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HIDDEN COSTS OF MOBILITY IN URBAN AREAS

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Abstract
The densification of an urban core forces outward growth of the city to suburbs. The movement towards the suburbs is mostly residential for various reasons including economic, environmental or leisure. The sprawl creates segregated work, live and play zones which require connectivity in the form of roads. Due to, mostly, lack of strong public transport facility, connecting the suburbs, in most of the cities a rise in the private vehicle ownership is seen. With increasing expansion, increased travel distance and increase in number, too, the vehicle users demand more roads. This cyclic nature of demand of road leading to increase of cars and again demand of road to accommodate excess vehicles is observed. The transportation is integral part of our daily life but as important as it is, comes with various issues of which some are direct such as congestions, air pollution, etc. and others are indirect such as health issues, temperature rise, etc. The cost of using transportation is paid by the users as well as non-users. This nature of this cost may be tangible i.e. Monetary or intangible i.e. mental peace & Health. This paper attempts to synthesize the studies on the direct and indirect issues related to transportation system and analyze the hidden costs paid by the users & non users. The outcome of the paper is consolidation of physical, environmental and social aspects of issues faced by the urban population due to increased private vehicles.

Keywords: *Roads, Traffic, Paved surface, Pollution, Environment*

Introduction

The cities have emerged as the commercial and industrial hubs. The dense urban fabric of the city center is the most sought after land for the commercial and institutional activity due to the obvious fact of high footfall. This has led to the high density development in the city center with bare minimum or no infrastructure for the populace. As well as the price of land goes skyrocketing.

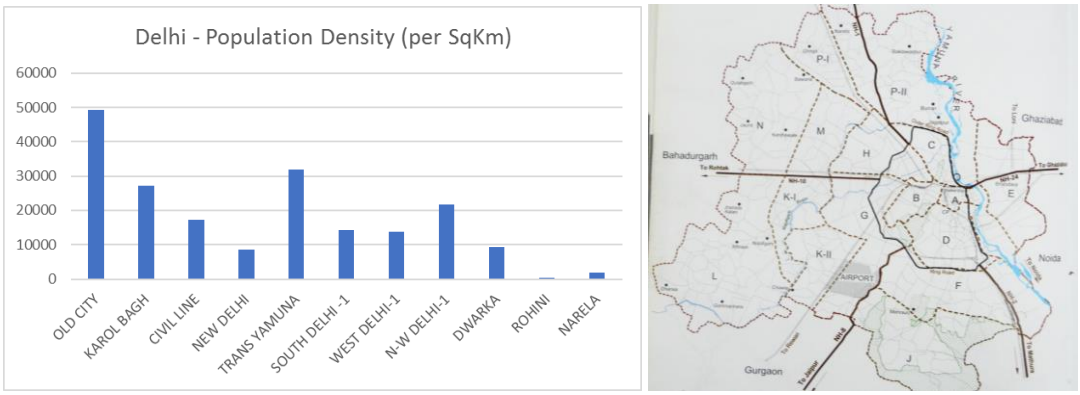


Figure 1 : zonal population density in Delhi (Source: Author)

On the other hand suburban development gives an affordable, uncongested and green area to live. But this increases the distance from the leisure and sometimes work place too.

The desirability of the city center and the livability of the suburbs is always a dilemma for the residents to choose. The driving factors of choice can be economic, environmental or the travel. The city cores are the commercial hubs of the system then city suburb is devoted to industrial areas too. The cost of land, the green areas with clean air or less commute to the industrial areas are few factors which lead to the settlement of people in the suburbs. The garden city proposed by Ebenezer Howard in his book 'garden cites of tomorrow (1908)' was envisioned as concentric layers of such activities. The Radburn city planning segregated the residential apart from commercial and industrial for comfortable living and suburban environment. And Le Corbusier theorized that city should have three separate zones for living, working and leisure.

The modern cities are built on similar concepts, where huge residential area with unified commercial hubs & leisure and the industries are located outside the city. People move/ travel to work, to shop, for leisure and back to homes. A huge sum of time, money and fuel/ energy is spend in doing so. But travel is an important aspect of life. In a study it was revealed that travel distance does not depend upon the income. In a metropolitan city like Delhi on an average a person may spend several hundred per day on travel.

Issues related to transportation

As essential it may be but transportation comes at a price. This cost is paid directly and indirectly in various ways. The payment mode may be tangible .i.e. monitory or intangible i.e. mental peace and health. Some of the important direct and indirect costs paid by users is discussed herewith in following points:

A. DIRECT ISSUES

i. With rising distances demand for vehicles rises;

Since the planning favors segregation of living, working & recreation places and the economics forces people out of the city to periphery or the adjacent satellite towns the in-evident travel comes into play. With this the need to connect distant places with motorable roads arises so as to enable commuters to reach their destination. But the huge number of users in transit everyday puts a tremendous pressure on public transport under which it crumbles forcing more and more people to opt for private vehicles.

ii. Increasing number of vehicles create more traffic and pollution;

The roads laid out in the city have a definite carrying capacity and can handle limited number of vehicles at a point of time. In last decade total Indian road length has increased about 200 percentage but due to finite availability of land in the city and continuous rise in the number of vehicles issues of traffic congestion has been prevented. Increase in number of vehicles puts these limits to a test under which the existing roads get chocked. High and slow traffic gives way to congestions leading to inefficient engine performance resulting in fuel wastage and air pollution in form of CO_2, NO_2, SO_2, etc. toxic gases. Delhi is ranked 2nd most polluted city in the world. This leads to loss of time and fuel enormously. The study has shown that Average speed of vehicles in peak hours in Delhi city is 6 km/hr as compared to suburbs 50km/hr.

The only way to reduce the pollution is to decongest the traffic. At this point of time these additional vehicles demand for additional space to move and park.

iii. With rising number of vehicles demand for wider roads is rising;

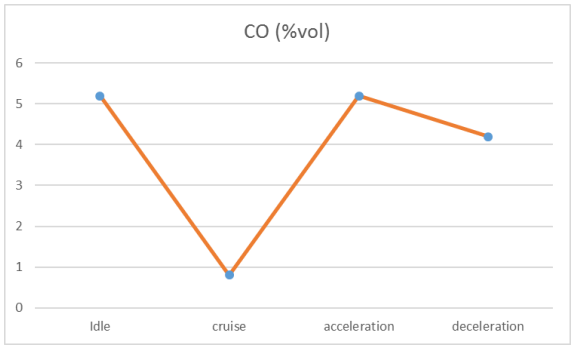
To accommodate the ever rising number of vehicles roads are widened wherever possible. Government spends several thousand crores from their annual budget on road addition and maintenance. Number of flyovers and underpasses get added to smooth out the traffic. This encourages new users to buy private vehicles which are added in the road traffic creating additional burden. Over time the renewed road network also becomes insufficient and requires addition.

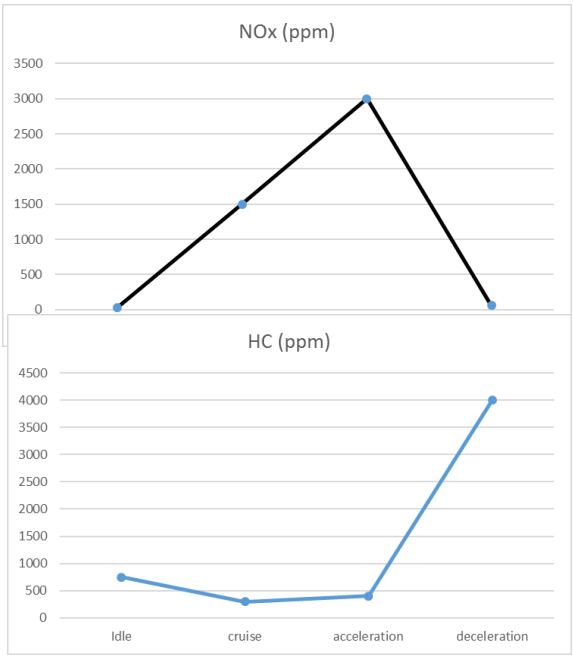
iv. Increasing number of vehicles also puts pressure of providing parking spaces.

The increasing number of vehicles pose a great problem of parking space. The inner or old city areas and other urban villages and unauthorized colonies without any regulation for parking face this problem immensely. The regular sight of vehicles parked on the neighbourhood roads leading to clashes between residents. The local bodies are also put under stress to provide parking spaces at commercial and public areas. The procuring land and building multilevel parking is an additional cost to government. On an average government spends approximately Rs. 7.5 lakh to create parking (multi-level) for each car.

v. Increasing air pollution increases chronic diseases related to lungs; (diseases related to pollution and traffic)

Automobile engines produce approx. 50% of airborne contaminants. Major pollutants are carbon monoxide (CO), hydro carbons (HC) & nitrogen oxides (NOx) with % sharing as 68%, 60% & 49% respectively. In cities due to traffic congestion, vehicles accelerate and decelerate regularly resulting in incomplete combustion and release of unburnt HCs.





Driving mode	HC (ppm)	CO (%vol)	NOx (ppm)
Idle	750	5.2	30
Cruise	300	0.8	1500
Acceleration	400	5.2	3000
Deceleration	4000	4.2	60

Figure 2 Emission in various modes of driving ((Source: Perkins)

Regularly inhaling the polluted air with toxic gases increases chances of chronic diseases related to lungs. The number of patients of lung diseases have increased multiple folds in last decade only.

B. IN-DIRECT ISSUES RELATED TO TRANSPORTATION

It is evident that with every inch of road expansion we lose same amount of natural ground, most of the times green too. As per the technical standards (Neufert architects' data) one car requires around 23 square meter of paved space for parking in an open lot alone. This gives rise to some more problems totally not related to transportation but to the living environment of users. These are not evident instantaneously but they affect our lives and living in the urban area. Few of the issues are discussed hereunder:

i. Less green and less trees;

The trees and green areas act as heat and pollution sink as they absorb carbon dioxide (CO_2) and hence limiting its presence in the atmosphere. The green areas are mostly cultivable land or fertile land to grow trees. Road expansion comes at a price, which is losing natural/green land and trees. Worst cases are scenarios of roads cutting through a forest or reserved area e.g. Mumbai-Pune e-way, Taj expressway through forest in Agra, etc. Tree felling, several thousands in numbers to make way for road accounts for significant factor for deforestation. Due to which we lose the only natural defense against air pollution and carbon dioxide (CO_2) increase in the atmosphere.

ii. More heat island effect;

Another problem due to paving only urban areas experience. The large paved and concrete surfaces absorb heat and increase the ambient temperature of the surrounding. On a regular afternoon paved concrete surfaces can be 27-50 degrees Celsius higher than the air temperature. This is increased exponentially in absence of trees to shade the surface and to balance the heat by absorbing it. This results in higher temperature inside the buildings and higher use of air-conditioning to lower the temperature for comfortable indoor environment in day time as well as in the night when the concrete surfaces radiates back the heat. The resultant expenditure of energy and money to do so for a metro-city like Delhi or Mumbai, if accumulated for million families will run into huge numbers.

iii. More rain water run-off and lower water table;

Very serious effect of large paved surfaces is rain water run-off in the storm drains eventually to the rivers, instead of percolating in the earth and recharging the water table. The retention capacity of soil is the property of soil, when fully wet, to contain some water between its particles. Larger the particles smaller the retention capacity of soil. Hence sandy or loose soil have least water retention. The studies show that loam and clay soils have highest water retention capacity in inches of water per

foot of soil i.e 2-2.5 and 1.5-1.7 respectively. With plants and trees the retention capacity of soil increases upto 200%. This percolated water becomes the part of the water table for future use by plants and humans. The paved concrete surfaces have no water holding or percolation property. Due to this urban areas face water scarcity with low water tables as well as flash floods in monsoons as the water cannot be dispersed into the ground. Metropolitan cities like Delhi and Mumbai face the above problems of acute shortage of water as well as flash floods.

Available Water Capacity by Soil Texture

Textural Class	Available Water Capacity (Inches/Foot of Depth)
Coarse sand	0.25–0.75
Fine sand	0.75–1.00
Loamy sand	1.10–1.20
Sandy loam	1.25–1.40
Fine sandy loam	1.50–2.00
Silt loam	2.00–2.50
Silty clay loam	1.80–2.00
Silty clay	1.50–1.70
Clay	1.20–1.50

Figure 3 : Available water capacity of soil texture

Measures taken in recent years

To ease the presence on the demand of private vehicles and reduce the effects of increasing vehicles govt. has taken a few measures as discussed under:

- *Public transport system- BRTS & MRTS*
  Bus Rapid Transport System commonly known as BRTS was implemented in Delhi unsuccessfully. The system was borrowed from BOGOTA where it is the lifeline of the city and known as greater trans-milenio. Its success can be verified from the fact that it provides transportation for 69% of the city population amounting to approx. 2.4 million riders. This system prioritizes bus movement by allocating exclusive bus lanes. An example of Mass Rapid Transport System or MRTS is metro rail in Delhi or the local trains of Mumbai. This is the rail network serving the city population to move around the city only. For instance the metro takes an approximate time of 2hrs to ply b/w Noida and Gurugram or 1hr either way from Rajiv chowk. But same distance if travelled with private vehicle or bus may take upto 2 hrs. Both the systems when working efficiently reduce the time of travel and expenditure too resulting in serving large population and reducing the number of vehicles on the road.

- *CNG and electric operated vehicles*
  The toxic fumes emitted by fossil fuel operated vehicles can be reduced by using alternate green fuel options. Buses and autos/taxis are a major source of toxic fumes in the city due to their considerable numbers. Buses running on CNG and battery operated rickshaws have been implemented so far in various cities. The level of increase in pollution have been reduced considerably with these implementations.

Measures to be taken

- *Strengthen public transport with new dimensions*
  The majority of population in a city requires low cost transport to travel daily. Hence the bus/rail users get the largest share of all the commuters. Due to which these transport system needs to be constantly updated to cater the needs of the increasing users. This requires periodical increase in the fleet size, monitoring and allocation of new buses/rails on high demand routes for maintained frequency of buses/rails at peak hours. The cost of travel also requires to be optimized because as soon as the travel cost difference decreases users prefer personal vehicles. Travel comfort is another factor for digressing to private vehicles from public transport. Apart from climatic condition, quality of mode and distance travelled to reach the mode is also important. Considering the climate of Delhi AC buses were added to the fleet. Which increased the comfort of the users who could afford to pay a

bit higher price. Last mile connectivity with adequate modes is the key to divert people towards the public transport systems.

- *Policy to limit number of vehicles*
  The second stage succeeding the strengthening of public transport is to limit the number of private vehicles on the road. The implemented and successful example of Singapore is available. In Singapore the number of vehicles on the road at a time is fixed. Old vehicles get disposed in order to get new ones. No private person can buy any vehicle without approval from the government authority. While in Greece ODD EVEN rule is followed in few of the cities. Vehicles with ODD/EVEN number are allowed to be taken out on ODD/EVEN dates respectively.

- *Adopting new road construction technology*
  Since the wider roads mean more paved area, which means more water run-off to the drains instead of seeping in to the ground water resources, new type of road construction technologies or the materials must be adopted. One of the materials around is porous concrete. Other elements can be regular water recharge provision in the road construction policy. Optimizing the road width for specific area or in the urban context.

- *Stricter norms to save green cover*
  Road construction and widening comes at a great price of green cover/forest. Urban areas are the worst hit with these actions. In some cases the most critical and important green areas come under the axe. Norms state that 500-600 new trees are required to be planted for each kilometer of road constructed through forest. But a thousand new trees cannot compensate for one fully grown several decade old tree. The importance of road cannot out-weight the importance of forest. For example "Mumbai – Pune highway planned in Sahyadri mountain ranges".

Conclusion

The expansion of the city is inevitable so is the increase in the distance of travel. The vicious circle of increasing demand leading to longer and wider roads leading to increased vehicle leading to the demand for more roads gets created. In this insatiable need of roads for connectivity city loses its connection with the nature and becomes diseased. Diseases such as water scarcity, increase in ambient temperature, polluted air and most of all loss of greens & trees. The cities are the engines of growth but also these engines require maintenance in the form of planning and upgradation with time. Use of technology and techniques in planning and policy can help us reduce the rate of spread of illness of the city and maybe stop it.

But the question remains "is there any alternative to the large scale movement of population everyday; can we plan the growth in such a way to curb the compulsive movement of the populace"?

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