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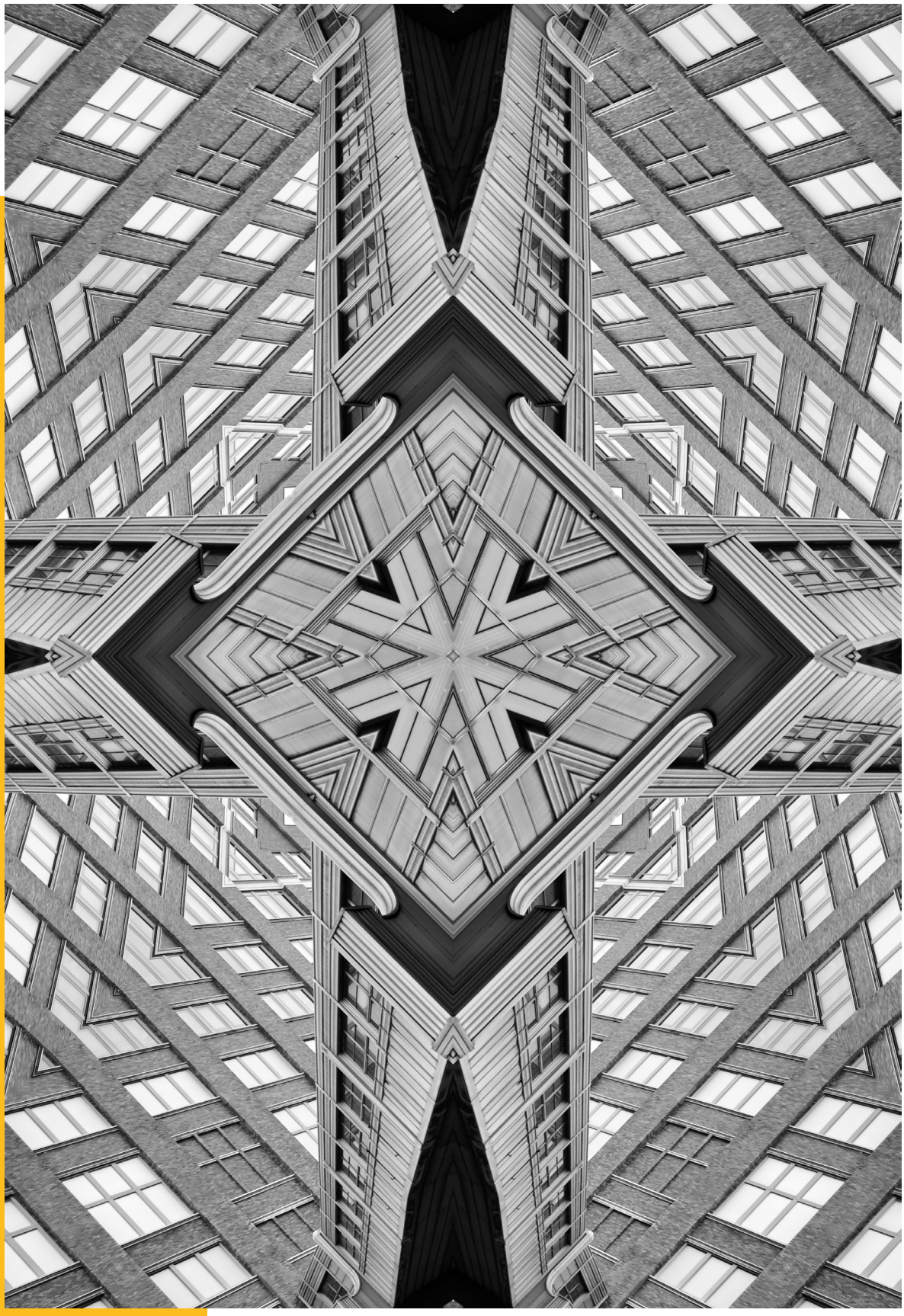

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Towards A Comprehensive Framework for Public Transport System Planning in India

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Abstract

Public transportation (PT) planning in Indian cities has historically focused on private vehicles and rail-based systems while neglecting bus-based transit. Such planning has led to fragmented urban mobility solutions. This study evaluates the effectiveness of PT systems planning in India by assessing the present state of these systems and analysing planning practices. It summarises the characteristics of various PT modes and the expert guidelines for selecting appropriate transit systems for different urban contexts. It investigates the role of para-transit services often overlooked in policy frameworks despite being crucial for first- and last-mile connectivity. The findings underscore the need for a more balanced approach to PT investment, advocating for optimisation of bus networks, improved integration of para-transit services with public transport, and establishing comprehensive institutional frameworks to develop a cohesive and sustainable urban mobility system that meets the diverse needs of India's rapidly growing cities.

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Urbanisation and Public Transportation in India

The number of metropolitan cities in India, with populations exceeding 1 million, rose from 35 in 2001 to 53 in 2011, with the number projected to increase to 65 cities by 2024.[1] India's urban population is expected to grow from 282 million in 2011 to 590 million by 2031.[2] An expanding industrial sector, intensified economic activity, and rise in urban employment prospects have primarily driven this growth.[3]

Urbanisation has increased travel demand and frequency of trips within urban areas. Forecasts suggest that the per capita trip rate for all modes of transport will rise from 0.8-1.55 to 1-2 by 2030.[4] Additionally, improved living standards and greater affordability of personal transportation options across income groups have fuelled the rise in ownership of private vehicles, both two-wheelers and four-wheelers, resulting in higher traffic volumes in cities. The total number of registered motor vehicles[a] reached 295.8 million in 2019, reflecting a compound annual growth rate (CAGR) of 9.91 percent from 2009. (Two-wheelers comprised 75 percent of registered vehicles in 2019, with a CAGR of 10.47 percent over the past decade, followed by four-wheelers with a CAGR of 10.29 percent.)[5] In contrast, the road network has grown much more slowly—the national highway network recorded a CAGR of only 5.54 percent during the same period.

The increasing demand for urban travel and reliance on private vehicles has exacerbated transportation-related externalities, such as traffic congestion, road accidents, inefficient peak-hour travel conditions, and environmental degradation.[6] In 2022, there were 461,312 road accidents in India, leading to 168,491 fatalities and 443,366 injuries—an increase of 11.9 percent in accidents, 9.4 percent in deaths, and 15.3 percent in injuries compared to the previous year. Pedestrians were particularly vulnerable, experiencing higher fatality rates than vehicle occupants, with 32,825 pedestrian deaths reported in 2022—a 12.7-percent rise from 2021. Additionally, 4,836 cyclists lost their lives in 2022, reflecting a 2.8-percent increase from the previous year.[7]

Further, studies have estimated that the average peak-hour travel speed in India's urban areas will decrease in the coming years, from the current 26-17 km/h range to 8-6 km/h by 2030.[8] Growing traffic congestion has also

a These include two-wheelers, three-wheelers, four-wheelers, and heavier vehicles, both state-owned and private.

contributed to deteriorating air quality in cities. In 2022, for instance, the air quality indices (AQI) for Delhi, Kolkata, and Mumbai were classified as 'Hazardous' (304), 'Very Unhealthy' (233), and 'Unhealthy' (158), respectively.[b,9]

A comprehensive examination of urban transportation planning in India reveals a historical lack of emphasis on sustainability. The primary planning focus of infrastructure development has been to move vehicles rather than people. This has led to a neglect of public transportation (PT) systems, which offer a viable means of reducing transportation externalities.

While many Indian cities have prioritised rail-based systems over bus-based alternatives, the lack of integration at the physical, operational, institutional, and informational levels and fares with other PT modes, including the bus, the Bus Rapid Transit System (BRTS), and para-transit systems, has led to a situation where all transport modes compete with, rather than complement, one another.

b AQI levels below 100 are generally regarded as satisfactory.

Indian cities feature diverse PT systems, traditional and modern, both rail-based modes—ranging from the traditional suburban rail and tramways to Metro Rail Transit (MRT) and Monorail (MOR)—as well as bus-based like conventional bus services (CBS), Bus Rapid Transit (BRT), and Bus Priority (BP) services.[c] Table 1 summarises the key characteristics of India's PT systems. These are supported by additional services, including para-transit or intermediate public transport (IPT), such as auto rickshaws and taxis, and inland water transport modes like ferry services. In a few areas, aerial ropeway transit (ART) has also been introduced. PT systems are classified according to their right-of-way (ROW) and ownership, which determine their design, operations, and overall performance.

Road-based systems, such as buses and IPT, typically share ROW with other vehicles, which can affect their efficiency. Exclusive lanes for buses enhance their reliability and travel speeds. High-speed modes like the Metro, LRT, and regional rail operate on dedicated ROWs, offering greater reliability but limited network reach. A closed BRT system also operates on an exclusive ROW but often relies on feeder systems for last-mile connectivity.

Rail-based Systems

Suburban Rail: These operate on shared tracks with other rail services, characterised by wider station intervals and lower service frequency compared to MRT and LRT systems. They have been in existence for well over a century in major Indian cities, and are primarily designed for longer-distance travel between suburban areas and urban centres.[10]

Metro Rail Transit (MRT): This is a fully segregated, rail-based mass transit system operating 'at grade' (i. e. on the ground), on elevated levels or at underground levels. Due to its physical segregation and advanced system technology, it can accommodate high capacities, ranging from 40,000 to 80,000 passengers per hour per direction (PPHPD).[11] The number of

c Transport systems in the offing also include the rail-based Light Rail Transit—also called Metrolite—as well as the road based Metro Neo and Pod Taxi, all three of which are in construction in various cities but are not yet operational.

Indian cities with operational MRTs is 17,[d] while construction is on in another five;[e] yet another five are evaluating project proposals.[f]

Tramways: These are ground-level rail-based systems operating in mixed-traffic conditions.[12] A century ago, they were used in a number of large cities, but today they are operating only in Kolkata.

Light Rail Transit (LRT)/Metro Lite (ML): This is typically an 'at-grade' rail-based MRTS with a dedicated ROW to ensure unobstructed movement.[13] Though LRT is yet to be introduced in the country, at least 19 cities are currently evaluating feasibility reports for its implementation.[g]

Monorail (MOR): These run on a single rail and typically have lower passenger capacity and higher maintenance costs.[14] MOR has been introduced in only one city so far, Mumbai, since 2014, connecting its three separate suburban rail tracks (Western, Central and Harbour Lines) but no other cities are exploring their viability.[15]

Road-based Systems

Conventional Bus Services (CBS): This is the primary PT option in Indian cities, operating on existing road networks, without any priority support such as dedicated lanes.[16] In 13 cities, they are managed by state-owned transport undertakings (STUs),[h] while in another 22, private parties do so through public-private partnerships (PPPs)[i] with the STUs. Seven cities

d Agra, Ahmedabad, Bangalore, Chennai, Delhi, Gurgaon, Hyderabad, Jaipur, Kanpur, Kochi, Kolkata, Lucknow, Mumbai, Nagpur, Navi Mumbai, Noida, Pune

e Bhopal, Indore, Meerut, Patna, Surat

f Chandigarh, Coimbatore, Guwahati, Madurai, Uttarakhand (Haridwar – Rishikesh)

g Aurangabad, Bangalore, Bhavnagar Chennai, Delhi, Gorakhpur, Jamnagar, Jammu, Kozhikode, Madurai, Prayagraj, Rajkot, Raipur, Srinagar, Trivandrum, Vadodara, Varanasi, Vijayawada, Vishakhapatnam

h Bangalore, Chandigarh, Chennai, Coimbatore, Faridabad, Kolkata, Madurai, Patna, Srinagar, Tiruchirappalli, Thiruvananthapuram, Vijayawada, Vishakhapatnam

i Ahmedabad, Amritsar, Aurangabad, Bhopal, Bhubaneswar, Dhanbad, DurgBhilai, Gwalior, Indore, Jabalpur, Jaipur, Jamshedpur, Jodhpur, Kota, Ludhiana, Nagpur, Nashik, Raipur, Ranchi, Rajkot, Surat, Vadodara, and Vasai-Virar

have bus services exclusively run by private operators,[j] while in another four, private operators are found alongside PPP models.[k] (In all, there are 1.8 million registered buses in the country, but most of them run on long-haul routes between cities, not within them. Barely 140,000 of them are STU-owned, with the rest belonging to private agencies.)[17]

Bus Rapid Transit System (BRTS): This is an advanced form of the bus-way,[l] incorporating additional features such as pedestrian facilities, accommodation for non-motorised vehicles (NMVs), and various supporting infrastructures, including operational and control mechanisms, to enhance the overall efficiency and integration of the system.[18] BRTS is currently operational in six Indian cities,[m] partially operational in another four,[n] and planned for three more.[o] In Delhi, the operations of the Bus Rapid Transit System (BRTS) were discontinued due to several challenges, including the absence of level boarding facilities, congestion along the BRTS corridor, and lukewarm public acceptance.[19]

Bus Priority (BP): These are strategies designed to enhance bus speeds for improved operational efficiency, service reliability, and cost-effectiveness. The movement of conventional bus service vehicles is prioritised through infrastructure modifications and traffic management techniques.[20]

Metro Neo (MN): This is a cost-effective, elevated or at-grade road transit system with rubber-tyred electric coaches powered by an overhead traction system. MNs are primarily designed as a feeder system to complement high-capacity metro networks, and have lower capital, operational, and maintenance costs.[21] They are under construction in three cities: Nashik, Warangal, and Pune.[22]

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j Asansol, Kannur, Kochi, Kollam, Kozhikode, Malappuram, and Thrissur

k Delhi, Pune, Hyderabad, and Mumbai

l Bus-ways are dedicated lanes on the main carriageway, physically segregated from general traffic to facilitate the exclusive movement of buses. At intersections, priority can be granted to buses through specialised traffic signal systems, ensuring their uninterrupted flow.

m Ahmedabad, Rajkot, Bhopal, Indore, Surat, and Hubli Dharwad

n In cities such as Pune-Pimpri Chinchwad, Jaipur, Amritsar, and Vijayawada, the routes outlined in the Detailed Project Reports (DPRs) were not fully constructed. Instead, operations were limited to select routes, resulting in partial implementation.

o Visakhapatnam, Kolkata, and Naya Raipur

Other Systems

Para-transit or Intermediate Public Transport (IPT): These offer flexible, door-to-door mobility, and are largely used to complement mass transport systems or as a feeder service.[23] They comprise three-wheelers, taxis, and even two-wheelers available for hire. In recent years, prominent ride-hailing services, such as Uber, Ola, Meru, BluSmart, Quickride, Jugnu, Rapido, and Lyft have offered a variety of shared and rental options of IPT. While the overall modal share of para-transit services is no more than 25 percent of all motorised trips, their usage in many small and medium-sized Indian cities is often more than nine times that of public transport (which is frequently skeletal).[24]

Aerial Ropeway Transit (ART): This is a transportation system designed for challenging terrains where traditional rail or road infrastructure is difficult or too costly to construct.[25] It comprises cable-propelled cabins to transport passengers or cargo. Originally designed for recreation and tourism in mountainous holiday spots, this technology has now emerged as a feasible PT option.

ART is of two main kinds: (a) aerial tramways, which use two large cabins operating alternately on the same cable, and (b) gondolas, featuring smaller cabins attached to a continuously moving cable.[26] A number of ARTs are already in use, such as the Girnar Ropeway in Junagadh district in Gujarat, the Guwahati Ropeway across the Brahmaputra River in Guwahati, the Gulmarg Gondola Cable Car in Jammu, the Bi-cable Jig-back Ropeway in Gangtok, the Mansapurna Karni Mata Ropeway in Udaipur, and the Aerial Ropeway in Nainital. More are likely to be built on the PPP model under a National Ropeways Development Programme (NRDP) called Parvatmala. The Union Budget 2022-23 had announced the award of eight more ropeway projects, totalling 60 km in length.[27]

Personalised Rapid Transit (PRT) or Pod Taxi: This is an efficient, speedy and environmentally sustainable mode of transportation comprising fully automated, electric-powered vehicles, each carrying a limited number of passengers (or even a single passenger), typically between four to six designated locations. The vehicles, often called “pod taxis,” operate on ‘at

grade' dedicated tracks at high speeds and with minimal headways, ensuring reduced road congestion and uninterrupted travel.[28] PRT is a demand-responsive, feeder shuttle system, connecting locations such as parking facilities with transport hubs and other destinations, such as shopping malls and exhibition centres.[29] Six Indian states plan to implement pod taxi services: Haryana in Gurugram, Rajasthan in Jaipur and Ajmer, Maharashtra in Mumbai, Uttarakhand in Dehradun, Kerala in Thiruvananthapuram, and Gujarat in Gandhinagar.[30]

Ferry services: These operate on inland waterways, transporting people and goods across or along water bodies.[31]

Table 1: Typical Characteristics of India's PT System

	MRT	TR	ML	MOR	MN	BRT	BP	CBS	IPT	PRT	ART
ROW	Exclusive	Exclusive	Exclusive	Exclusive	Exclusive	Exclusive	Partially Shared	Shared	Shared	Exclusive	Exclusive
ROW dimension (meters)	7-10	6.5-9	7-10	6.5-9	6-8	Depends on location	Depends on location	NA	NA	6-8	NA
Grade Separation	Underground/ Elevated	Elevated/ At grade	Elevated/ At grade	Elevated	Elevated/ At grade	Elevated/ At-grade (Segregated)	At-grade (Segregated)	At-grade (Unsegregated)	At-grade (Unsegregated)	At-grade (Segregated)	Elevated
FUEL	Electric	Electric	Electric	Electric	Electric	Diesel/CNG/ Electric	Diesel/CNG/ Electric	Diesel/CNG/ Electric	Diesel/CNG/ Electric	Electric	Electric
Capacity[p] (in thousands)	40-80	5-15	8-15	10-12	5-8	20-40	5-10	2-5	NA	12-15	12-16
Operational Speed (kmph)	30-50	20-25	25-45	30-40	30-40	25-45	20	15-20	15-20	30-40	25-30
Cost/km[q] (in billion)	2-2.5	0.5-0.75	1.2-1.5	2-2.15	0.8-1	0.1-0.2	0.012	0.01	NA	0.45-0.5	0.45-0.75
Flexibility to Expand	Low	Medium	Low	Low	Medium	Medium	High	High	High	Low	Low
Route Adaptability	Low	Medium	Low	Low	Medium	High	High	High	High	Low	Low

Source: Author's compilation, using data from The Infravision Foundation Report,[32] Standard Specification of Metro Neo,[33] Standard Specification of Metrolite,[34] CEPT Portfolio,[35] Mumbai monorail,[36,37] IUTI report,[38] MoUD report.[39] IRC 124-2017,[40] Research Guide on Ropeways,[41] Expert Insights on Pod Taxi,[42] MoHUA presentation on Metrolite,[43] Feasibility report of Delhi's monorail,[44] Pod Taxi in Mumbai's BKC,[45] Presentation on Aerial Ropeway in India,[46] Report on Modern Trams (LRT) in Indian Cities,[47] Presentation on Metroneo and Metrolite.[48]

p Capacity depends on the number of transit units (trains or bus fleets), number of cars or vehicles in each unit, number of passengers (standees and seating) in each car or vehicle, and hourly frequency of transport units. The figures in the table summarise the values calculated by different sources.

q Cost per kilometre of PT depends on the type of alignment—at-grade, elevated, or underground. Cost per kilometre is based on the values mentioned in different sources.

Guidelines for Rapid Transit Systems in Indian Cities

The National Urban Transport Policy (NUTP) of 2006 marked a shift in the approach to PT in urban India. It acknowledged that "given the wide range of possibilities, it is not possible to prescribe a particular technology in a generic policy; such a choice will have to be made as part of city-specific land use and transport plans." This statement underscores the importance of tailored PT solutions to suit the unique requirements of diverse urban environments in India. The NUTP also advocated establishing a dedicated knowledge centre to facilitate selection of appropriate PT technologies.[r]

Highlighting the advantages and disadvantages of different MRTS transport technologies, NUTP 2006 recommended the metro rail system as the optimal solution for very high-density, long-haul corridors with constrained road space. It recommended Light Rail Transit (LRT) and Bus Rapid Transit (BRT) systems for medium-density cities with limited sprawl—LRT for medium-density corridors with sufficient space to accommodate elevated structures or at-grade tracks, and BRT for corridors (with an available, dedicated ROW) in cities where space is limited.

Table 2 shows how the policies, guidelines, and recommendations for selecting appropriate public transport modes within cities have evolved since NUTP 2006. It has been compiled through a meta-analysis of India's PT planning documents. These include the Ministry of Housing and Urban Affairs' (MoHUA) 'toolkit' and guidelines for a comprehensive mobility plan (CMP) prepared in collaboration with the Asian Development Bank in 2008,[s] the report of the Working Group on Urban Transport for the 12th Five-Year Plan (2012-17) of 2012, the National Transport Development Policy Committee's (NTDPC) report on urban transport also released the same year, MoHUA's Urban and Regional Development Plans Formulation and Implementation Guidelines (URDPFI) of 2014 and its Metro Rail Policy, and standard specifications for Metro Neo and Metro Lite announced in 2020. The guidelines of the Infravision Foundation, a Gurgaon-based think tank, for planning the PT system of Indian cities, released in October 2023, have also been considered. In each case, the following criteria were used to evaluate the PT's suitability for a particular city: (a) the peak hour peak direction traffic (PHPDT) of the city; (b) its total population; (c) its population density; and (d) the average length of a motorised trip undertaken.

r The Institute of Urban Transport (India) (IUTI) has undertaken efforts to develop and publish comprehensive guidelines and documentation for the selection of appropriate public transport technologies.

s It was then called the Ministry of Urban Development.

Table 2: Guidelines for Selecting PT System for Indian Cities

Criteria	*Preferred Mode*	Guidelines as per Planning Documents					
		MoHUA's Guidelines and toolkit for PT development (2008)	***Working Group's report on Urban Transport for Twelfth Five-Year Plan (2012)***	***NTDPC report (2012)***	***URDPFI-2014***	***Standard specification of Metro Neo and Metro Lite (2020)***	***Infravision Foundation report (2023)***
Peak hour peak direction traffic (PHPDT) (Passenger/Hr/ Direction)	BRT	7,500-15,000	≥4,000 and up to 20,000		7,500–15,000		
	LRT	15,000-45,000	≤10,000		15,000–45,000		
	MOR	-	≤10,000		-		
	MRT	10,000–15,000* 40,000–75,000	≥15,000 travelling at least 5 km of continuous length		10,000–15,000* 40,000–75,000		
	MN	-	-		-	< 8000	
	ML	-	-		-	2000-15000	
Population according to 2011 census (millions)	IPT	-			-		Less than 0.5
	CBS						0.5-1
	BRT		>1				0.5-1
	LRT		>1				0.5-1
	MOR		>2				4-8
	MRT		≥2				4-8
Population density (People per sq. km)	BRT	500-6500	-		500-6500		
	LRT		-				
	MOR	500-8000			500-8000		
	MRT	≥10000			≥10000		
Average motorised trip length (km)	BRT	-	Greater than 5		-		
	LRT		Greater than 7-8				
	MOR		About 5-6				
	MRT		Greater than 7-8				
* Existing PHPDT with more than 15km trip length							

Source: Compiled using different sources: Nitin Lambat et.al,[49] Specification of Metro Meo & Metro Lite,[50],[51] Infravision report.[52]

Guidelines for Rapid Transit Systems in Indian Cities

The 12th Five Year Plan's Working Group and the NTDPC primarily advocated the development of BRT and rail systems, with a notable preference for MRT in urban areas with populations exceeding 4 million. They emphasised that the selection of technology should depend on multiple factors, including population density, per capita income, land availability, urban morphology, and public aspirations as expressed through political demand and comprehensive mobility plans. They also recommended conducting detailed feasibility studies for cities with populations greater than 2 million to assess potential MRTS options. They suggested MRT as the appropriate option for cities with linear development patterns and projected high demand and MOR for those with narrow ROW and significant vertical development. BRT systems were advised for corridors with high passenger PHPDT. Both the reports indicated a preference for 'at-grade' construction of MRTS due to its convenience for commuters, despite acknowledging that exclusive lanes can increase travel times.

The URDPFI guidelines further elaborated upon the criteria for choosing an appropriate MRTS. The Metro Rail Policy of 2017 too, reinforced the need for a balanced evaluation of all MRTS options based on social, economic, and environmental criteria, with stakeholder inputs and local preferences taken into consideration. It asserted that the choice of MRTS should consider factors other than population, justifying MRT investments for linear cities whose population densities may be relatively low.

However, compliance with these guidelines is only required for states seeking financial assistance from the Centre, as urban transport remains a state responsibility. Overall, the Metro Rail Policy 2017 represented an advancement in unbiased planning and development of MRTS across Indian cities, emphasising comparative analysis as a key component of decision-making.

The Infravision Foundation's report dwelt on the need for a comprehensive analysis of travel patterns in Indian cities, to select appropriate PT systems. It underscored the importance of various factors, including trip length distribution, the total number of trips during peak hours, and road network characteristics (apart from PHPDT, population and population density). It proposed a standardised template to identify the appropriate PT system, establishing threshold values for each criterion suggested.[53]

Shortcomings of India's PT Systems

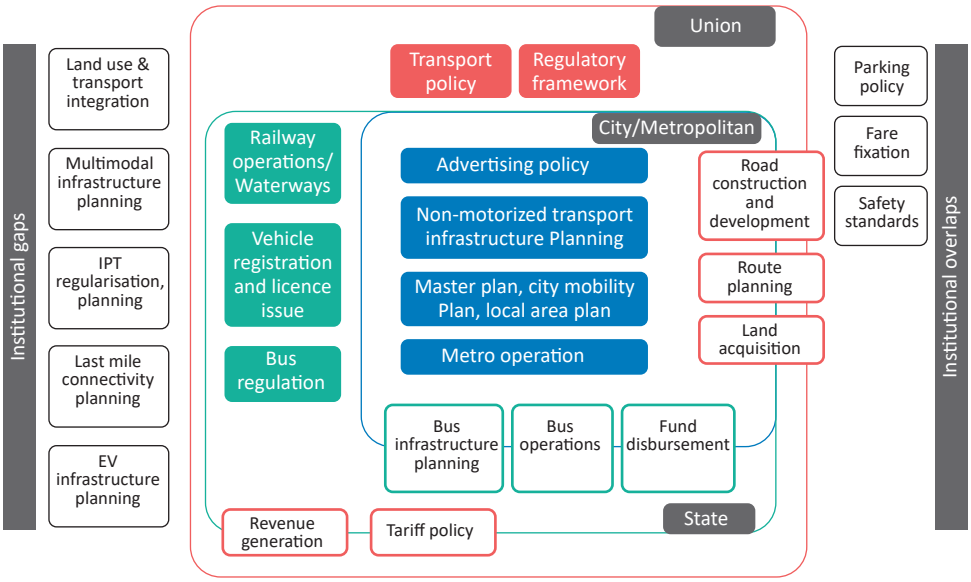
Despite the findings of various expert committees on PT in urban India in recent years, the services continue to suffer from four critical shortcomings. First, the planning, implementation, and management of PT remain highly fragmented, resulting in inefficient service delivery. Second, the significant time lag between the planning and actual operation of metro projects increases commuters' dependence on private vehicles, as they need reliable alternatives during the prolonged construction period. Third, the government's marked preference for MRT over improving existing bus-based transport has also led to problems. Finally, state failure to integrate para-transit services into its urban transport plans has led to a scenario where these services compete with, rather than complement, the mass transport modes.

Fragmented Approach

In India, transport governance is fragmented across multiple ministries, departments, and agencies at the national, state, and municipal levels (Figure 1). Urban transport lacks a centralised governing authority or overarching legislation.[54] State governments' role is primarily regulatory, overseeing public transport services and facilitating infrastructure investments through various departments, while city-level authorities are responsible for street development and maintenance, and often operate in silos.[55]

This fragmented structure was identified over a decade ago by the Planning Commission but still persists. Individual departments remain constrained within their defined roles, hindering collaborative approaches to address complex challenges comprehensively. Competing agendas and overlapping responsibilities among departments impede cohesive planning. Further, critical planning principles such as land use integration, non-motorised transport use, and multimodal connectivity are often absent from broader transport strategies. The emergence of new technologies and the transition to electric vehicles further highlight the need for adaptive roles and enhanced interdepartmental coordination to ensure efficient management and planning.

Figure 1: Institutional Gaps and Overlaps in Urban Transport Functions



Source: CEEW[56]

The creation of new entities, such as Special Purpose Vehicles (SPVs) to build smart cities (under the Smart Cities Mission), has brought unique benefits, but they have also created challenges. While SPVs have contributed to more efficient project management and delivery, they have also introduced additional layers of authority into an already fragmented and complex network of urban transport institutions.[57]

Time Lags in Building Metros

Table 3: Years Taken for Metro Systems to Become Operational

Metro rail system	Planning initiated	Construction approval	Commencement of first phase of operations	Time gap from planning to operation (in years)
Delhi	1984	1995	2002	18
Mumbai	1997	2006	2014	17
Bengaluru	2003	2006	2011	8
Kolkata	1970	1972	1984	12
Chennai	2003	2007	2015	12
Hyderabad	2003	2008	2017	14
Lucknow	2008	2013	2017	9
Ahmedabad	2004	2014	2019	15

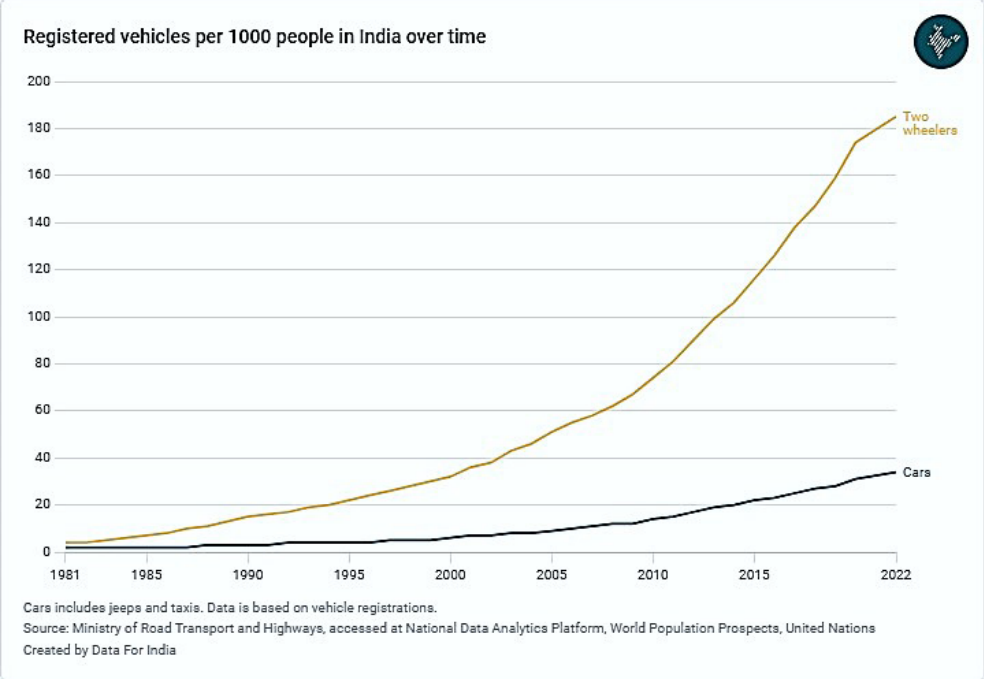
Source: Compiled by author using different sources: Urban Transport News,[58] BBJ,[59] Madhur,[60] CMRL,[61] HMRL,[62] TOI,[63] OC India[64]

Complex approval processes, land acquisition difficulties, financing constraints, and technical challenges inherent in urban infrastructure projects have led to delays from eight to 18 years in metro infrastructure development. Securing land, in particular, is an obstacle that causes extended delays, while the intricate regulatory procedures involving multiple agencies extend project timelines even further, as Table 3 shows.[65]

Simultaneous data analysis of private vehicle growth (Figure 2), especially two-wheelers, from 1981 to 2022 illustrates their rapid increase. There are now approximately 260 million two-wheelers in the country and 50 million cars[66]— which amount to 185 two-wheelers and 34 cars per 1,000

people. The limited availability of bus-based public transport, coupled with inordinate delays in metro rail development and rising purchasing power of the urban population, has led to increased dependence on private vehicles over the years.

Figure 2: Registered Vehicles per 1,000 Population in India



Source: Data for India[67]

The situation highlights the urgent need to minimise delays in future metro projects, which can only be achieved through improved urban transport planning, robust project management, and streamlined regulatory frameworks. Addressing these systemic issues can support the development of an efficient, integrated transport network that in time encourages a shift from private vehicles to public transit options, ultimately enhancing urban mobility and reducing the burden on city infrastructure.

Emphasis on Metro over Bus Transport

While many experts consider the MRT as a panacea for a city's transport woes, data shows that ridership is not commensurate with the carriage capacity of operational MRT systems in any Indian city. Some metros have failed to achieve even the ridership estimated in their Detailed Project Reports (DPR) (See Table 4). The heavy reliance on private vehicles for daily commutes, fostered over decades, is among the primary factors contributing to the reluctance of people to opt for metro rail. Cities such as Bengaluru, Ahmedabad, Lucknow, Kanpur, and Gurugram have achieved less than 10 percent of the ridership they hoped for.

Table 4: Metro Ridership in Select Indian Cities, Estimated and Actual

City	Estimated daily ridership, in million (Forecasted year as per DPR)	Actual daily ridership, in million (Year)	Percentage of ridership achieved (%)
Mumbai (Phase I)	0.665 (2021)	0.5 (2024)	75
Bengaluru (Phase I)	1.61 (2021)	0.096 (2021)	6
Chennai (Phase I)	0.75 (2016)	0.28 (2024)	37
Hyderabad	1.9 (2017)	0.49 (2023)	26
Ahmedabad	0.675 (2022)	0.03 (2022)	4
Jaipur (Phase I)	0.21 (2022)	0.037 (2022)	18
Lucknow	1.17 (2025)	0.07 (2020)	6
Kochi	0.53 (2025)	0.09 (2023)	17
Kanpur	0.661 (2025)	0.01 (2023)	2
Nagpur	0.41 (2026)	0.066 (2023)	16
Gurugram	0.45 (2020)	0.04 (2023)	9

Sources: Infravision report,[68] MMRDA,[69]The Times of India,[70],[71] DTNext,[72] The Hindu,[73] CPPR.[74]

In contrast, an analysis of ridership data for bus-based transit systems in the same cities reveals variations, with most demonstrating higher commuter volumes on buses than on MRT. Table 5 is a comparative study of bus and metro rail ridership across nine of the above 11 Indian cities, reflecting the predominant reliance of commuters on bus services and underscoring the critical differences in transit patterns between the two transportation modes.

Table 5: Bus Vs. MRT Ridership in Select Indian Cities

City	Bus ridership (million)	Ratio of bus to rail ridership
Mumbai	3.3	2.9
Bengaluru	4	6.0
Chennai	3.07	11.5
Hyderabad	2.4	4.9
Ahmedabad	0.59	19.7
Jaipur	0.026	0.7
Lucknow	0.06	0.9
Kochi	1.2	13.3
Kanpur	0.18	18.0

Source: Compiled by the author from The Times of India,[75,76] Money Control,[77] MTC,[78] Siasat daily,[79] LCTSL,[80] CPPR,[81] KCTSL.[82]

Lucknow is the only city where bus and rail ridership are nearly equivalent. In all others (barring Jaipur), bus ridership surpasses rail by at least three times. A consolidated analysis of ridership trends across these cities also reveals that bus transit ridership is 0.9 to 19.7 times greater than that of rail-based systems.

Against this backdrop, an assessment of the number of buses in these cities reveals a concurrent deficiency in the sizes of their fleets. Table 6 shows how all the 11 cities considered earlier (barring Bengaluru) fall short of complying with MoHUA's standard of a minimum bus fleet size of 40-60 per one lakh population.[83,84]

Table 6: Buses per one lakh Population in Select Indian Cities

City	Buses per one lakh population
Mumbai	28
Bengaluru	45
Chennai	31
Hyderabad	31
Ahmedabad	16
Jaipur	10
Lucknow	7
Kochi	20
Kanpur	11
Nagpur	8
Gurugram	14

Source: Infravision report[85]

Neglect of Para-transit

Three-wheeler auto-rickshaws, operating on diesel, petrol, liquefied petroleum gas (LPG), or compressed natural gas (CNG), with a passenger capacity ranging from three to seven individuals, are the primary para-transit mode in India. They provide contract carriage services delivering dedicated, door-to-door transportation. In many cities, they also function

as shared services along designated routes, facilitating frequent travel between high-demand origins and destinations where formal public transit is limited.[86]

In smaller cities and towns with insufficient bus services, shared auto-rickshaws are a useful PT alternative. In metropolitan regions, they accommodate shorter trips and serve as first- and last-mile connectors to larger PT systems. Table 7 illustrates the modal share of transport options based on the population size, revealing higher dependence on para-transit vehicles in cities with a population of less than 1 million.[87] It shows that while larger cities are served more by formal transport systems such as buses, Metro and suburban rail, these systems decrease in cities with less than 10 million population and fall further still in those with less than 1 million (most of them do not have any train or Metro service operating anyway), while the use of auto-rickshaws and two-wheelers correspondingly rises.

Table 7: Modal Share of Transportation in Indian Cities

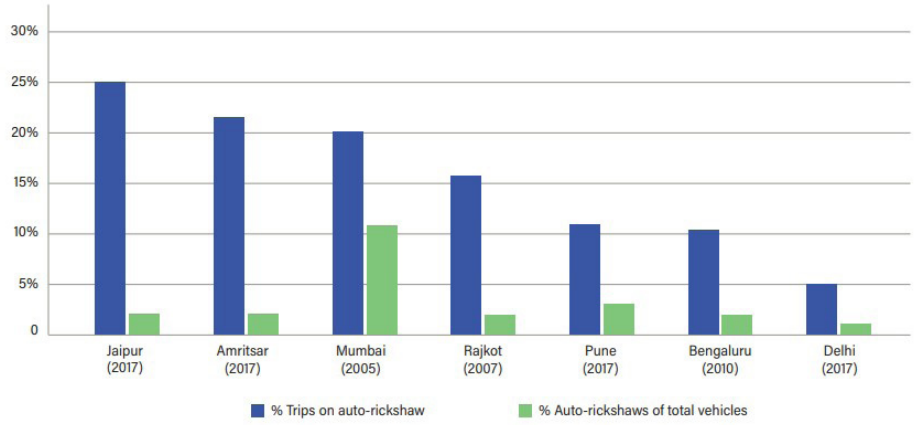
Population	Bus	Auto-Rickshaw	Rail/ Metro	Car	Two-wheeler	Bicycle	Walking
>10 million	20	3	14	6	9	5	43
1-10 million	13	11	2	3	23	13	37
< 1 million	4	13	0	2	27	6	49

Source: Economic and Political Weekly.[88]

Additionally, a comparison of the proportion of trips made using auto-rickshaws with their percentage share of the total number of registered vehicles shows higher dependence of city dwellers on this mode of transport (Figure 3). In the majority of cities, the use of auto rickshaws considerably surpasses its share of vehicle registrations, as seen for example, in Amritsar, Rajkot, Pune, and Jaipur.

A micro examination of PT system planning also reveals a conflict of interest between para-transit services and formal transportation modes, especially in Tier I and II cities. In many of them, the latter were introduced long after the former. Para-transit services thus frequently compete with PT systems instead of complementing them. Even so, in the coming years, para-transit systems will have to play a crucial role in developing economies like India by providing first- and last-mile transport, ultimately fostering an integrated and sustainable multi-modal transit system (ISMTS) in urban areas.[89]

Figure 3: Percentage of Auto-rickshaw Trips Vs. Registered Auto-rickshaws



Source: NIUA[90]

There is a clear need for a comprehensive policy and regulatory framework to manage para-transit services across Indian cities. Current policies regarding auto-rickshaws fail to adequately address the needs of drivers. The lack of coordination and communication among various government bodies and stakeholders involved in regulating and managing these services hampers effective policy implementation even when policy exists.[91]

Shortcomings of India's PT Systems

While NUTP 2006 emphasised the integration of various urban transportation modes, it did not provide clear strategies to integrate para-transit services with formal transit systems. Increased attention should be given to achieving seamless operational, informational, institutional, and fare integration between para-transit and other systems.[92] The quality of para-transit services suffers due to insufficient formal training and skill development initiatives for drivers. Enhancing their professionalism through comprehensive training is essential.[93]

A robust monitoring and evaluation framework is also needed. Currently, comprehensive data on the impact of new policies is largely unavailable, contributing to lack of accountability and undermining the capacity to make informed decisions for the future.

The Way Forward

A number of Indian cities have adopted metro rail systems as a primary solution to their urban transport challenges. This approach has often overlooked the importance of expanding and enhancing bus fleets and networks. Nor is there a thorough needs-assessment to justify adoption of the significantly costlier MRT.

No doubt MRT is necessary for certain cities, but the absence of clearly defined regulations about the time to be taken in operationalising them and scale of investments required has resulted in inappropriate financial commitments to unsuitable PT modes in many places, leading to significant financial losses.[94]

The following paragraphs outline the measures that need to be taken urgently to improve sustainable transport in Indian cities:

- Cities must adopt a scenario-based approach, tailored to their unique socio-economic and spatial contexts. By evaluating factors such as population growth, transportation demand, travel behaviour, mode choice, and land use patterns, cities can strategically expand their urban transport networks to align with future demographic and mobility needs.[95] A foundational step is prioritising bus-based transit systems. By enhancing bus services and promoting their use, cities can cultivate a culture of sustainable urban mobility and encourage a shift away from private vehicles. Only after a robust bus network has been established should cities consider higher-cost transit modes, such as MRT or LRT, to further improve efficiency and capacity.

- Strategic planning for MRTS in Tier 2 and Tier 3 cities requires a comprehensive approach primarily focused on integrating it with existing PT networks to optimise efficiency. Since travel distances are short in these cities, a well-structured bus system is often the most cost-effective and efficient form of MRTS. Enhancing the city bus system by increasing fleet size and expanding service coverage should be the immediate priority. High-capacity, capital-intensive rail-based MRTS should be considered only after the bus system has been optimised and has reached operational limits.

The Way Forward

- Existing guidelines for MRTS selection rely excessively on factors such as population, population density, average trip length, and PHPDT. Other factors, including trip time and trip cost—which are key indicators of affordability—are often overlooked in mode selection. The spatial characteristics of each city, its form and size, should also be a critical consideration while choosing MRTS modes.

- Current guidelines adopt a largely technological perspective when addressing the choice of PT, without adequately considering the magnitude of investments required for each kind. They overlook commuter-specific criteria, which are essential to deciding the most suitable mode. Cities must develop knowledge-based policies and guidelines that integrate both investment considerations and commuter needs.

- Integrating the para-transit perspective into urban mobility planning calls for establishing institutional frameworks, such as Public Transport Authorities (PTAs) in each state, to ensure cohesive governance and regulation across various mobility modes. The PTAs should play a role in key policy decisions, including establishing service standards across different transportation modalities. They must be tasked with developing a comprehensive multimodal PT strategy tailored to each city's requirements. They must oversee the issuance of contracts to transport operators, ensuring that services adhere to predetermined schedules and agreed-upon compensation terms. Such a structured framework would enhance efficiency and accountability within the PT sector, thereby elevating urban mobility standards.

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