An Overview of Transport Challenges in India

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Abstract

Cities are locations having a high level of accumulation and concentration of economic activities and are complex spatial structures that are supported by transport systems. The larger the city, the greater its complexity and the potential for disruptions, particularly when this complexity is not effectively managed. The most important transport problems are often related to urban areas and take place when transport systems, for a variety of reasons, cannot satisfy the numerous requirements of urban mobility. This paper has dealt with some of major challenges of transport in cities.

1. Introduction

Urban productivity is highly dependent on the efficiency of its transport system to move labor, consumers and freight between multiple origins and destinations. Additionally, important transport terminals such as ports, airports, and rail yards are located within urban areas, contributing to a specific array of problems. Some problems are ancient, like congestion (which plagued cities such as Rome), while others are new like urban freight distribution or environmental impacts. Among the most notable urban transport problems are:

- **Traffic congestion and parking difficulties**. Congestion is one of the most prevalent transport problems in large urban agglomerations, usually above a threshold of about 1 million inhabitants. It is particularly linked with motorization and the diffusion of the automobile, which has increased the demand for transport infrastructures. However, the supply of infrastructures has often not been able to keep up with the growth of mobility. Since vehicles spend the majority of the time parked, motorization has expanded the demand for parking space, which has created space consumption problems particularly in central areas; the spatial imprint of parked vehicles is significant. Congestion and parking are also interrelated since looking for a parking space (called "cruising") creates additional delays and impairs local circulation. In central areas of large cities cruising may account for more than 10% of the local circulation as drivers can spend 20 minutes looking for a parking spot. This practice is often judged more economically effective than using a paying off-street parking facility as the time spent looking for a free (or low cost) parking space as compensated by the monetary savings. Also, many delivery vehicles will simply double-park at the closest possible spot to unload their cargo.

- **Longer commuting**. On par with congestion people are spending an increasing amount of time commuting between their residence and workplace. An important factor behind this trend is related to residential affordability as housing located further away from central areas (where most of the employment remains) is more affordable. Therefore, commuters are trading time for housing affordability. However, long commuting is linked with several social problems, such as isolation, as well as poorer health (obesity).

- **Public transport inadequacy**. Many public transit systems, or parts of them, are either over or under used. During peak hours, crowdedness creates discomfort for users as the system copes with a temporary surge in demand. Low ridership makes many services financially unsustainable, particularly in suburban areas. In spite of significant subsidies and cross-financing (e.g. tolls) almost every public transit system cannot generate sufficient income to cover its operating and capital costs. While in the past deficits were deemed acceptable because of the essential service public transit was providing for urban mobility, its financial burden is increasingly controversial.

- **Difficulties for non-motorized transport**. These difficulties are either the outcome of intense traffic, where the mobility of pedestrians, bicycles and vehicles is impaired, but also because of a blatant lack of consideration for pedestrians and bicycles in the physical design of infrastructures and facilities.

- **Loss of public space**. The majority of roads are publicly owned and free of access. Increased traffic has adverse impacts on public activities which once crowded the streets such as markets, agoras, parades and processions, games, and community interactions. These have gradually disappeared to be replaced by automobiles. In many cases, these activities have shifted to shopping malls while in other cases, they have been abandoned altogether. Traffic flows influence the life and interactions of residents

and their usage of street space. More traffic impedes social interactions and street activities. People tend to walk and cycle less when traffic is high.

- **High maintenance costs**. Cities with an aging of their transport infrastructure are facing growing maintenance costs as well as pressures to upgrade to more modern infrastructure. In addition to the involved costs, maintenance and repair activities create circulation disruptions. Delayed maintenance is rather common since it conveys the benefit of keeping current costs low, but at the expense of higher future costs and on some occasion the risk of infrastructure failure. The more extensive the road and highway network, the higher the maintenance cost and the financial burden.

- **Environmental impacts and energy consumption**. Pollution, including noise, generated by circulation has become a serious impediment to the quality of life and even the health of urban populations. Further, energy consumption by urban transportation has dramatically increased and so the dependency on petroleum. These considerations are increasingly linked with peak mobility expectations were high energy prices incite a shift towards more efficient and sustainable forms of urban transportation, namely public transit.

- **Accidents and safety**. Growing traffic in urban areas is linked with a growing number of accidents and fatalities, especially in developing countries. Accidents account for a significant share of recurring delays. As traffic increases, people feel less safe to use the streets.

- **Land consumption**. The territorial imprint of transportation is significant, particularly for the automobile. Between 30 and 60% of a metropolitan area may be devoted to transportation, an outcome of the over-reliance on some forms of urban transportation. Yet, this land consumption also underlines the strategic importance of transportation in the economic and social welfare of cities.

2. Automobile Dependency

Automobile use is obviously related to a variety of advantages such as on demand mobility, comfort, status, speed, and convenience. These advantages jointly illustrate why automobile ownership continues to grow worldwide, especially in urban areas. When given the choice and the opportunity, most individuals will prefer using an automobile. Several factors influence the growth of the total vehicle fleet, such as sustained economic growth (increase in income and quality of life), complex individual urban movement patterns (many households have more than one automobile), more leisure time and suburbanization. Therefore, rising automobile mobility can be perceived as a positive consequence of economic development.. In addition to the factors contributing to the growth of driving, two major factors contributing to automobile dependency are:

- **Underpricing and consumer choices**. Most road infrastructures are subsidized as they are considered a public service. Consequently, drivers do not bear the full cost of automobile use. Like the "Tragedy of the Commons", when a resource is free of access (road), it tends to be overused and abused (congestion). This is also reflected in consumer choice, where automobile ownership is a symbol of status, freedom and prestige, especially in developing countries. Single home ownership also reinforces automobile dependency.

- **Planning and investment practices**. Planning and the ensuing allocation of public funds aim towards improving road and parking facilities in an ongoing attempt to avoid congestion. Other transportation alternatives tend to be disregarded. In many cases, zoning regulations impose minimum standards of road and parking services and de facto impose a regulated automobile dependency.

However, from the 1980s, motorization started to be seen more negatively and several cities implemented policies to limit automobile circulation, at least in specific areas, by a set of strategies including:

- **Dissuasion**. Although automobile circulation is permitted, it is impeded by regulations and physical planning. For instance, parking space can be severely limited and speed bumps placed to force speed reduction.

- **Prohibition of downtown circulation**. During most of the day the downtown area is closed to automobile circulation but deliveries are permitted during the night. Such strategies are often undertaken to protect the character and the physical infrastructures of an historical city. They do however, like most policies, have unintended consequences. If mobility is restrained in certain locations or during certain time periods, people will simply go elsewhere (longer movements) or defer their mobility for another time (more movements).

- **Tolls**. Imposing tolls for parking and entry (congestion pricing) to some parts of the city has been a strategy being considered seriously in many area as it confers the potential advantage of congestion mitigation and revenue generation. Most evidence underlines however that drivers are willing to bear additional toll costs for the convenience of using a car, especially for commuting since it is linked with their main source of income.

3. Congestion

Congestion occurs when transport demand exceeds transport supply at a specific point in time and in a specific section of the transport system. Under such circumstances, each vehicle impairs the mobility of others. Urban congestion mainly concerns two domains of circulation, often sharing the same infrastructures:

- **Passengers**. In many regions of the world incomes have significantly increased; one automobile per household or more is becoming common. Access to an automobile conveys flexibility in terms of the choice of origin, destination and travel time. The automobile is favored at the expense of other modes for most trips, including commuting. For instance, automobiles account for the bulk of commuting trips in the United States. The majority of automobile related congestion is the outcome of time preferences in the usage of vehicles (during commuting hours) as well as a substantial amount of space required to park vehicles. About 95% of the time an automobile is idle.

- **Freight**. Several industries have shifted their transport needs to trucking, thereby increasing the usage of road infrastructure. Since cities are the main destinations for freight flows (either for consumption or for transfer to other locations) trucking adds to further congestion in urban areas. The "last mile" problem remains particularly prevalent for freight distribution in urban areas. Congestion is commonly linked with a drop in the frequency of deliveries tying additional capacity to insure a similar level of service.

The former is often performed within fixed schedules while the latter complies with variable and discretionary schedules. Correspondingly, congestion comes in two major forms:

- **Recurrent congestion**. The consequence of factors that cause regular demand surges on the transportation system, such as commuting, shopping or weekend trips. However, even recurrent congestion can have unforeseen impacts in terms of its duration and severity. Mandatory trips are mainly responsible for the peaks in circulation flows, implying that about half the congestion in urban areas is recurring at specific times of the day and on specific segments of the transport system.

- **Non-recurrent congestion**. The other half of congestion is caused by random events such as accidents and unusual weather conditions (rain, snowstorms, etc.), which are unexpected and unplanned. Non-recurrent congestion is linked to the presence and effectiveness of incident response strategies. As far as accidents are concerned, their randomness is influenced by the level of traffic as the higher the traffic on specific road segments the higher the probability of accidents.

4. Mitigating Congestion

In some areas, the automobile is the only mode for which infrastructures are provided. This implies less capacity for using alternative modes such transit, walking and cycling. At some levels of density, no public infrastructure investment can be justified in terms of economic returns. Longer commuting trips in terms of average travel time, the result of fragmented land uses and congestion levels are a significant trend. Convergence of traffic at major highways that serve vast low density areas with high levels of automobile ownership and low levels of automobile occupancy. The result is energy (fuel) wasted during congestion (additional time) and supplementary commuting distances. In automobile dependent cities, a few measures can help alleviate congestion to some extent:

- **Ramp metering**. Controlling the access to a congested highway by letting automobiles in one at a time instead of in groups. The outcome is a lower disruption on highway traffic flows.

- **Traffic signal synchronization**. Tuning the traffic signals to the time and direction of traffic flows. This is particularly effective if the signals can be adjusted on an hourly basis to reflect changes in commuting patterns.

- **Incident management**. Making sure that vehicles involved in accidents or mechanical failures are removed as quickly as possible from the road. Since accident on average account between 20 and 30% of all the causes of congestion, this strategy is particularly important.

- **Car ownership restrictions**. Several cities and countries (e.g. Singapore) have quotas in the number of license plates that can be issued or require high licensing fees. To purchase a vehicle an individual thus must first secure through an auction a license.

- **Carpooling**. Concerns two issues. The first and most common is an individual providing ridership to people (often co-workers) having a similar origin, destination and commuting time. Two or more vehicle trips can thus be combined into one. The second involves a pool of vehicles (mostly cars, but also bicycles) that can be leased for short durations when mobility is required. Adequate measures must be taken so that supply and demand are effectively matched.

- **HOV lanes**. High Occupancy Vehicle (HOV) lanes insure that vehicles with 2 or more passengers (buses, taxis, vans, carpool, etc.) have exclusive access to a less congested lane, particularly during peak hours.

- **Congestion pricing**. A variety of measures aimed at imposing charges on specific segments or regions of the transport system, mainly as a toll. The charges can also change during the day to reflect congestion levels so that drivers are incited to consider other time periods or other modes.

- **Parking management**. Removing parking or free parking spaces can be an effective dissuasion tool since it reduces cruising and enables those willing to pay to access an area (e.g. for a short shopping stop).

- **Public transit**. Offering alternatives to driving that can significantly improve efficiency, notably if it circulates on its own infrastructure (subway, light rail, buses on reserved lanes, etc.) and is well integrated within a city's development plans. However, public transit has its own set of issues (see next section).

- **Non-motorized transportation**. Since the great majority of urban trips are over short distances, non-motorized modes, particularly walking and cycling, have an important roll to play in supporting urban mobility. The provision of adequate infrastructure, such as sidewalks, is often a low priority as non-motorized transportation is often perceived as not modern in spite of the important role it needs to assume in urban areas.

All these measures only partially address the issue of congestion, as they alleviate, but do not solve the problem. Fundamentally, congestion remains a failure at reconciling mobility demands and acute supply constraints.

5. The Urban Transit Challenge

As cities continue to become more dispersed, the cost of building and operating public transportation systems increases. For instance, as of 2015 about 201 urban agglomerations had a subway system, the great majority of them being in developed countries. Furthermore, dispersed residential patterns characteristic of automobile dependent cities makes public transportation systems less convenient to support urban mobility. In many cities additional investments in public transit did not result in significant additional ridership. Unplanned and uncoordinated land development has led to rapid expansion of the urban periphery. Thus, the automobile remains the preferred mode of urban transportation. Among the most difficult challenges facing urban transit are:

- **Decentralization**. Public transit systems are not designed to service low density and scattered urban areas that are increasingly dominating the landscape. The greater the decentralization of urban activities, the more difficult and expensive it becomes to serve urban areas with public transit. Additionally, decentralization promotes long distance trips on transit systems causing higher operating costs and revenue issues for flat fare transit systems.

- **Fixity**. The infrastructures of several public transit systems, notably rail and subway systems are fixed, while cities are dynamical entities, even if the pace of change can take decades. This implies that travel patterns tend to change and that a transit system built for servicing a specific pattern may eventually face "spatial obsolescence".

- **Connectivity**. Public transit systems are often independent from other modes and terminals. It is consequently difficult to transfer passengers from one system to the other. This leads to a paradox between the preference of riders to have direct connections and the need to provide a cost efficient service network that involves transfers.

- **Automobile competition**. In view of cheap and ubiquitous road transport systems, public transit faced strong competition and loss ridership in relative terms and in some cases in absolute terms. The higher the level of automobile dependency, the more inappropriate the public transit level of service. The public service being offered is simply outpaced by the convenience of the automobile.

- **Financing and fare structures**. Historically, most public transit systems have abandoned a distance-based fare structure for a simpler flat fare system. This had the unintended consequence of discouraging short trips for which most transit systems are well suited for, and encouraging longer trips that tend to be costlier per user than the fares they generate. Information systems offer the possibility for transit systems to move back to a more equitable distance based fare structure, particularly with the usage of smartcards that enable to charge according to the point of entry and exit within the public transit system.

- **Legacy costs**. Most public transit systems employ unionized labor that have consistently used strikes (or the threat of a strike) and the acute disruptions they create as leverage to negotiate favorable contracts, including health and retirement benefits. Since public transit is subsidized these costs were not well reflected in the fare systems. In many transit systems, additional subsidies went into compensation or to cover past debt, and not necessarily into performance improvements or additional infrastructure. As most governments are facing stringent budgetary constraints because of social welfare commitments, public transit agencies are being forced to reassess their budgets through an unpopular mix of higher fares, deferred maintenance and the breaking of labor contracts.

- **Self-driving vehicles**. Development in information technologies let anticipate in the coming years the availability of self-driving vehicles. Such a development would entail point to point services by on demand vehicles and a much better utilization level of such assets. This system could compete directly with transit systems due to its convenience, comfort and likely affordability.

Conclusion

Public transit systems are therefore challenged to remain relevant to urban mobility or to increase its market share. The rise in petroleum prices since 2006 has increased the cost of vehicle ownership and operation, but it still remains affordable. A younger generation is perceiving the automobile as a less attractive proposition than the prior generations and is more willing to use public transit and live in higher density areas. Electronic fare systems are also making the utilization of public transit more convenient. A recent trend concerns the usage of incentives, such as point systems (e.g. air miles with purchase of a monthly pass) to further promote the use of public transit and to influence consumer behavior. Yet, evidence underlines that the inflation adjusted cost of using public transit is increasing, implying that the cost advantage of public transit over the automobile is not changing in a significant way.

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