of traffic congestion has to be dealt extensively on priority basis. Examples of the feasible options are mentioned below.

Metro Rail Network

Metro rail network is an electricity based rapid transit train system for faster commuting inside the city. The successful examples of metro systems across the world are underground London metro, the oldest of all; Shanghai Metro system, the one with longest route length; Beijing metro system is known as subway and has the highest number of people in the world using this mode for commuting. Metro rail system has also been introduced in Delhi, which has now stretched its limit to Gurugram , Noida and Ghaziabad. Various studies have been carried out, which have proved that Metro Rail network has brought down a significant amount of congestion, for example, west Bengaluru has witnessed 15% decrease in traffic congestion because of metro.

Electric Vehicles

Electric vehicles are basically totally clean and green mode of transportation because they run on rechargeable batteries that store chemical energy in it. With the modern technology, continuous efforts are in process to convert the fuel based modes of transport into electricity based vehicles. At present, bicycles, motorcycles, scooters, cars, buses, trucks and even trains run on rails and watercrafts have taken the form of electric vehicles. Among the all-electric car models, Nissan Leaf has topped the sales all over the world followed by Tesla Model S. According to NITI Aayog, the nation is estimated to see sales of 30.81 million electric vehicles by 2040. Arcimoto is an emerging electric vehicle, which runs on electricity, carries two passengers comfortably and safely. It can be driven at a maximum speed of 85 km/hr and acquires one-third of the parking space required usually by cars. Look and comfort wise it is a mixture of car and motorcycle, so if only one or two passengers have to travel, it is the best option as it is environmental friendly and also covers much less space as compared to the car. The Arcimoto can be looked upon as the future generation transportation for daily trips and it has already launched its eight generations.

Flying Car

The time is not far when flying cars of science fiction will come into reality. A flying car is a personal air vehicle, which can provide the transportation both by air and road as per the requirement. Many models like AeroMobil, Urban Aeronautics' XHawk, The Moller Skycar M400, The Xplorair, etc have already been built and tested but its production has not yet started for public use.

Solar Car

Solar vehicles are also an example of electric vehicle only just with the difference that they are powered by solar energy directly. The electrical energy used in solar vehicles is converted from solar energy by photovoltaic cells carried in solar panels. So far, demonstration models of solar cars, solar bike, solar train, solar watercraft, etc. are ready. However, finer adjustments need to be completed to bring these to the commercial front.

Odd-Even Rationing of Vehicles

Under the Odd-Even Rule, the four wheelers with odd number can travel on odd dates and vice versa. This practice was introduced in Delhi, the capital of India in two terms each of 15 days. This practice was expected to reduce the number of vehicles on road. Such a reduction was achieved to some extent but it has increased the chaos among the public also (Hindustan Times, 27 April 2016). If we talk in terms of pollution level during the Odd-Even Rule in Delhi, its critical assessment indicated hardly any improvement in pollutants level such as $PM_{2.5}$, PM_{10} and CO (Singh and Kulshrestha, 2016). Nevertheless, the scheme reduced the traffic congestion during both the Odd-Even trials.

Transit Elevated Bus

Transit Elevated Bus is a new concept to cope up from the problem of traffic congestion, with alternative names such as straddling bus and land airbus. This kind of bus is actually elevated, so that it can straddle above the road traffic. China is the pioneer in creating such kind of a bus and had its first trial in 2016. Vehicles with a height of 2m can pass from below this straddling bus, which is 4-4.5m high and a capacity to carry 300 passengers (Limer, 2016). It will function like the normal buses, just that the stops of these buses will be elevated. Though this concept has yet not been functionalized, because it is being criticized on the fact that whether the vehicles under this bus will be safe or not and usually lanes are not straight all along for its smooth functioning.

Work and Learn from Home

The concept of work from home is new and is being explored. It is linked with E-commerce. In the age of technologies and high speed network of internet, offices and colleges can be set up in home itself; one need not travel to carry out office work. With the help of Skype or other networking sites, online official conferences or college classes can be made possible. In order to legalize this approach of study, government can take actions and make plans as to how one can do all the requisite things like admission, attendance, examination, issuing degree with least possibilities of fake entries. Also, nowadays, migration of students from small places to metro cities is very common, in order to avail better opportunities and better studies. If the extent of communication technology can be expanded till the nook and corner of each city, town and village, one can avail such opportunity at their home itself and the reasons to migrate will subside.

Bullet Train

Bullet train is a high-speed rail transport system, which is much faster than the traditional trains and can easily maintain a speed of maximum 350km/hr. This mode of transportation took its birth in Japan and is now spreading all over the world as a quicker and comfortable way to commute. It is just launched on September 14, 2017 in India too. The first bullet train will run between Ahmedabad and Mumbai covering 508 km distance in 2.07 hours. There are many benefits of bullet trains. A large number of passengers can travel at a time; it saves time, energy and money by covering large distances with its fast speed; highways and runways for traveling in the city can be relieved and also congestion and delays are avoided even during rush hours.

Taxes for Toll Roads

The concept of toll roads is very old where road user is charged for distance driven in a particular area. Access fees and time based charges are applied for accessing a particular area for a given amount of time by the road user; infrastructure tolling for incurring the cost of building infrastructures like bridges, tunnel, mountain pass, flyovers, etc. However, many times road users have complaints of waiting in long queues, which further add to the traffic congestion. But the waiting and queue problem can be resolved by online payment facility of toll taxes and providing a separate lane for the free flow of the road users who have already paid the taxes. In general, toll booths have such provision but the facility can be provided at smaller booths too.

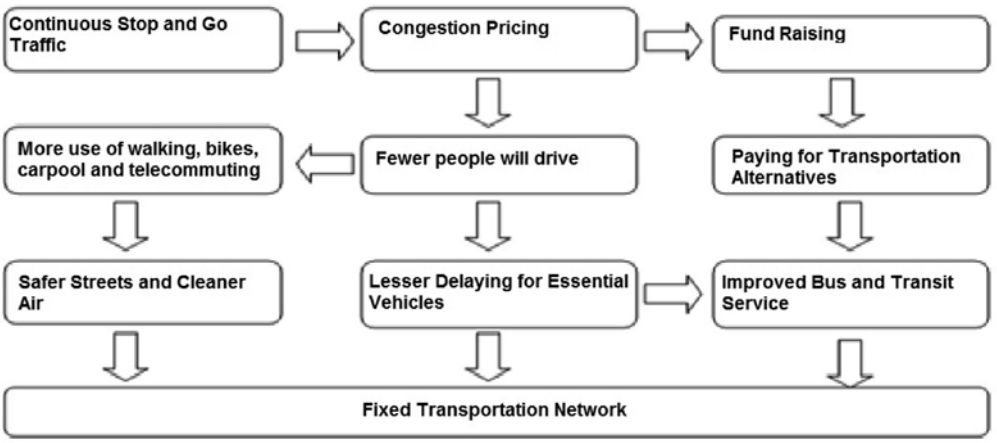

Figure 1. A flow chart to describe the strategy of congestion pricing. (Source: Congestion Pricing-Wikipedia).

Introduction of Congestion Price

In congestion pricing method, a fee is charged from the road users in rush hours, which is variable depending upon the time and day. Singapore has become the first city of the world to apply this scheme (Small et al., 2007). During rush hours or peak timings of the day, the congestion price is highest whereas in off-peak hours it is the lowest and sometimes there is no charge at all. This is a viable economic way of decongestion as this method ensures the minimum traffic on road (Sheldon et al., 1995). This method is worthy to implement as commuters become more cautious to avoid congestion, and would start thinking of the alternate ways to get to their destination in rush hours (Small et al., 1998). Figure 1 illustrates how congestion pricing works.

Limit the Number of Vehicles or Vehicles from other regions during peak hour

This can prove to be a very useful strategy towards reducing the traffic congestion and increase the usage of public transport. Already China has introduced such measures, where only 20,000 new passenger cars can be issued in a month (the registered residents of the city will be assigned new license plates by lottery system and 88% of the cars are reserved for private car users) and not allowing vehicles from outside regions in the main parts of the city during rush hours.

Systemized Urban Planning

There is yet another way to look at the solution for traffic congestion, which is to restructure the planning of the cities (Verma and Singh, 2017). If all or majority of these purposes are clubbed and offered at a single place, there will be no need to travel such large lengths, which will further reduce congestion. For example, for a particular section of people who are working for the same profession, a society can be constructed, which is having the facilities of their common office, housing, garden and parks, fitness clubs, swimming pool, shopping mall, multiplexes, school, college and other basic facilities. In order to closely observe how traffic flow and density are related in urban areas, Macroscopic Fundamental Diagram (MFD) is a very useful tool. With the help of MFD, effective urban planning can be done, so that resource allocation can be done efficiently. The MFD thoroughly examines the congestion and evaluates its relation with density and hence can very well correlate the features of transportation network and land use pattern, which can further help in designing the city with optimum land use, well planned road network and traffic control. MFD can easily monitor and model congestion and can prove to be a useful aid in framing policies for smooth traffic flow and minimum possible environmental pollution in the city. Tsekeris and Geroliminis (2013) have proposed and studied in detail a model of the city, which is mono-centric in nature and has surrounding neighborhood in concentric pattern.

EFFORTS MADE BY INDIAN GOVERNMENT

According to the National Highways Authority of India, the average growth rate of number of vehicles is 10.16 percent per year in India. Major sufferers of traffic congestion are cities like Mumbai where every km of road is holding about 674 vehicles (Hindustan Times, 23 Mar 2012); Bangaluru with 3000km of road stretch is having around 5 million vehicles; Delhi alone has more vehicles than Kolkata, Chennai and Mumbai together (Economic Survey of Delhi, 1999-2000). Indian government is making explicit efforts to combat the problem of traffic congestion. It has recently sanctioned a $50 billion highway project in order to enhance the 40,000kms of highways of India. The Urban Transport Working Group is designing a completely new framework, which will consist of major use of public

transport such as Bus Rapid Transit and Metro rail, traffic signals, development of more lanes and one-way streets.

In December 2005, a seven-year plan was launched, Jawaharlal Nehru National Urban Renewal Mission (JNURM) city-modernization scheme with a total investment of $20 billion ,which will work towards the upgrading of city structure, socially and economically, planning to minimize traffic congestion, broadening roads and construction of more flyovers and foot bridges. In order to cope up with the traffic problem, Government has developed a strategy called Delhi's Master Plan 2021, which promises to increase the use of public transport by around 80% of the commuters by 2020.

Some of the additional measures of air pollution and congestion prevention and control include- increased greenbelt, control of construction dust, development of flyovers and express bye passes, enforcing stringent Pollution Under Control (PUC) check up, implementation of Bharat VI standards, projecting only one nodal agency as a top management body for effective implementation, spreading more public awareness, making rule for primary school not beyond 5 km circle and by emphasizing for quality controlled monitoring data for policy formulation.

CONCLUSION

Traffic congestion is a monster for a commuter. Reducing traffic congestion should be the priority for both the government and the public. In addition to the metro expansion, road widening, flyovers, bypasses reduction of sales of new vehicles and withdrawal of vehicles of 12 years age need to be enforced to reduce congestion. Our top recommendation for reducing congestion is to legally allow 'work from home' culture, which will not only reduce congestion but also solve or reduce the personal or family problems such as attending to the needs of kids, old parents and other family members.

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Compliance with Ethical Standards

The authors declare that they have no conflict of interest and adhere to copyright norms.

REFERENCES

Ahmad, S., PuppimdeOliveira, J.A., 2016. Determinants of urban mobility in India: Lessons for promoting sustainable and inclusive urban transportation in developing countries. Transport Policy v.50, pp: 106–114.

Downie, A., (2008-04-21). "The World's Worst Traffic Jams". Time. Retrieved on 2008-06-20.

Beydoun, M., Guldmann, J.M., 2006. Vehicle characteristics and emissions: logit and regression analyses of I/M data from Massachusetts, Maryland, and Illinois. Transport. Res. Part D, v.11, pp: 59–76.

CPCB, Central Pollution Control Board. Air Quality Trends and Action Plan for Control of Air Pollution from Seventeen Cities. Series: NAAQMS/29/2006-07, September 2006.

Chen, C., Huang, C., Jing, Q., Wang, H., Pan, H., Li, L., Zhao, J., Dai, Y., Huang, H., Schipper, L., Streets, D.G., 2007. On-road emission characteristics of heavy-duty diesel vehicles in Shanghai. Atmospheric Environment, August 2007, v.41, no.26, pp: 5334-5344.

Choudhary, A., and Gokhale, S., 2016. Urban real-world driving traffic emissions during interruption and congestion. Transportation Research Part D, v.43, pp: 59-70.

Wikipedia, Congestion pricing: https://en.wikipedia.org/wiki/Congestion_pricing.

Hindustan Times, Dharmendra Jore (2012-03-23) "Mumbai has 674 vehicles for every km of road".

Durbin, T.D., Truex, T.J., Norbeck, J.M., 1998. Particulate Measurements and Emissions Characterization of Alternative Fuel Vehicle Exhaust. Center for Environmental Research and Technology, College of Engineering, University of California, Riverside.

Economic Survey of Delhi, 1999-2000. Chapter 12. Transport.

Eddington, R., 2006. The Eddington Transport Study, The case for action: Sir Rod Eddington's advice to Government. UK Department for Transport. Archived from the original on 2008-03-24.

Faiz, A., Weaver, C.S., Walsh, M.P., 1996. Air Pollution from Motor Vehicles: Standards and Technologies for Controlling Emissions. World Bank Publications.

Gokhale, S., 2012. Impacts of traffic-flows on vehicular-exhaust emissions at traffic junctions. Transport. Res. Part D: Transp. Environ. v.17, pp: 21–27.

Limer, Eric., 2016. "Chinese Straddling bus can carry 300 people". Yahoo Tech. Retrieved 4 August 2016.

Mishra, M., and Chaturvedi, M., 2017. Air pollution of megacities. In Air Pollution & Climate Change in South Asia; Issues, Impact and Initiatives (Editor: Umesh Kulshrestha), Athena, IK, pp: 119-127.

Pandian, S., Gokhale, S., Ghoshal, A.K., 2009. Evaluating effects of traffic and vehicle characteristics on vehicular emissions near traffic intersections. Transport. Res. Part D: Transp. Environ. v.14, no.3, pp: 180–196.

Ramachandra, T., 2009. Emissions from India's transport sector: state wise synthesis. Atmos. Environ. v.43, no.34, pp: 5510–5517.

Reynolds, C.C., Kandlikar, M., Badami, M.G., 2011. Determinants of PM and GHG emissions from natural gas-fueled auto-rickshaws in Delhi. Transport. Res. Part D: Transp. Environ. v.16, no.2, pp: 160–165.

Sheldon, G., Strickland, Wayne Ber., 1995. Congestion Control and Demand Management. Public Roads Magazine. U.S. Federal Highway Administration. v.58, no.3.

Shukla, A., and Alam, M., 2010. Assessment of real world on-road vehicle emissions under dynamic urban traffic conditions in Delhi. Int. J. Urban Sci. v.14, no.2, pp: 207–220.

Singh, S.K., 2006. Future mobility in India: implications for energy demand and CO2 emission. Transp. Policy v.13, no.5, pp: 398–412.

Singh, Y., and Kulshrestha, U.C., 2016. Critical Assessment of Odd and Even in Delhi. Journal of Energy Environment and Carbon Credits. v.6, pp: 1-6.

Small, Kenneth A., José A., Gomez-Ibañez., 1998. Road Pricing for Congestion Management: The Transition from Theory to Policy. The University of California Transportation Center, University of California at Berkeley. p: 213.

Small, Kenneth A., Verhoef, Erik T., 2007. The Economics of Urban Transportation. Routledge, New York. ISBN 978-0-415-28515-5, p: 120.

Tennoy, A., 2010. Why we fail to reduce urban road traffic volumes: Does it matter how planners frame the problem? Transport Policy v.17, pp: 216–223.

Tsekeris, T., and Geroliminis, 2013. City size, network structure and traffic congestion. Journal of Urban Economics v.76, pp: 1–14.

Verma, K., and Kulsreshtha, U.C., 2015. CO2 emissions and soft approaches of mitigation fro NCR-Delhi. World Focus, October, 2015.

Verma, K., and Singh, Y., 2017. Air Pollution & Climate Change in South Asia; Issues, Impact and Initiatives, Editor: Umesh Kulshrestha. Chapter 13: Climate Change Mitigation.

Zhang, K., Batterman, S., Dion, F., 2011. Vehicle emissions in congestion: comparison of work zone, rush hour and free-flow conditions. Atmos. Environ. v.45, no.11, pp: 1929–1939.

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Quotations on Air Pollution and Traffic Congestion

"Water and air, the two essential fluids on which all life depends, have become global garbage cans."

Jacques-Yves Cousteau (1910 –1997) was a French naval officer, filmmaker, scientist, author and researcher.

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"The environmental effects of the automobile are well known: motor vehicles cause, for example, as much as 75 percent of the noise and 80 percent of the air pollution in our cities, and the industry must face mounting pressure from environmentalists."

Stewart Udall (1920 –2010) was an American politician.

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This isn't life in the fast lane, its life in the oncoming traffic.

Terry Pratchett (1948 -2015) was an English author of fantasy novels, especially comical works.

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Traffic is only one of the side effects of growth.

Roy Barnes (1948--) is an American attorney and politician.

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"The more we pollute the earth, the less we deserve to live on earth!"

Mehmet Murat ildan(1965--) Was a Turkish playwright and writer.

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Relationships are like traffic lights. And I just have this theory that I can only exist in a relationship if it's a green light.

Taylor Swift (1989--) is an American singer-songwriter.