Role of Intermediate Public Transport in Indian Cities

RAVI GADEPALLI

Policymakers must recognise the intermediate public transport systems like autorickshaws and private buses which provide transport services where city bus and other mass transit systems cannot meet the dynamic demands of urban residents. Integrating these intermediate systems with various mass transit systems is essential to meet urban India's transport challenges.

Ravi Gadepalli (*ravi.gadepalli@gmail.com*) is with the Shakti Sustainable Energy Foundation, New Delhi.

India's urban population is expected to increase from 377 million in 2011 to approximately 600 million by 2030. The country currently has approximately 468 cities with a population of more than 1,00,000 inhabitants (Census 2012b). The sustainable development of these cities depends on developing safe and low-carbon transport systems which provide access to the required goods, services and activities for all citizens. However, serious backlogs exist in urban transport infrastructure in most cities. The lack of efficient public transport combined with inadequate access infrastructure are resulting in users looking for alternative means of mobility, including an increased use of private vehicles, leading to further deterioration of air quality, reduced traffic safety, and increasing congestion on roads (Pucher et al 2005; Wilbursmith 2008). Many small- and medium-sized Indian cities are still low on per capita incomes and vehicle ownership rates compared to many developed and developing economies. As a result, usage of personal cars and two-wheelers is still prohibitively expensive for large sections of the society, who still rely on public transport (Census 2012a).

Various national-level policy initiatives have provided recommendations on the transport supply solutions to address the challenges of urban growth. These include: the National Urban Transport Policy (MoUD 2006), National Transport Development Policy, Twelfth Five Year Plan (GoI 2014), National Mission on Sustainable Habitats (MoUD 2011), and the High Powered Expert Committee report on Indian urban infrastructure and services (HPEC 2011). One of the key recommendations that was emphasised in all the policies was the need to provide good quality public transport systems in cities. An efficient public transport system helps meet the mobility needs of a city, using fewer financial and energy resources, compared to private vehicle-oriented mobility. It also helps in improving the public health and well-being of inhabitants by reducing pollution and improving safety on roads.

In line with policy recommendations, the Ministry of Urban Development (MoUD) has identified improving public transport infrastructure and services as a priority, and has made investments across the country through the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) between 2007 and 2014 (MoUD 2012). The JNNURM investments in public transport included funding to augment or introduce bus fleets, develop mass rapid transit systems like bus rapid transit system (BRTS), and metro rail systems across the country. Even after these efforts, only 61 cities in the country have formal city bus systems. While 49 cities augmented their bus services through the scheme, 12 cities have introduced bus services for the first time. Of these cities, 11 have also taken up BRTS and six cities have taken up metro systems funded partially or totally by the government (MoUD 2013).

However, such simplistic top-down approaches of adding bus fleets to cities do not necessarily match well with the mobility needs and existing transport systems in cities. The bus fleets sanctioned by the MoUD were decided based on the population of the city without considering any other mobility or development characteristics of the city such as its area, population density, travel demand patterns, etc. Additionally, the government's definition of "public transport" is restricted to city bus and rail-based systems and does not consider local and informal tranport services like shared autorickshaws, maxi cabs, mini buses, etc. In cities where the formal systems are absent or have inadequate capacity, these informal modes operate as an intermediate public transport (IPT) system providing high frequency shuttle services on a few high-demand corridors. Table 1 (p 47) shows the mode of transport shares of Indian cities of varying population sizes. The role of public

transport in the larger cities is served by formal systems like the bus, metro and suburban rail. In small- and medium-sized cities, that is, cities with population less than 10 million, the shares of the bus systems is lower, while the IPT as a shared mode of transport operating as a shuttle service along fixed routes (Mani et al 2012; IUT 2014). As a result, their day-to-day operations are not monitored by any government agency.

Table 1: Mode of Transport Shares in Indian Cities (%)

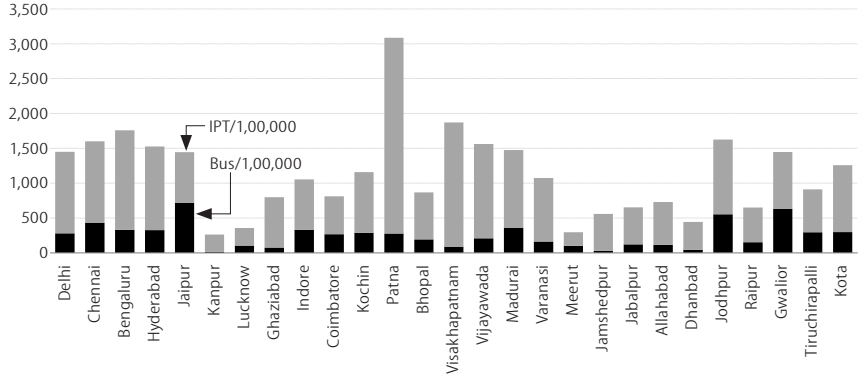
Population	Bus	Autorickshaw	Rail/Metro	Car	Two-wheeler	Cycle	Walk	Total
>10 million	20	3	14	6	9	5	43	100
1–10 million	13	11	2	3	23	13	37	100
<1 million	4	13	0	2	27	6	49	100

Source: Compiled from Comprehensive Mobility Plans of 27 cities.

modes like autorickshaw are equivalent to or more than the formal bus systems. In smaller cities, it is also observed that the proportion of two-wheeler trips is larger. This shows the inadequacy of the overall public transport services provided by the formal and informal systems combined.

These IPT modes are mostly individually owned and operated, and are much more demand-responsive than the formal bus systems. Figure 1 shows the IPT numbers per 1,00,000 inhabitants in various cities compared to their city bus numbers. It is observed that the per capita IPT numbers are much higher than the city bus numbers. This is further proof of the fact that the city bus systems do not cater to the entire public transport demand, and that cities are hugely dependent on the IPT systems. Therefore, it is important that their presence is acknowledged and they are included when cities plan their public transport systems.

Figure 1: Bus and IPT Numbers per 1,00,000 People



Source: MoRTH (2012).

Two Types of IPT

Depending on the size and transport characteristics of a city, IPT modes operate in two broad categories: (a) taxi (contract carriage) services, which are flexible demand-based services in which the passenger determines the destination; and (b) informal public transport (bus-like) services characterised by shared fixed-route services with intermediate stops for boarding and alighting. Even though the licence to carry out their operations is given by the Road Transport Authority (Badami and Haider 2007), each vehicle is given an annual licence to operate as a "contract carriage," that is, as a taxi service for end-to-end trips. However, a soft enforcement regime allows them to operate as a "stage carriers," that is,

While IPT caters to a significant proportion of trips in cities, even greater than the city bus system in many cases, being privately managed and informal in nature has traditionally excluded them from the formal transit policy and planning processes (Wilbursmith 2008). This has led to the formal and informal systems operating in silos and competing with each other, rather than synergising to meet the larger societal objective of maximising transit services in the city. An integrated public transport system in a city would require the bus and IPT systems in a city to integrate their operations such that they complement each other and deliver a wider network of services. However, there is very little research available on the operational characteristics of the IPT systems and their relative efficiency in comparison to a formal city bus system. Therefore, the comparative operational performance of bus and IPT systems of a typical medium-sized Indian city has been presented below in order to generate insights on the ways to develop an integrated operations plan.

Bus and IPT Operations

The city of Visakhapatnam (or Vizag), a medium-sized port city located on the eastern coast of India along the Bay of Bengal, is taken as the case study to analyse the comparative operational performance of city bus and IPT systems. With a population of 1.73 million it is the largest city in Andhra Pradesh (Census 2012b). The city is well connected nationally by a National Highway (NH–5) passing through it. It is also well connected by railways, an airport, and the sea port. From 1858, when its "Municipal Association" was formed to becoming the current Greater Visakhapatnam Municipal Corporation (GVMC) in 2007, the city has developed into a significant economic, educational, health and tourism hub for the region. The current total urban agglomeration of Visakhapatnam is spread over a vast area of 534 sq km, of which the built-up area is only 166 sq km. This is due to the growth in the city concentrating in a few pockets separated by hills, forests, industries, and the port (iTrans 2013). The city has a significant presence of both bus and IPT, with buses carrying 18% of the total trips in the city and the IPT catering to 9% of the total trips in the city. It is observed that out of the 624 km of arterial and sub-arterial roads in the city, approximately 201 km (32%) of the road network has access to bus services while only 91 km (15%) have access to IPT services. All the links that have access to IPT also have access to bus services showing the

competition that exists between the two services. These characteristics make the city representative of many other medium-sized Indian cities.

The city bus system of Visakhapatnam is managed by the Andhra Pradesh State Road Transport Corporation (APSRTC), a government-owned state transport undertaking (STU). The network planning, bus operations, and fleet management of the system are carried out by the same organisation. The city has a total fleet size of 670 buses divided across 133 bus routes operating from four depots, out of which 92 routes operate entirely within the city limits while the remaining routes provide connectivity to the suburban areas. An analysis of these 92 routes is carried out to understand the operational characteristics of the existing bus system and the key factors that impact their efficiency. APSRTC monitors the operational performance of the city bus system on a daily and a monthly basis disaggregated by each route and depot. Aggregated data for September 2014 has been shared for the purpose of this analysis.

Table 2: Comparison of Input and Output Parameters of Bus and IPT Operations

Type of Parameter	Parameter	Bus	IPT
Operational characteristics	Number of routes	92	Dynamic
	Daily hours of operation	16	10.4
	Network length (km)	201	91
	Monthly km operated/vehicle	8,864	1,678
	% road length covered	32	15
	Average vehicle capacity	56	4.5
System performance parameters	Average occupancy	33	4.35
	Average % occupancy	59	97
	Passengers/vehicle/day	891	243
	Revenue/vehicle/month (Rs)	6,952	8,469

The IPT in the city comprises three-wheeled autorickshaws with two variants in terms of passenger-carrying capacity: six seaters and three seaters. Each vehicle operates on its own either as a taxi service for individual trips or as a shuttle services providing shared mobility between fixed origins and destinations with high demand. Some vehicles switch between different modes of operation depending upon the demand at a given point in time. The IPT operations are not monitored by any centralised authority. Their operations are analysed based on primary surveys that collected data through personal interview-based questionnaire surveys of 150 IPT operators. In the absence of route-level data, information from the questionnaire survey of individual IPT operators has been summarised and presented.

In order to understand the key differences in the operational characteristics of buses and IPT, their key operational parameters have been aggregated at the city level and presented in Table 2. The parameters have been classified into two categories, that is, the operational characteristic and system performance parameters of both the systems. The operational characteristics measure the physical service provision attributes like duration, capacity and network coverage of the operations. System performance parameters measure the efficiency in operations of the service in terms of the passengers served, revenue generated, and the occupancy achieved, which is a proxy to measure services during peak demand.

It is observed that buses have a wider network coverage and carry more passengers overall, whereas IPT is more efficient in their operations, that is, they have a higher occupancy ratio and also generate higher revenues within fewer kilometres of operation. The dynamic nature of operations of the IPT allows them to quickly change their routes of operation to the high-demand routes in the city and to only operate as a function of the demand. However, the city bus system operates with a service motive to provide access to mobility throughout the city, and operates on a wider network even where the demand does not justify the capacity provided. Despite the service motive, it has to be noted that there is significant scope for improvement in the service planning methods followed by the city bus operators. Their service planning has been static for many years and is not responsive to the changing demand patterns and the presence of IPT operations in the city. It is therefore recommended that the city bus operations adopt a demand-responsive and dynamic service planning approach, which also integrates the IPT operations in the city to develop a comprehensive public transport system for the city.

Conclusions

Indian cities have two forms of shared transport: the city bus system, planned and managed by the government and an IPT system that is privately operated and not recognised by the government as a formal mode of shared services. The institutional and regulatory framework for urban transport in India, therefore, does not integrate IPT into decision-making and investments. As a result, the public transport interventions in the cities have only resulted in providing or augmenting the city bus services and mass transit systems.

In view of their illegality in the current framework, the city bus operators view autorickshaws as unhealthy competition rather than as a complementary mode of transport. As a result, the routes and schedules of autorickshaws and buses overlap and they operate in competition with the bus systems. Even in cities without any bus system, the autorickshaw routes and operations are decided at the individual discretion of the operators but are not based on an integrated public transport network of the city. Therefore the overall public transport operations are suboptimal in all cities in the current scenario.

A comparative analysis of the operational characteristics of the city bus and IPT systems in the city of Visakhapatnam showed that while these two systems provide shared mobility services, they perform varying roles in catering to the city's mobility needs. The city bus system operates with a service motive, that is, to provide access to mobility to as many citizens as possible. As a result the bus system operates for 16 hours every day, has a network reach throughout the city and carries three times more passengers than the IPT system. However, it performs poorly on operational efficiency indicators like occupancy ratio, revenue per bus and revenue per bus per

kilometre. While this is partly because of operating in non-peak hours and network, the key reason is that the operational plans of the system have been static for many years. The system does not carry out demand-responsive planning and does not update route networks and frequency.

The IPT system operates with a business motive, that is, to maximise revenue through their operations. As a result, they operate only during peak hours, along high-demand corridors and vary their routes of operation dynamically as a function of demand. Their small vehicle size enables them to have high occupancy numbers, and their large numbers in the city help provide high frequency services along the corridors in which they operate. On the other hand, IPT operates only during the high-demand hours of the day in certain high-demand corridors, thereby achieving high unit occupancy rates, maximising their revenue. By virtue of being dynamic and demand-responsive, IPT performs a key role in providing high frequency services in corridors with insufficient public transport supply. Therefore, both the bus and IPT systems are crucial in developing sustainable urban mobility solutions in Indian cities. Currently, both of them operate in silos, thereby acting as competition to each other. It is therefore recommended that the government recognises IPT as a formal mode of transport and uses an integrated planning and operations framework, so as to optimise the operations of the bus and IPT services in cities.

REFERENCES

Badami, M G and M Haider (2007): "An Analysis of Public Bus Transit Performance in Indian Cities," *Transportation Research Part A: Policy and Practice*, Vol 41, No 10, pp 961–81.

Census (2011): "Provisional Population Totals: Urban Agglomerations and Cities," Census of India, Government of India.

— (2012a): "Distance from Residence to Place of Work and Mode of Travel to Place of Work—2011," Census of India, Government of India.

— (2012b): *Provisional Population Totals Paper 2, Volume 2 of 2011: Andhra Pradesh*, Census of India, Government of India.

GoI (2014): "India Transport Report: Moving India to 2032," *National Transport Development Policy Committee*, Government of India, Planning Commission.

HPEC (2011): *The High Powered Expert Committee (HPEC) for Estimating the Investment Requirements for Urban Infrastructure Services*, Ministry of Urban Development, Government of India.

iTrans (2013): *Low Carbon Comprehensive Mobility Plan (LCMP) for Visakhapatnam*, Innovative Transport Solutions (iTrans), New Delhi.

IUT (2014): *Improving and Upgrading IPT Vehicles and Services: A Stud,* I o U T I India.

Mani, A, M Pai and R Aggarwal (2012): "Sustainable Urban Transport in India: Role of the Autorickshaw Sector," World Research Institute.

MoRTH (2012): *Road Transport Year Book*, Ministry of Road Transport and Highways, New Delhi.

MoUD (2006): "National Urban Transport Policy," Ministry of Urban Development, Government of India, New Delhi.

— (2011): "Parameters for the National Mission on Sustainable Habitat (NMSH)," Ministry of Urban Development, Government of India, New Delhi.

— (2012): *Jawaharlal Nehru Urban Renewal Mission (JnNURM)*, Ministry of Urban Development, Government of India.

— (2013): "Transforming City Bus Transport in India through Financial Assistance for Bus Procurement under JnNURM," Ministry of Urban Development.

Pucher, J, N Korattyswaropam, N Mittal and N Ittyerah (2005): "Urban Transport Crisis in India," *Transport Policy*, Vol 12, No 3, pp 185–98.

Wilbursmith (2008): "Study on Traffic and Transport Strategies and Policies in India," Ministry of Urban Development (MoUD), Government of India.