

Environmentally Sustainable Urban Transport: An Emerging Concern

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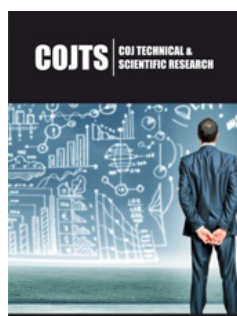
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Abstract

Urban areas on a global scale are posing multidimensional environmental problems, of which urban transport is one of the significant emerging concerns. The urban transport in the present context is resulting into significantly high traffic congestion, air pollution coupled with noise pollution and various diseases associated with psychological stress and disorder. To address this issue globally, concept of sustainable urban concept came into existence and subsequently replaced to environmentally sustainable urban transport system. The term sustainable transport came to describe modes of transport along with systems of transport planning which match the wider dimensions of sustainability. Subsequently, the problems of air, noise and other environmental problems were considered to add environment to sustainability. The authors of the present paper have attempted to describe environmental sustainability of urban transport in terms of its concepts, predominant indicators, ideal parameters etc. to address the issues relating to urban transport.

Keywords: Environment; Sustainability; Urban transport; Environmental challenges; Green vehicles; Bicycle and walking approach; Carrying capacity; Economic model

Introduction

The concepts of sustainable transport were developed much earlier. The first mode of transport was considered as walking which is supposed to be most sustainable [1]. Public transport came into existence with the invention of the public bus by Blaise Pascal in 1662 [2]. The first passenger tram started in 1807 whereas the first passenger rail service in 1825 and Pedal bicycles in 1860s. These were the only transport systems available to most people prior to World War II. Sustainable transport visualizes the broad areas of transport which is sustainable in terms of social, environmental and climate impacts [3,4]. Parameters used for evaluating sustainability include vehicles used for road, water or air transport; the source of energy; and the supporting infrastructure like roads, railways, airways, waterways, canals etc. to accommodate the transport. Transportation sustainability is predominantly assessed by the effectiveness of transportation system along with system employed to evaluate environmental and climate impacts [5]. According to estimates 2.4 million premature deaths each year could be avoided from outdoor air pollution as per the United Nations Environment Programme (UNEP) [6]. The emissions released from vehicles Particularly black carbon, which is a known cause of respiratory and carcinogenic diseases and a significant contributor to global climate change. [7]. Moreover, traffic congestion imposes economic costs by wasting people's time along with other negative impacts. Traditional transport planning aims to improve mobility, especially for vehicles, but may fail to adequately consider wider

impacts in the form of environmental and social impacts along with managing traffic congestion [8]. An integrated planning in respect of environmentally sustainable transport network would lead to more vibrant, livable, sustainable cities.

Environmental Impacts

Major emitters of greenhouse gases are from transport sectors which were responsible for 23% of world energy related GHG emissions in 2004. Currently 95% of transport energy comes from petroleum [9] and this energy is consumed in the manufacture as well as the use of vehicles including transport infrastructure in the form of roads, bridges and railways [10]. The Life Cycle environmental impact of vehicle was first evaluated by using a model based on the second law of thermodynamics and energy analysis [11] known as Von Karman model. Subsequently, Chester et al. [12-14] have developed a similar model based on the first law which accounts costs for the infrastructure. The environmental impacts of transport can be reduced by reducing the weight of vehicles, sustainable styles of driving, reducing the friction of tires, encouraging electric and hybrid vehicles, improving the walking and cycling in cities, and by enhancing the role of public transport, especially electric rail [9]. Green vehicles are intended to have less environmental impact compared to other conventional vehicles. Public transport well defined networks using buses use less fuel per passenger than private vehicles, and are generally safer and use less road space than private vehicles [15] Green public transport vehicles including electric trains, trams and electric buses is one of the sustainable transport choices. Other choices with very low environmental impact are cycling, other human-powered vehicles, and animal powered transport. The most common green transport choice with the least environmental impact is walking.



Figure 1: Showing ideal urban transport with green infrastructure.

Predicting environmental impacts is necessary for carrying assessment of urban transport planning. It would be of utmost importance to carry system dynamics (SD) which is used to solve complex problems. Such a system dynamics (SD) was employed to evaluate the environmental impacts associated with urban transport planning in Jilin City, China having regard to the local economy, society, transport, the environment and resources [16-18]. Simulation models were developed comprising interrelated subsystems designed to utilize changes in the economy, society, road construction, changes in the number of vehicles, the capacity of the road network, air pollutant emission, traffic noise, land

used for road construction and fuel consumption associated with traffic to estimate dynamic trends in the environmental impacts associated with Jilin's transport planning. Such simulation models should develop for Indian cities and the Strategic Environmental Assessment (SEA) should be carried out and effectively used in urban transport planning. An ideal urban transport coupled with green infrastructure is reflected in (Figure 1).

Ideal Approach

To achieve environmentally sustainable urban transport, there could be many technological, social, economic and planning strategies, some of which are being briefly explained here under:

Technical innovation of road network

Urban areas are most busy areas, so the road networks here. Technology for vehicles are being improvised in a fast pace but what about the roads? If road network is less disrupted, then the gas emission will also decrease from vehicles. Engineers are trying to build roads which can last long but the implementation or usage of those technologies is not adopted fast. Materials should be used in such a way that a balance can be established between vehicle loads and roadway use. Being considerate for the environment a great innovation was done by Rajagopalan Vasudevan, the "plastic Man of India", he proposed the way of disposing plastic waste by reusing it to build roads in 2001. Many countries like India, Australia, Indonesia, United Kingdom, United States and others are using this technology which can incorporate plastic into an asphalt mix, according to the idea given by Rajagopalan Vasudevan. These roads are highly resistant to weather and wear due to the various chemical and physical properties of plastics. Its surface remains smooth for long and needs lower maintenance, absorbs sound better and also doesn't absorb water. It is more eco-friendly than the normal concrete road. Now more than 500 billion plastic bags are used to build plastic roads worldwide but still it's a long to go making all roads by plastic wastes.

Public transport system

People in the 21st century are well known for their fast-paced lifestyle. To be more fast they started owning more vehicles, such that the production of motor vehicles has increased rapidly (except for the covid-19 situation in year 2020), there are almost 1.4 billion cars on the roads among the population of 7.6 billion here two wheelers are not taken into account. San Marino has the most 1263 motor vehicles per 1000 people. In India two wheelers are more popular and the sale has been increasing each year. An annual sale of 990,000 has been increased in India in the year 2018-19, a total sale of 26.3 billion motor vehicles was recorded in the same year. Where passenger vehicle sale was only 12.9 percent of the total. In India traffic control is a major problem; one solution to it could be increasing number of public transports. If only public transport system is improvised with better maintenance and punctuality, the public will automatically switch to it instead of using their own personal motor vehicles. Now the share of public transport is just 18.2% of work trips, and the share is recorded as decreasing. Right now, the average speed of the traffic is in key Indian cities is

17-23km/h, which is not good for the environment because more disruption means more air pollution by the smoke of vehicles. More public transport will decrease the usage of private vehicles and can cause less traffic on the roads.

Green vehicles

Switching to green vehicles needs an initiative by government. Green vehicles mean the vehicles which causes less harm to the environment like hybrid electric vehicle, battery electric vehicle, compressed air vehicles, hydrogen fuel vehicle, natural gas vehicles, etc. Subsidizing environment friendly vehicles and charging more tax on harmful fuel vehicles can be effective. Now the technology is more focused on electric vehicles among all green vehicles but still lacking in many ways in comparison to the conventional vehicles which is keeping people from switching [14-18]. But now the some of the top motor companies are focusing more on electric vehicles, they are continuously investing in R&D to improve the technology. Tesla, BMW, Mercedes, Lamborghini and others have invented great hybrid electric vehicles with great features but right now these are not affordable to all. However, the electric vehicle sale is rising year per year, in 2019 it was more than 5.2 million. A picture of eco bus or green vehicle is shown in (Figure 2).



Figure 2: Showing green or eco bus.

Use of bicycle



Figure 3: Showing bicycle lane in an urban area.

However, due to the lack of planned infrastructure leads to decrease in the share of bicycle usage. Superhighways are best way to give an incentive to bicyclists. In Patna, India it was experimented that if proper infrastructure is provided the usage of bicycle could be increased up to 48% but allowing motor bikes can decrease it to 44%. The increase in bicycle means switching from conventional motor vehicles, public transport and walk. Allowing only bicyclist on the superhighways improved congested urban areas, reduced traffic and emissions. But when motor bikes are allowed then it reduces the accessibilities and increases emissions. Just few changes in the road structures can cause less harm to the

environment. (Figure 3) shows an ideal bicycle lane which is most environmentally sustainable option for urban transport.

Walking

Earlier, when there was not much vehicles, people used to walk for short or long distance to travel. It would keep them fit, healthy and they used to live more. But now affordable vehicles made everyone forgot about walking. Even for shorter distances people like to save time and choose to go through motor vehicle. The average steps that a human must walk are 10000 per day but most of the people in urban areas don't even walk halfway. Walking is not just good for health but also for environment. Some NGOs and government organizations organize programs like marathon to spread awareness. Now a day's technology like pedometers is also there to keep individual alert about the steps he/she is walking per day. An ideal walking lane is shown in (Figure 4).

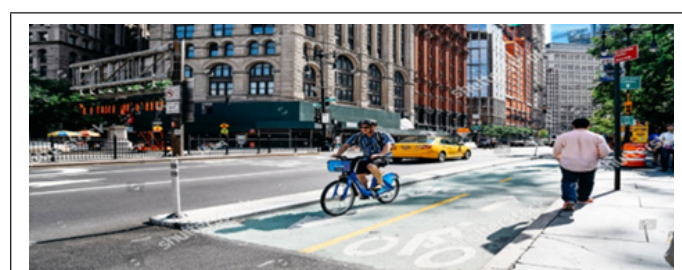


Figure 4: Showing an ideal walking lane.

Economic parameters

75% of air carbon monoxide emissions come from automobiles and it is between 50-90% in urban areas. If only above-mentioned alternatives used by people, the air pollution will go much down. This will increase in the health of people by preventing them from the disease caused by pollution. More healthy labor will increase in their working efficiency which will ultimately cause in rise in GDP, and a rise in GDP will cause rise in country's living standard. Less air pollution will also save the budget of government for environment and which can be used for other causes. If more alternatives were to find the less pollution it will cause and give improved and more efficient technology. By finding other sustainable alternatives of transport, many fuels and natural resources can be saved and used for further economic development.

Conclusion

Urban transport is getting more congested on a time scale with fast increasing of vehicles and limited road infrastructure to match flow of vehicles. Such a limiting factor leads to enhanced air and noise pollution with increased travel time. This problem is not only relevant to India but also globally to a greater extent. Lots of diseases are being caused on account emissions released from urban transport which realizes to focus on a concept of environmentally sustainable urban transport. Under the concept of sustainable approach well defined and scientifically compatible carrying capacity of road network needs to be estimated for a period up to 2051. Public transport with adequate comforts needs to be put in place to reduce individual cars plying on roads. Moreover, green transport system as mentioned in this should encouraged

and honestly implemented, use of bicycles and walking practices should be encouraged but supporting infrastructure in the form of separate lanes to be developed. Besides, self-supporting economic models should be formulated and put in place and made effective to achieve the goal of environmentally sustainable urban transport.

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