

# An Analytical Study of Indian Transport System — Challenges and Strategies

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**Abstract:** *In the present world scenario where fuel and environment have become areas of major concern, especially in the field of transportation, a kind of transport system is required which helps in sustainable development without compromising the present traffic needs. The new transportation system should ideally be eco-friendly, congestion free, accident free, fuel efficient and economical. PRT (Personal Rapid Transit) is the most recent development in public transportation and is best possible option which compiles to the above needs. PRT is a new innovative and on demand system for developed or urban environments. The system uses small, driverless, electric vehicles which run on guide ways. Its lightweight and flexible nature enables it to be retrofitted into a broad range of environments. It is designed to be reliable and safety built in to ensure comfort and security of its passengers. The system is running successfully at Heathrow Airport, Morgantown (US) and Masdar City UAE. Amritsar (India) is going to show case world's first urban PRT. The paper deals with detailed discussion and how PRT is efficient in managing urban traffic and solving most of the modern traffic problem. From an urban mobility perspective, public transport is far more efficient than personal motor vehicles in terms of the road space it uses up and the energy it consumes. Public transport is thus important for improving sustainable mobility in urban areas, and we consider it the right approach to encourage low-carbon growth in cities*

**Key words:** *PRT, podcar, topology, commuters, flexibility, transit, Automated people mover (APM), Automated Guideway Transit (AGT)*

## 1. Introduction

Transport is an important part of India's economy. Since then infrastructure development has progressed rapidly; today there is a variety of modes of transport by land, water and air. However, Different city expanded significantly resulting in a twofold rise in population and a fivefold rise in the number of vehicles. Consequently, traffic congestion and pollution soared, as an increasing number of commuters took to private vehicles with the existing bus system unable to bear the load. 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. 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.

The total population in India was estimated at 1254.0 million people in 2015, according to the latest census figures. Looking back, in the year of 1950, India had a population of 359.0 million people.

INDIA POPULATION



SOURCE: WWW.TRADINGECONOMICS.COM | MINISTRY OF STATISTICS AND PROGRAMME IMPLEMENTATION (MOSPI)

The population of India represents 17.99 percent of the world's total population which arguably means that one person in every 6 people on the planet is a resident of India. Every nook and corner of India is a clear display of increasing population. Whether we are in a metro station, airport, railway station, road, highway, bus stop, hospital, shopping mall, market, temple, or even in a social/ religious gathering, we see all these places are overcrowded at any time of the day. This is a clear indication of overpopulation in the country.

India's rapidly growing population has called for the government to introduce policies regarding the development of urban infrastructure. Delhi's Master Plan 2021 is set to encourage up to 80 per cent of commuters to use public transport by 2020. It has been estimated that by 2021, there will be a demand for transport by 27.9 million passengers in comparison with 13.9 million in 2001.

## 2. India loses \$10.8bn annually due to traffic congestion

Grappling with the fall of rupee, inflation and political turmoil, there seems to be no abating of crises in India. According to a recent study

conducted by the Transport Corporation of India and IIM (Kolkata), India faces a loss of Rs 600bn (\$10.8bn) a year due to congestion, slow speed of freight and waiting time at toll plazas. This study covered operational efficiencies of freight transportation and revealed India's freight volume's annual growth stands at 9.08%, vehicles at 10.76% but road length is increasing at only 4.01% which has resulted into dearth of road space and accommodation of vehicles. Traffic congestion costs time and money. "Delay in traffic attracts four major costs—safety, death, delay and cost of doing business. Each of these segments, in turn, have a direct economic impact. As per the last study conducted by the Transport Corporation of India and IIM Calcutta (2012), India stands to lose almost Rs.60,000 crore a year due to traffic delays (including fuel wastage) on high-volume highways,"

## 3. Vehicular growth and availability of transport infrastructure in metropolitan cities

During the year 2009, 115 million vehicles were plying on Indian roads (Table 1). According to the

statistics provided by the Ministry of Road Transport & Highways, Government of India, the annual rate of growth of motor vehicle population in India has been around 10% during last decade. The basic problem is not the number of vehicles in the country but their concentration in a few selected cities, particularly in metropolitan cities. From 1999 to 2009, number of vehicles per 1000 people in metropolitan cities has increased more than two-fold from 132 to 286 (Figure 1). Vehicle ownership rate, number of vehicles per 1000 people, in many big cities including Delhi has already crossed the mark of 400. There are at least 5 metropolitan cities having vehicle ownership rate in excess of 500. It is interesting to note that nearly 35% of the total vehicles in the country are plying in metropolitan cities alone, which constitute just around 11% of the total population.

#### 4. Pollution

There is a direct relationship between transport system and air pollution in a city. Vehicular emissions depend on vehicle speed, vehicle-km, age of vehicle, and emission rate. In general, the average peak hour speed in Indian cities is far less than the optimum one. Growing traffic and limited road space have reduced peak-hour speeds to 5-10 Km/h in the central areas of many major cities. The quantity of all the three major air pollutants (namely, nitrogen oxides, hydrocarbons, and carbon monoxide) drastically increases with reduction in motor vehicle speeds. For example, at a speed of 75 Km/h, emission of carbon monoxides is 6.4 gm/veh.-km, which increases by five times to 33.0 gm/veh.-km at a speed of 10 Km/h. Similarly, emission of other pollutants increases with the reduction in vehicle speed. Thus, prevalent traffic congestion in Indian cities particularly during peak-hour not only increases the delay but also increases the pollution level. Problem is aggravated due to high average age and poor maintenance of vehicles in India. With inadequate availability of mass transport services and increasing use of personalized motor vehicles, vehicular emission is assuming serious dimensions in most of the Indian cities. It is amply clear that among various modes of road based passenger transport, bus occupies less road space and causes less pollution per passenger-km than personalized modes.

#### 5. Safety

Why is the road safety situation so bad in so many cities of India? The main reason for this appears to be the prevailing imbalance in modal split, inadequate transport infrastructure and its sub-optimal use, and the lack of effective road-safety policies. Very few cities of India have an adequate public transport system. People rely primarily on

personalized modes such as cars and two-wheelers, Para-transit modes such as auto rickshaws and tempos, and non-motorized transport modes such as tricycles, bicycles, and walking. In most of the cities, two-wheelers and cars account for over 90% of the motorized vehicle population whereas the share of buses is negligible in comparison to personalized vehicles. In general, the road space in cities is grossly insufficient. There is hardly any provision for pedestrians and cyclists to safely use the road. Lane marking and traffic signs are usually missing and the intersections often require geometric correction. To make the situation worse, most of the major roads and junctions are heavily encroached by parked vehicles, roadside hawkers, and pavement dwellers. As a consequence of these factors, already deficient space for movement of vehicles is further reduced. The problem of traffic accidents gets aggravated because of mixed nature of traffic composition. Busy roads often carry a mix of fast moving motor vehicles along with cyclists, pedestrians, and other non-motorized transport users. The experience shows that fatalities are concentrated around roads that are not fit for their purpose of carrying mixed streams of traffic safely. Many cities have somewhat dysfunctional roads with all the features that aggravate the traffic injuries and fatalities. Features such as roads with traffic volumes and speeds that they were not designed for, high proportion of young and inexperienced drivers and high proportion of non-motorized transport users in the same road space are prevalent in number of cities. Also, there is a lack of effective road-safety policies in India. Even simple measures like use of seat-belts and helmets, mandatory according to the Motor Vehicle Act 1988, are not properly enforced. One can get not only a driving license without having an adequate driving skill, but also drive the vehicle under the influence of alcohol particularly in smaller cities and towns. It is not uncommon to see over speed and rash driving on city roads. Some of the city authorities are even unable to tackle the problem of stray cattle on the roads, which often jeopardize the safety of road users.

#### 6. Why Personal rapid transit (PRT)?

Referred to as pod cars is a public transport mode featuring small automated vehicles operating on a network of specially built guide ways. PRT is a type of automated [guide way transit](#) (AGT), a class of system which also includes larger vehicles all the way to small subway systems.

Guide ways are arranged in a network topology; with all stations located on sidings and with frequent merge/diverge points. This allows for nonstop, point-to-point travel, bypassing all intermediate stations. The point-to-point service

has been compared to a taxi or a horizontal lift (elevator). Most mass transit systems move people in groups over scheduled routes. This has inherent inefficiencies. For passengers, time is wasted by waiting for the next arrival, indirect routes to their destination, stopping for passengers with other destinations, and often confusing or inconsistent scheduled routes. Passengers can ideally board a pod immediately upon arriving at a station, and can — with a sufficiently extensive network of tracks — take relatively direct routes to their destination without stops.

Perhaps most importantly, PRT systems offer many traits similar to automobiles. For example, they offer privacy and the ability to choose one's own schedule. PRT may in fact allow for quicker transportation than cars during rush hour, since automated vehicles avoid unnecessary slowing.

### **7. Fully automated vehicles (i.e., without human drivers)**

- Vehicles captive to the guideway- Small vehicles available for exclusive use by an individual or a small group traveling together by choice.
- These vehicles can be available for service 24 hours a day, if desired. - Small guideways that can be located aboveground.
- Vehicles able to use all guideways and stations on a fully connected (a “coupled”) PRT network.
- Direct origin to destination service, without a necessity to transfer or stop at intervening stations (i.e., “nonstop” service). - Service available on demand rather than on fixed schedules.
- PRT is one type of “Automated People Mover” (APM). APMs are transit systems in which vehicles are automatically controlled over exclusive guideways. Other frequently used names for APMs are “People Movers” (PM) and “Automated Guideway Transit” (AGT). The committee prefers the term “Automated People Mover” (APM) and encourages others to use it for this class of transit. APMs have also been called such names as “Downtown People Movers”, and

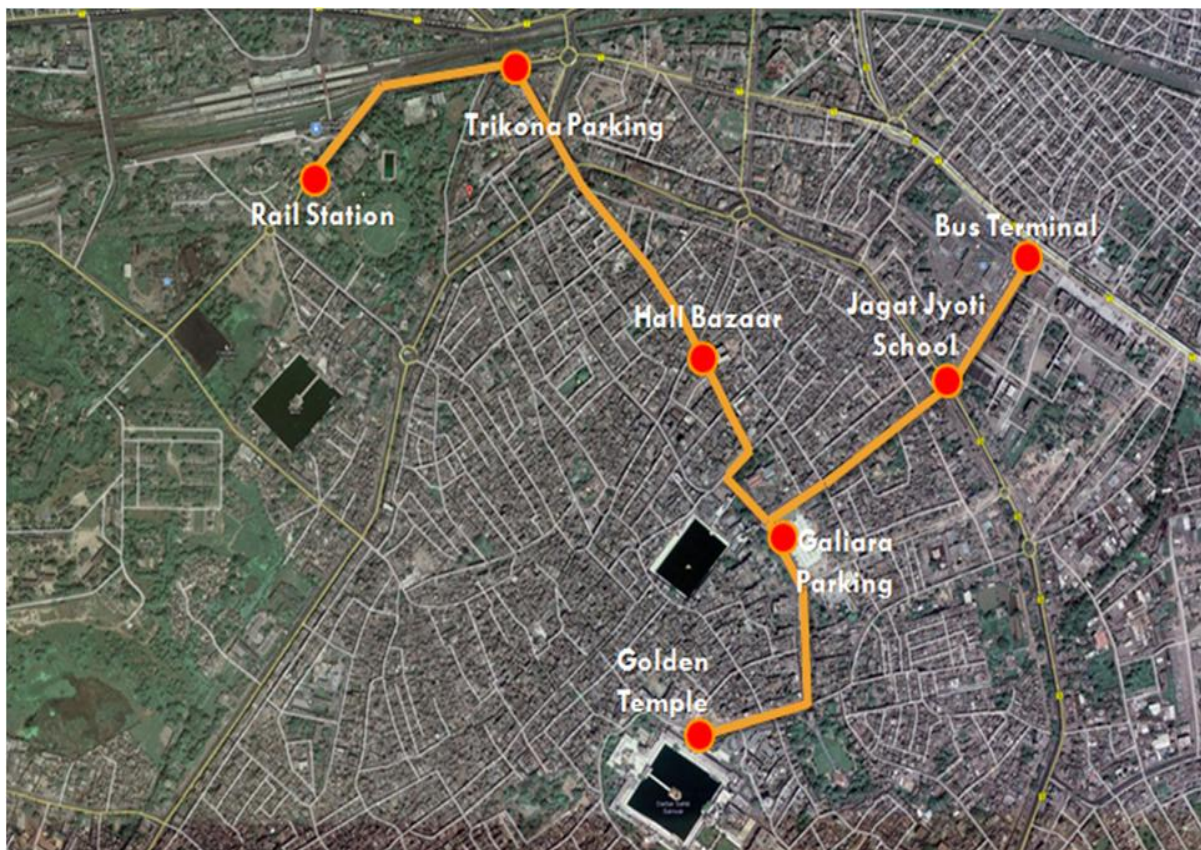
APMs have also been given local names such as “Metromover” (used for the Miami, Florida APM).

- Would provide future cities "a highly accessible, user-responsive, environmentally friendly transport system which offers a sustainable and economic solution."
- Could "cover its operating costs, and provide a return which could pay for most, if not all, of its capital costs."
- Would provide "a level of service which is superior to that available from conventional public transport."
- would be well received by the public.
- Fewer emissions because they use less energy. Typically electrically powered, the emissions are associated with those of the power plant that is typically out of town and systems may even be augmented with clean energy such as solar or wind. Rubber tires on concrete or steel, low weight and speed all combine to produce less noise and vibration. Most importantly, Personal Rapid Transit's high level of service is expected to attract many more riders than conventional transit.

### **8. World's largest urban PRT system is announced; Amritsar**

Ultra Fairwood, the collaboration between Ultra and Fairwood created to bring the Ultra technology to Asia, has been awarded a contract for the world's first urban Passenger Rapid Transport (PRT) system in Amritsar, India . Amritsar represents the first urban application of PRT. At peak capacity the Amritsar system can carry up to 100,000 passengers a day on a 8km / 4.8 mile elevated guideway in over 200 pods between seven stations, making it the world's largest PRT system. Financed entirely by private funding on a build, own, operate transfer (BOOT) basis. The cost of the scheme is subject to commercial confidentiality, it demonstrates that a large scale urban PRT system can be delivered on a financially viable, fare-based model and offer very real returns for financial backers.





Amritsar system: 7 stations, 3.3 km / 2 miles of guideway

Amritsar is home to the holiest shrine of Sikhs, the Golden Temple, and is rich in historical, religious and heritage sites. As such it's a big draw for large numbers of visitors, especially during festivals and religious events, as pilgrims flock to the area. Up to 500,000 people visit the Golden Temple on important religious festival days. The PRT system will ease congestion and reduce the current long travel transit times. The route will focus on taking passengers from the railway and bus stations to the Golden Temple and will:

- Take 35% of daily visitors to the Golden Temple
- Save up to 30 minutes on the current journey times
- Attract passengers from a wide geographic and demographic profile, from regular commuters to "one off day trip" users.
- Run from 04.00 – 24.00 seven days a week

- Charge fares competitive with alternative modes such as taxis and auto-rickshaws

## 9. Concluding remarks

Transport demand in most of the Indian cities has increased substantially due to increase in population as a result of both natural increase and migration from rural areas and smaller towns. Availability of motorized transport, increase in household income, and increase in commercial and industrial activities has further added to it. Unfortunately, public transport systems in Indian cities have not been able to keep pace with the rapid and substantial increase in travel demand. Rail based public transport services and well-organized bus transport services are limited to few big cities only. Qualitatively, the available public transport services are overcrowded particularly during peak hours and involve long waiting periods. As a result, there is a massive shift towards personalized transport, specially cars and two-wheelers, and also proliferation of various types of intermediate public transport modes, such as auto-rickshaws and taxis. The increasing use of private motor vehicles in cities has been rapidly changing

their modal-split structure. Motorization may have brought a higher level of mobility to the high-income segments of urban population, but its adverse impact in the form of congestion, air pollution, and traffic accidents is also substantial. Although these impacts are inherent to motorization, the excessively high level of impact faced by many Indian cities has a lot to do with the lack of effective public policy. The city cannot afford to cater only to the private cars and two-wheelers and there has to be a general recognition that without public transport in general and bus transport in particular cities would be less viable. Although rising income of the people is one of the most important reasons for change in modal-split structure, the more important reasons are to be found in the public transport system itself. Speed, service quality, convenience, flexibility and availability favour adoption of private mode as the main mode of transport. Given the opportunity, people reveal widely divergent transport preferences, but in many places city authorities favour a basic standard of public transport services. It is often thought to be in egalitarian to provide special services such as premium or guaranteed seats in return for higher fares. As a consequence, those who can afford private vehicle are successively leaving public transport. Until recently the main function of public transport was to satisfy the individual needs of the less affluent members of

society, but now it has to contribute for congestion relief and environmental preservation. This requires a fundamental change of emphasis to fulfil its new role of attracting enough people away from the cars, two-wheelers, auto-rickshaws, and taxis. The problem of acute road congestion, rising air pollution, and a high level of accident risk faced by metropolitan cities of India is taking serious dimensions and worsening the people's quality of life. Without vigorous action, this problem would intensify, as rising population over the coming decades and the goal of growing economic prosperity put more pressure on the system. Reducing traffic congestion, vehicular emission, and accident risk requires a comprehensive strategy. The main objective of such strategy should be to provide and promote sustainable high quality links for people, goods, and services to, from and within the city. Strategy should be designed in such a way that it reduces the need to travel by personalized modes and boosts public transport system. This requires not only increasingly stringent emissions standards, specifications for clean fuels, proper maintenance of in-use vehicles, optimal pricing of transport services, demand as well as supply side management measures, but also a complete overhaul of public transport system. **The time has come to act now.**