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National Investment Program for Bus-based Public Transport Systems in India

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Shakti Sustainable Energy Foundation seeks to facilitate India's transition to a sustainable energy future by aiding the design and implementation of policies in the following areas: clean power, energy efficiency, sustainable urban transport, climate change mitigation and clean energy finance.

SUMMARY

Private vehicles have grown exponentially in India causing a rapid increase in carbon emissions, fossil fuel consumption, air pollution, traffic congestion and a decrease in road safety. These externalities have a huge economic impact which will increase further with growth in passenger traffic - estimated to grow 16 times from 10,375 billion passenger kilometers (bpkm) in 2011-12 to 168,875 bpkm in 2031-32.

To minimize the impacts, there is a need to develop passenger transport in a sustainable manner. Measures such as modal shift towards mass transport systems, fuel efficiency improvements, electrification, travel demand management and cleaner vehicles can help mitigate impacts. But these measures can be time and cost intensive. A quick and cost-effective mechanism is improvement and scaling of bus based public transport systems. Buses are cheaper to deploy, flexible to operate, space efficient, safer and have low gestation periods compared to other modes.

However, improvement of bus systems requires support from the National and State Governments as State Transport Undertakings (STUs) - who are responsible for provision of bus transport - do not have adequate financial resources. All STUs in the country are facing financial losses due to significant gaps in costs of operating buses and revenue earned. STUs serve a social objective of providing mobility for all at affordable fares. This means that STUs - whose main source of income is passenger fare - do not have sufficient capital to cover the mounting costs of bus operations.

Investments by National and State governments in bus systems will help in achieving national goals on carbon reduction, fuel savings and accessibility and address local challenges of traffic congestion, air pollution and road crashes. It will help improve mobility for 70 lakh Indians who use buses every day to access work, education and health care.

Globally, Governments in several countries like Colombia, Mexico, Brazil, United States of America and China have implemented policies and financial packages to support bus systems. The Indian Government has also in the past provided financial support to augment bus systems through the Jawaharlal Nehru National Urban Renewal Mission (JNNURM).

This report proposes a National Program that prioritizes investments and technical support for development and improvement of bus systems through an assessment of the existing bus based public transport systems and requirements for bus systems of 2031.

Existing status of bus based public transport systems

Bus systems in India are owned and operated by the public (STUs) and private sector with around 18 lakh registered buses. Of these, 1.4 lakh buses are owned and operated by STUs, making availability of 10.8 buses per lakh population. It is important to note that 22% of the fleet being operated by STUs is overaged. The remaining 17 lakh buses are held by private sector but only 29% of these buses have a valid permit to operate. Currently, 1.8 lakh private buses are operated on stage carriage permits, making availability of around 14 buses per lakh population. However, private operators tend to operate on profitable routes leaving large demand underserved.

The existing availability of buses - around 24 (public and private) buses per lakh population - is significantly less that the national and international standards on bus service provision i.e. 40-60 buses per lakh population. Currently, there is a deficit of 2.03 lakh buses in the country, of which 1.3 lakh buses are missing in urban areas.

Additionally, there are shortages in the support infrastructure - depots and terminals - required to operate these buses. Evidences from past indicate that several bus agencies have been unable to develop and maintain these infrastructures due to technical and financial constraints and unavailability of land in prime locations.

The financial constraints of STUs are due to their poor financial performance measured as the difference between their costs and revenue. In 2016-17, all STUs combined recovered only 74% of their bus operations costs from earned revenue.

STUs operate buses on unviable routes and at off-peak hours to ensure mobility for all at affordable fares. As a result, STUs who collect 84% of their income from passenger fare have little revenue to meet the costs of operating buses. At the same time, fares cannot be increased to increase income as it will exclude disadvantaged commuter categories and cause a mode shift towards non-motorized modes and two wheelers. STUs also have limited scope to reduce their operational costs as components such as staff salaries and fuel prices that form 80% of the overall cost of operations are determined by factors - government mandated commissions and market prices (respectively) - not under their control. The COVID-19 pandemic has further worsened the financial situation of STUs as bus services have low patronage due to travel restrictions, fears related to COVID infection and preference to work and study from home.

Estimated requirements for Bus Systems of 2031

To cover the existing deficits and meet the requirement of 2031, there is a need to operationalize 5.85 lakh buses in the country by 2031. Around 3.38 lakh of these buses will be offset by the BAU procurement patterns of public and private operators. Over and above this, there is a need to add another 2.46 lakh buses by 2031. These buses will require development of 2,464 depots and 1,232 terminals for operations over the next 10 years. The 2.46 lakh buses will cover 16,550 crore kms in 10 years. Of these, 4963 crore kms will be operated in urban areas where bus agencies require financial support for operating buses. Added to this is the need to procure intelligent transport systems and build technical capacity to operate the buses.

The total cost of procuring 2.46 lakh buses, developing infrastructure, implementing ITS, building capacity and supporting costs of operations in urban areas is estimated to be INR 3.5 lakh crores.

Recommendations

A Central Government led funding program with support from State Governments can help in meeting the requirements of bus systems by 2031. This report proposes three main components for the program:

1. **Funding:** Financial support for bus procurement, support infrastructure development, bus operations, ITS implementation and technical capacity building
2. **Trainings:** Capacity building trainings on data-based service planning and monitoring, design and management of support infrastructure, management of PPP contracts and use of ITS
3. **Reforms:** Policy reforms to enable financial autonomy of STUs, making land available for support infrastructure, enhancing the private sector participation and providing greater support for STUs operating in urban areas

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1. INTRODUCTION

1.1. Overview of passenger transport in India

India's passenger transport segment is dominated by roadways and railways as traffic carried by airways and waterways is negligible[1]. Within roadways and railways, 85.9% of the total passenger kilometers (kms) are performed using road-based modes[2]. And within road transport, buses play the most important role in meeting mobility needs of people. The National Sample Survey Office (NSSO) in 2016 reported that buses are the most preferred mode of transport both in urban and rural areas[3]. Mode share of buses in urban areas is as high as 35% depending on the city size and types. Even in cities with metro rail services, buses are the main mode of public transport. In Delhi, which has the most extensive metro rail network, buses contribute up to 64% of the completed public transport trips and 38% of metro users use buses for first and last mile connectivity[4].

1.2. Growth of passenger transport and vehicle population

Despite their popularity, bus systems have grown at 7%[5] which is lower than the 15.4%[1] growth in road passenger traffic. This demand-supply difference has resulted in operations of overcrowded, uncomfortable and unsafe buses reducing their attractiveness. As a result, choice bus users - those who aspire convenience and have economic means - are shifting towards use of personal vehicles over public transport modes[6].

Personal vehicles - two wheelers and cars - have grown steeply over the last few decades and form 87% of all registered vehicles in the country. The share of buses in total vehicle population is meagre 0.74%. The share of public-owned buses is 0.06%.

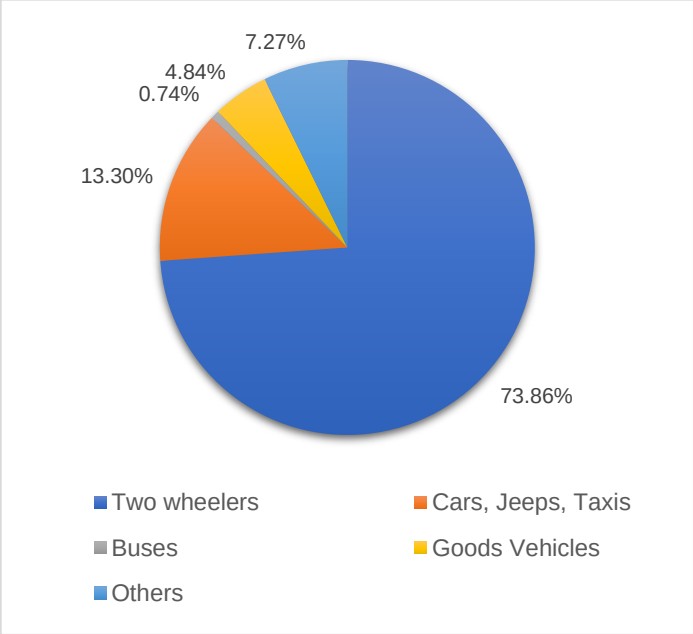


Figure 1: Share of different modes in total number of registered vehicles -2017[5]

1.3. Impacts of unsustainable growth of passenger transport

The growth in use of personal vehicles for mobility has caused a rapid increase in negative externalities of transport sector. Majority of urban areas in the country are witnessing poor air quality, traffic congestion and reduced road safety. Indian cities are ranked among the world's most polluted[7] and congested cities[8] and record the highest fatalities in road crashes[9].

The associated economic impact of these externalities is huge. In 2013, India lost USD 221 billion[10] (8.5% of GDP) due to increase in welfare costs and lost labor due to air pollution related sickness. Traffic congestion related losses in four major cities - Mumbai, Delhi, Bengaluru and Kolkata - alone are over USD 22 billion per annum[11]. Congestion impacts productivity loss of workforce delayed in traffic and higher fuel consumption and air pollution due to idling. The economic loss due to road crashes is estimated to be USD 58 billion[12] (3% of the GDP) across the country.

Cars and two wheelers are also a major contributor of carbon emissions[13]. Passenger transport is also the biggest consumer of diesel and petrol used in the country[14]. This is in a scenario when India

imports 84% (2018-19) of its petroleum requirements, amounting to USD 108.66 billion[15] (3-4% of GDP) in the first three quarters of 2019.

1.4. Need for intervention

The economic impacts of the transport sector will increase further with growth in road based passenger traffic - estimated to grow 16 times from 10,375 billion passenger kilometers (bpkm) in 2011-12 to 168,875 bpkm in 2031-32[1]. To minimize the impacts, there is a need to guide the development of passenger transport in a sustainable manner.

Measures such as modal shift towards mass public transport systems, fuel efficiency improvements, electrification, travel demand management and cleaner vehicles can mitigate impact. A 30% shift in passenger kms from personal vehicles and taxis to public transport can help reduce fuel consumption by 31% and carbon emissions by 24% compared to business as usual (BAU) scenario[16]. A 30% shift in passenger kms from hydrocarbons to electric (adoption of electric two wheelers, cars, taxis and buses) can help reduce fuel consumption by 28% and carbon emission by 11% compared to a BAU scenario[16].

a) Need to prioritize bus systems for impact mitigation

Implementation of fuel efficiency improvements, electrification and introduction of cleaner vehicles can be time and cost intensive. A quick and cost-effective way to achieve mitigation gains, based on evidences is through improvement of bus based public transport systems. Buses are cheaper to deploy, flexible to operate, space efficient, safer and have low gestation periods compared to other transport modes.

Evidences from Ahmedabad and Bengaluru suggest that by making moderate investments in augmenting bus fleet and improving service quality, the cities witnessed substantial reduction in carbon emissions[17]. Both cities enabled mode shift to buses by attracting new commuters and serving pent-up demand for public transport. Over five years, Ahmedabad and Bangalore saved 70,000 and 59,000 tons of CO2 emission per year. Increased use of public bus transit also helped in reducing traffic fatalities in Ahmedabad. Within two years of implementation of the Bus Rapid Transit System (BRTS) in the city, fatalities related to traffic crashes reduced by 66%[18].

a) Need for action from the Government

Targeted financial support for bus systems is required from the government because state-owned State Transport Undertakings (STUs), which are responsible for provision of bus transport, are unable to invest in improving or scaling services. All STUs in the country are facing financial losses as costs of operating buses exceed revenue generation. In 2016-17, STUs reported a combined loss of INR 16,409 crores[19]. Bus agencies also are unable to break the cycle of loss as factors that determine operational costs - fuel prices, staff salaries, taxes, etc. - are not under their control. At the same time, STUs meet the social objective of providing mobility for all at affordable fares. This means STUs, whose 84% income is generated from passenger fare, have little capital to cover operational costs. Fares cannot be increased to increase income as it will exclude disadvantaged commuter categories and cause a mode shift towards non-motorized modes and two wheelers

Investments in improving bus systems can help Governments achieve national goals on carbon reduction, fuel savings and accessibility and address local challenges of traffic congestion, air pollution and road crashes. It will help improve mobility for 70 lakh Indians who use buses every day to access work, education and health care.

2. LITERATURE REVIEW

Losses in bus operations are not unique to Indian STUs and are witnessed by operators across the globe and all public transport modes. Recognizing this and the benefits offered by bus transport, National level Governments across various countries have instituted policies and financial packages to support bus systems. In the past, Government of India has also provided financial support through the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) to augment city bus services. The ongoing Faster Adoption and Manufacturing of Electric (&Hybrid) vehicles (FAME) scheme is also supporting states and cities to deploy electric buses.

2.1. International Case Studies

Federal Governments in various countries through policies and financial packages are providing support to their bus agencies for operating and procuring buses, implementing new technology and improving overall urban transport. The key features and funding structures of some international programs and schemes are discussed below.

1. Colombia: National Policy for Urban Mobility and Transport (2002 onwards)

Beginning 2002, Colombia has advanced sustainable mobility in its urban areas through the 'National Policy for Urban Mobility and Transport'. Its main objective is to strengthen local institutions for planning and managing urban mobility, promote technical, economic and environmental efficient urban mobility solutions, improve public and non-motorized transport, enhance private participation, promote inter-modal connectivity, etc. The policy provides technical and financial support as per the city size. The National Government covers 70% of the capital investments for project infrastructure[20].

In 10 years (2002-12), the policy has enabled 6 cities to introduce mass transit, increased ridership on buses and other mass transit to 25 and 33 lakh passengers per day respectively and build institutional capacity in public and private sector[21]. The cities also witnessed positive socio-economic impacts due to reduction in operational costs, travel times, air pollution and traffic crashes.

2. Mexico: Federal Mass Transit Program - PROTRAM (2007)

Mexico created the Federal Mass Transit Program or PROTRAM in 2007 to guide the development of urban transport on low-carbon path and improve its efficiency. Through PROTRAM, the National Government provides support to city governments with population more than 0.5 million for mass transit projects in urban and sub-urban areas. The program funds up to 50% cost of the project cost. The Government also provides loans to local governments to cover the remaining 50% if they can leverage the private sector to covers 34% cost of capital assets. This is done to maximize private sector participation and strengthen local institutions responsible for planning, operating and regulating urban transport. The private sector gains from the business. Through support from the program, the country is developing 42 mass transit projects of which 38 are BRT corridors in various Mexican cities. The remaining 4 projects cover suburban rail and light transit rail projects[22].

3. Brazil: Growth Acceleration Program (2007)

Brazil launched its Growth Acceleration Program (PAC) in 2007 to improve its infrastructure with a multi-year dedicated World Cup Investment Package[23]. As part of the program, the Ministry of Cities earmarked a percentage of the total program investment to support mass public transport projects including BRT, LRT and metro rail in large cities. The National Government and local governments supported up to 95% and 5%, respectively of the project cost. These efforts to promote sustainable transport were supplemented by the announcement of the National Policy on Urban Mobility in 2012. It requires all cities with population more than 20,000 and tourism and trade centers to create urban

mobility plans that prioritize NMT and public transport to gain access to national funding for transport. The policy impacts 3000 cities in Brazil.

4. United States of America: Federal Public Transportation Program (2010 onwards)

The Federal Public Transportation Program (FPTP), functional since 2010 as part of the Fixing America's Surface Transportation (FAST) Act, provides financial assistance for improving public transport. Funding under the Act is available for various public transport modes - buses, subways, commuter rail, light rail, paratransit and ferryboat, and is disbursed under six major programs - urbanized area formula, state of good repair, capital investment grants, rural area formula, bus and bus facilities and enhanced mobility of seniors and individuals with disability. FPTP covers 18% of the capital and operating funds spent by transit agencies (this is formula-based funding linked to increase in ridership) and provides support for development and scaling of transit rail and BRTS (through the capital investment grant) [24]. This support has led to a 11% increase in bus fleet for public transport and stabilized 1% annual increase in bus fleet[25]. It also enabled a 5% increase in the vehicle revenue miles since 2010.

The funds for FPTP are received from the 'mass transit account' of the Highway Trust Fund (80%) and the general fund of US treasury (20%)[26]. The major (85-90 %) source of revenue for the Highway Trust Fund is from excise taxes on motor fuel know as 'gas tax'. The government collect 18.4 cents per gallon for gasoline and 24.4 cents per gallon for diesel. The remaining revenue comprises of taxes on tires and trucks[27].

5. China: Ten Cities-Thousand Vehicles (2009)

The Central Government in China has instituted policies and incentives to motivate the development of plug-in electric vehicles (PEV) industry. These include R&D grants, lenient policies and government procurement to push forward the PEV development. The first among these was the 'Ten Cities - Thousand Vehicles' program (2009) that was designed to encourage sale of 1000 electric vehicles in 10 cities (now scaled to 25 cities) through monetary incentives and government procurement. It also offers financial support from Local Governments. This program is a variation of China's experimental strategy where different cities adopted different modes for delivering the program. For example,[28]: Beijing focused on creating public sector support to electric vehicles, Shanghai focused on replicating and demonstrating international models, Shenzhen focused on creating a leasing model through strategic partnerships, Hangzhou created a rental model where users can rent the battery and Chongqing is pursuing fast charging technology.

This approach gave flexibility to cities to choose models that best suited their purpose. However, due to this approach the program did not lead to creation of any standards or single model that can be rolled out at scale. Shenzhen, by 2018, was the first city in the world to fully transition to electric public bus systems with a fleet of 16,359 buses[29]. This was due to its ability to utilize the national and local subsidies to meet the cost of e-buses, leasing vehicles from manufacturers instead of purchasing which saved upfront investment and optimization of bus operations to reduce costs involved in operating e-buses.

2.2. Indian Case Studies

The 'National Urban Transport Policy', launched in 2006, was the first major step by the Central Government in India to improve transport in urban areas. The policy was followed by implementation of Government of India's flagship program JNNURM which provided financial support to cities for civic amenities projects including transport. In 2015, the Central Government launched the FAME scheme to provide support to states and cities for deployment of electric buses.

1. JNNURM (2009-2014)

Under JNNURM, the Government of India launched a bus funding scheme in 2009 to provide financial support to states and cities to procure buses and implement BRTS. The funding support was linked to enactment of reforms in field of urban transport[30]. The scheme was administered in two phases. It supported procurement of more than 23,000 buses which were deployed in urban areas[31] and creation of new institutions referred to as Special Purpose Vehicles (SPVs) to operate bus services. As bus procurement was subsidized, many states were able to introduce bus systems for the first time in Tier II cities and connect smaller towns and villages with major economic centers.

The scheme supported only the capital costs. As such, STUs/SPVs found it difficult to cover the cost of O&M of buses through farebox revenues[32]. Bus agencies also incurred greater O&M costs for buses procured through JNNURM compared to in-house built buses due to their larger chassis, lack of capacity to maintain the new technologies and ITS requirements.

Additionally, many cities were implementing bus services for the first time. SPVs in these cities lacked experience and technical knowledge to operate a city bus service. They also struggled to develop support infrastructure due to limited financial resources. Lack of depots compromised bus parking and maintenance and led to an eventual shut-down of services in many cities. PPP models adopted by most newly formed SPVs were also not successful as they lacked technical experience and knowledge on executing contracts and monitoring the private partner. Lastly, due to poor performance management and enforcement, reforms such as establishing Unified Metropolitan Transport Authority (UMTA) and Urban Transport Fund (UTF) made conditional for receiving the funding were enacted partially by States and are mostly defunct now.

2. FAME I & II (2015- 2021)

The FAME scheme was launched in 2015 to create a market for electric vehicles through demand incentives for all vehicle segments. The Department of Heavy Industries, in the first phase of the scheme, offered a financial support of INR 20,000 per kilowatt-hour to STUs in 9 cities to procure 465 buses[33]. The second phase, approved in 2019, is providing support for deployment of 5595 electric buses in 64 cities[34]. As a pre-condition, the second phase necessitates STUs to adopt a wet lease Gross Cost Contract model for bus operations. Additionally, the State Governments are required to provide favorable policies for electrification of vehicles, availability of power at affordable price, space for installation of charging infra, dedicated depots and concession in registration fees.

3. EXISTING BUS BASED PUBLIC TRANSPORT SYSTEMS

3.1. Background

Bus-based public transport systems in India are owned and operated by public (STUs) and private sector[35]. The industry, however, is dominated by STUs as private sector is highly fragmented and inclined to operate buses only in profitable segments[36].

STU-owned bus systems: The Government of India (GoI), in 1950s, categorized passenger transport as a state led activity and STUs were formed at the state-level under the Road Transport Corporation (RTC) Act of 1959 to operate buses. Today, more than 60 years later, STUs are the major stakeholder in provision of formal bus transport for intracity, intercity and rural segments. There are 53 STUs: 24 corporations, 7 municipal undertakings, 9 government departments and 13 companies[19].

Private-owned bus systems: Even though bus transport is a state-led activity, policies and regulations have allowed operations of private-owned buses to meet the demand for public transport[35]. However, existing regulations do not specify the role and extent of involvement of private sector. Currently, private sector operates buses by obtaining permits under the Motor Vehicle Act. They have also entered agreements with bus agencies, mostly in urban areas, to provide bus services on Public Private Partnership (PPP) basis. Private buses are also used as private service vehicles (PSV) for school, office and tourist transport.

3.2. Bus Fleet and Service Quality

In 2016-17, there were 18 lakh buses registered in India[6]. Of these, 1.4 lakh buses are owned and operated by STUs. The remaining buses are held by the private sector. Table 1 shows the distribution of registered buses between the public and private sector. As explained in section 3.2.b, not all registered private buses have valid permits.

Table 1: Total number of registered buses in India[37]

Year	No of buses with STUs *	No of buses with private sector	Total no of registered buses
		(nos are in thousands)	
2011-12	131.8	1544.7	1676.5
2012-13	137.9	1676.1	1814.0
2013-14	140.2	1746.7	1886.9
2014-15	140.5	1830.3	1970.8
2015-16	142.9	1613.8	1756.7
2016-17	149.1	1715.2	1864.2

**includes buses hired from the private sector*

a) STU-owned bus systems

1. Fleet Strength

Data reported by 53 STUs in 2016-17 shows that they own 139,386 buses and had hired 11,902 buses from the private sector for operations[19]. Between 2007-08 and 2016-17, fleet has grown marginally by 20,800 buses (CAGR: 1.8%), mostly supported through the Bus Funding Scheme under JNNURM.

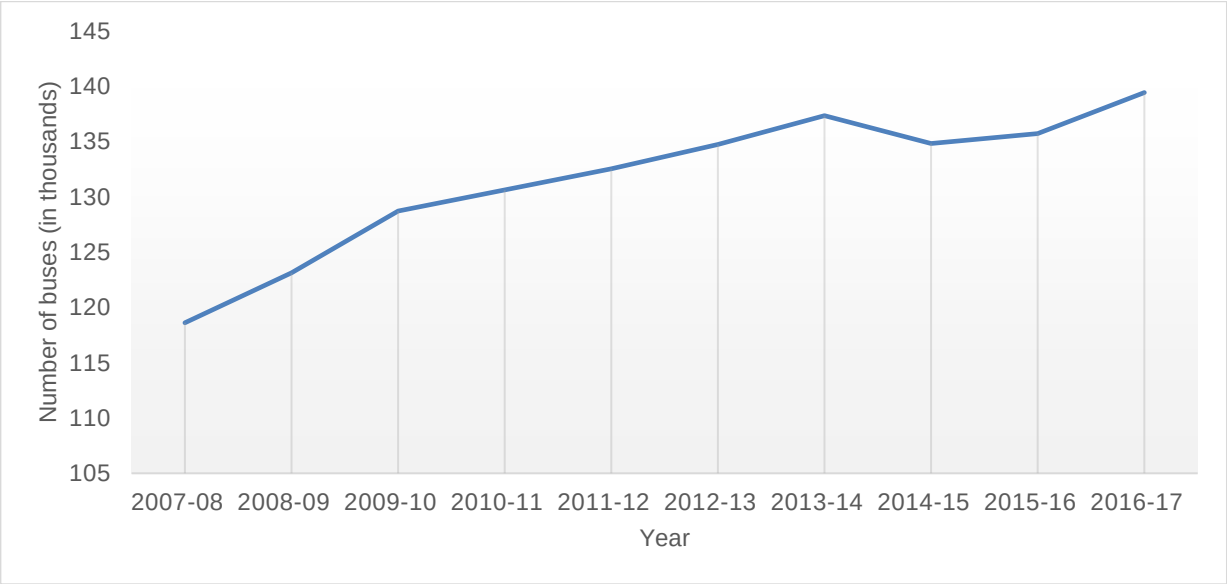


Figure 2: Growth of bus fleet owned by STUs[19]

2. Availability of buses

The availability or extent of bus supply is a service level benchmark (SLB) by the Ministry of Housing and Urban Affairs (MoHUA) to evaluate bus public transport services. It measures the number of buses available per lakh of the population. As per the standards proposed by Ministry, cities should have 30-60 buses per lakh population based on their size[38]. Further, sector experts suggest that for rural and intercity segment there should be 40 buses per lakh population[39]. Availability of buses lesser than this will impact service quality - reduced bus frequency, increased passenger wait time, overcrowding, etc. - reducing their attractiveness and limiting use by captive users.

Currently, pan India, STUs are providing only 10.8 buses per lakh population which is significantly less than the standards. Also, this number has remained constant over the last decade (figure 4). This means new fleet that is procured is replacing only the old and worn buses. There is a lag in bus growth to meet the increase in public transport demand.

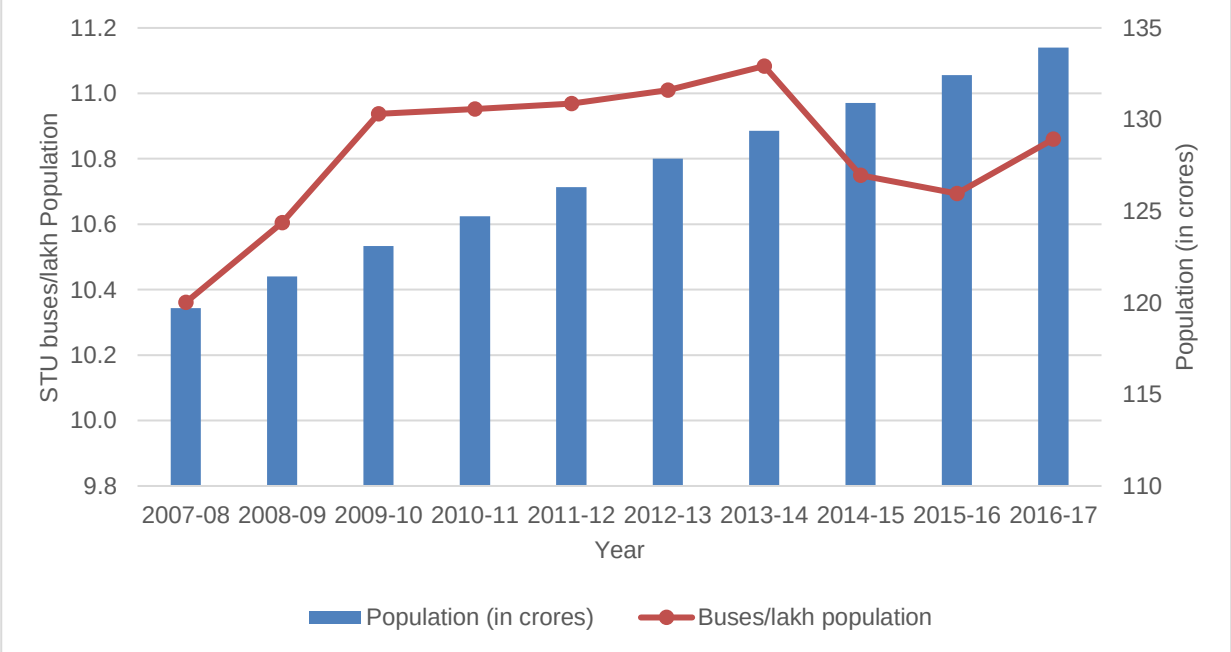


Figure 3: Population growth vs availability of public buses/lakh population[40]

The extent of bus availability is highly disparate at the state level (figure 5). States and Union Territories (referred to as states hereafter) like Chandigarh, Karnataka and Himachal Pradesh have more than 40 buses per lakh population whereas Bihar has less than 1 bus per lakh population.

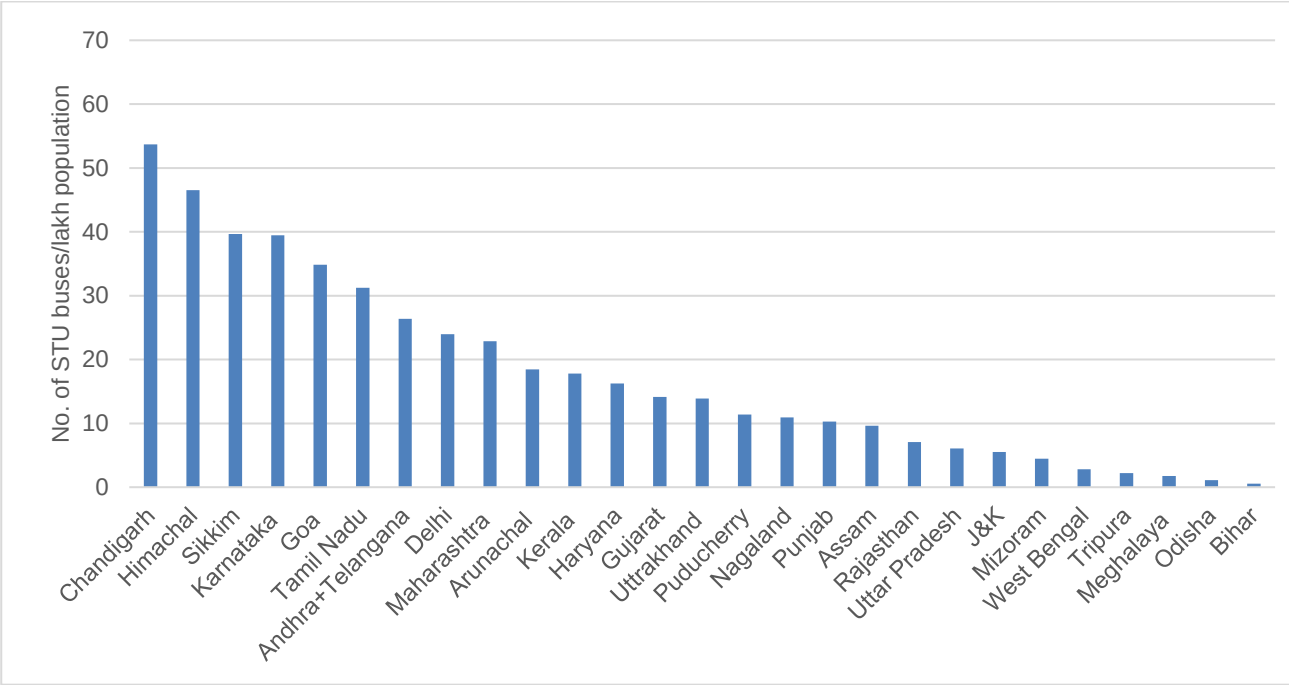


Figure 4: Public buses per lakh population in major States and UTs[19]

3. Age of buses

As per the aging criteria for buses adopted by STUs, 22% of the public bus fleet is overaged and should have been retired. Tamil Nadu is operating 60% overaged fleet. In Chandigarh, Karnataka and Himachal Pradesh, where bus supply standards are achieved, up to 20% of the operational fleet is overaged. Aged buses are unsafe and uncomfortable, resulting in poor service quality for passengers and increased operating costs for bus agencies.

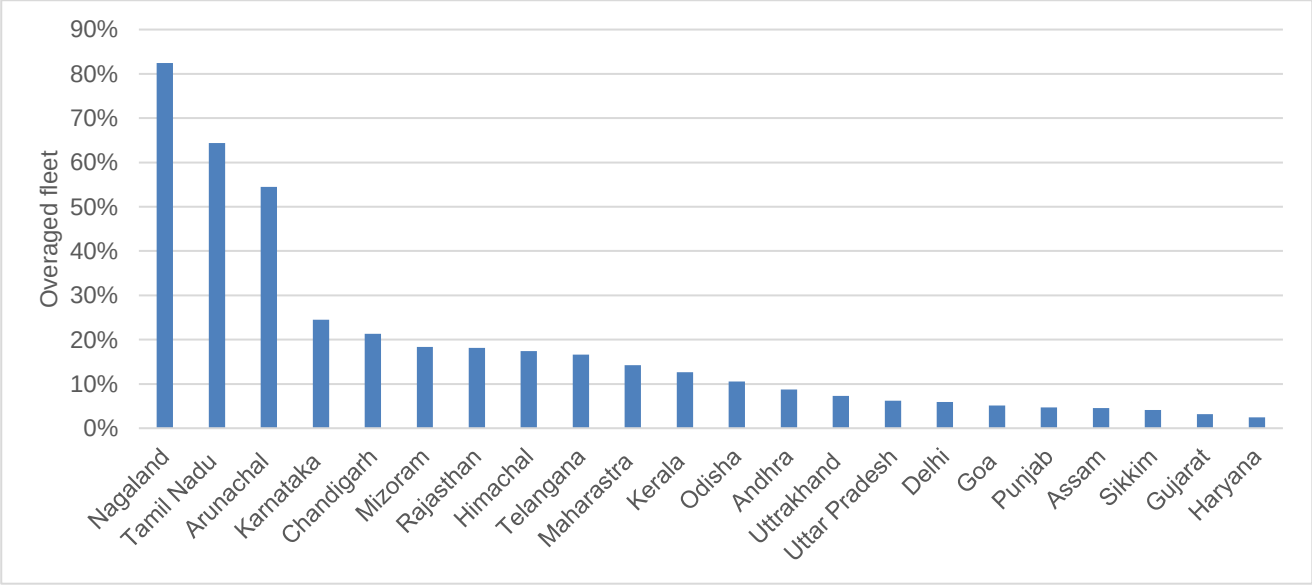


Figure 5: Percentage of overaged public buses in major States and UTs[19]

b) Private-owned bus systems

1. Fleet Strength and extent of supply

As mentioned earlier, private sector operators own 17 of the 18 lakh buses registered in the country. However, not all these buses have valid permits to operate. As per data from Ministry of Road Transport and Highways (MoRTH), only 29% of the registered private buses have valid permits - stage carriage, contract carriage or private service vehicle (PSV).

Table 2: Number of private buses with valid permits[37]

Year	Total no of registered private buses *(in thousands)*	No of private buses with valid permits *(in thousands)*			% of private buses with valid permits (all types)	% of private buses with valid stage carriage permit
		Stage carriage permit	*Contract carriage permit*	*PSV permit*		
2011-12	1544.7	135.1	27.1	177.1	22%	9%
2012-13	1676.1	174.4	54.8	235.5	28%	10%
2013-14	1746.7	176.2	46.2	246.6	27%	10%
2014-15	1830.3	177.4	55.9	259.6	27%	10%
2015-16	1613.8	183.3	45.4	193.9	26%	11%
2016-17	1715.2	186.5	104.6	202.3	29%	11%

Currently 1.8 lakh private buses (11% of the registered private buses) are being operated on stage carriage permits. As such, private bus availability is around 14 buses per lakh population. However, it is important to note that private operators are more inclined to operate buses on rural and intercity routes[6] or select routes in urban areas[35] as they offer higher profit margins. As such, it is likely that private services are concentrated in specific geographies, leaving a large demand underserved.

CITY BUS SERVICES

Bus fleet and service level: Around 127 India cities have formal and organized bus services with a fleet size of 46,000 buses. Of these 36,000 buses are operational in 53 cities which have a population of more than 10 lakh. As such, the bus supply varies between 22 buses per lakh population in larger cities (population > 10 lakh) to 5 buses per lakh population in remaining cities.

Disparity in services - case of cities with population more than 10 lakh: As per 2011 census, 53 cities in India had a population of more than 10 lakh. Of these, 9 cities had population more than 40 lakh and can be categorized as mega cities. These include Mumbai, Delhi, Kolkata, Chennai, Bengaluru, Hyderabad, Ahmedabad, Pune and Surat. The population distribution between these 9 mega cities and remaining 44 cities is almost equal - 56% and 44% respectively of the 16.1 crore people residing in these cities together. However, 82% of the 36,000 buses owned by these cities are operational in mega cities alone. This makes the service levels in these cities slightly better than remaining urban areas where unmet demand is met through unorganized systems - private bus services and/or intermediated public transport (IPT). Inadequate public transport in cities also leads to increased use of private vehicles.

Private sector in urban bus services: Private operators are formally engaged in provision of city bus services through PPP models. The public and private stakeholders enter an agreement which distributes the responsibility of planning, managing and monitoring bus services to public authority and bus operations and maintenance is with the private operators. PPPs in bus operations gained momentum in the last two decades. However, not all projects were successful due to the ad-hoc implementation of PPP frameworks at the ground-level[35], lack of technical capacity within public and private sector and weak contractual frameworks.

c) Existing (2017) deficit in bus fleet

Currently, there are only 24 (10 STU owned and 14 private owned) buses per lakh population operational in the country. This is significantly less that the standards proposed by MoHUA[38] and transport sector experts[39] that suggest that cities and states should operate 30-60 buses per lakh population. Using the proposed standards, the bus deficit in the country is calculated to be around 2.03 lakh buses of which 1.3 lakh are required in urban areas.

Table 3: Bus deficit in India - 2017

		Urban	Rural/Intercity	Total
Population (2017)		46 crores[41]	89.4 crores	133.4 crores
No of buses/lakh population as per standards to achieve Level of Service (Los) 1	Cities with population > 40 lakh	60		-
	Cities with population 10-40 lakh	40		
	Other cities	30		
	Rural/intercity		40[39]	
No of buses required in 2017 as per standards (a)		1,79,812	3,49,376	5,29,188
Existing no of STU operated buses (stage-carriage permits) (b)		-	-	1,39,400
Existing no of private operated buses (stage-carriage permits) (c)		-	-	1,86,526
Existing Bus Deficit (d=[a-(b+c)])		**-**	**-**	**2,03,262**

d) Ongoing policies and schemes for fleet augmentation

Department of Heavy Industries (DHI), GoI is supporting states and cities to deploy electric buses through the FAME scheme. The first phase of the scheme (FAME I), launched in 2015, has provided support to 9 cities to procure 465 buses[33] and the second phase (FAME II), beginning 2019, is supporting deployment of 5595 electric buses in 64 cities[34].

3.3. Support Infrastructure Availability (Depots and Terminals)

Support infrastructure comprises of terminals and depots with workshops and is required to ensure smooth operations of buses[42].

Bus Terminal: It is an interchange point for passengers between different bus routes and transport modes[42]. It serves two primary functions - movement of people and buses and commercial activities. A terminal can vary from being a roadside bus stop with no passenger or crew amenities to a purpose-built-off-road bus station offering facilities such as food stalls, ticketing, toilets, etc[53]. The number of terminals required for a bus system depends on the size of the system and the city

Bus Depot: It serves as an operating base for buses providing space for parking, administrative offices for allocation of buses and crew to duty and bus servicing and maintenance facilities[53]. Adequate number of well-equipped depots enable the STUs to operate and expand their services. The number of depots for a bus system depends on the fleet size and geographic coverage of the service. The Public-Private Infrastructure Advisory Facility (PPAIF) guidelines recommend one depot for every 100 full-sized buses.

a) Existing support infrastructure

Currently, there is lack of data on the quantity, quality and type of support infrastructure available with STUs. However, past experiences suggest that the available infrastructure is inadequate to meet the operational needs of STUs. Few cities, that started bus services with support from JNNURM, were unable to develop and maintain depots and terminals due to technical and financial constraints. This compromised bus parking and maintenance and led to an eventual shut-down of bus services. Even STUs with established systems struggle to expand support infrastructure due to financial challenges and unavailability of land. The Delhi Transport Corporation (DTC) and the Brihanmumbai Electric Supply and Transport Undertaking (BEST) have been unable to add fleet due to unavailability of land with these bus agencies[32].

While land continues to be a hindrance, several STUs have adopted PPP models for terminal development to generate financing[32]. In these models, STUs provide land and monitor the performance of the private partner who is responsible for construction and operations and maintenance (O&M) of the terminal. Several challenges have limited the success of these projects:

1. Lack of capacity within STUs and the private partners to design terminals that accommodate the functions of a terminal - operations and commercial activities
2. Limited number of dedicated trained staff within the STUs to ensure contract adherence and monitor the performance of the private partner
3. Lack of robust contractual agreements that define the role of each partner and hold them accountable for their responsibilities

PPPs, so far, have not been used for depot development. The public sector has been the sole funder, developer and operator of depots[43]. This trend is likely to continue as it is difficult to attract PPP in depots due to their non-commercial nature and condition that investors can be paid only through revenue generated from the project.

b) Ongoing policies and schemes initiatives for support infrastructure development

MoRTH, in 2018, launched the 'Development of Bus Ports in States on Build Operate Transfer (BOT)/Hybrid Annuity Model (HAM) basis' scheme to develop high quality bus terminals (called bus ports) and ensure their continued operations and maintenance[44]. The bus ports developed through this scheme will cater to both public and private sector operators. The financial support, capped at 40% of the project cost, is provided for development of one port in each State on pilot basis which can then be replicated in other parts of the State. Cities such as Vadodara, Cuttack and Madurai have used the scheme to develop world-class terminals.

3.4. Financial performance of STUs: Bus Operations

STUs incur costs in operating buses and generate revenue through farebox and non-farebox sources. STUs are expected to cover the operational costs from farebox revenue. However due to social obligations and reasons mentioned in this section, it is not possible for STUs to achieve this.

Costs: Expenditure incurred by STUs in operating buses. It includes expenses on bus O&M, fuel, staff salaries, vehicles registration fee, taxes etc. Over the lifecycle of a bus the operational cost is up to three times its procurement cost[32].

Revenue: Income earned by the STUs from their business activities. It includes farebox sources - sale of tickets and passes to passengers and non-farebox sources - advertisement, cross subsidy, commercial development etc. The farebox revenue forms 84% of the total income of STUs[19].

a) Costs vs Revenue: Reasons for poor financial performance of STUs

STUs operate buses on low-demand unviable routes and at off-peak hours to ensure mobility for all, while keeping the fares affordable for all commuter categories. This means that STUs, whose 84%[19] income is from fare collection, do not earn significant revenue to cover costs of operating buses. In 2016-17, cost recovery for STUs varied between 47.2% in urban areas to 81.5% in rural areas. The resulting financial losses amounted to INR 16,409 crore[19]. While losses mount, STUs have limited scope to reduce their operational costs as components such as staff salaries and fuel prices that form 80% of the overall cost of operations are determined by external factors.

Factors that influence operational costs and revenue generation capacity of STUs are discussed below:

1. Factors affecting costs

- **Staff salaries**: Expenditure on staff salaries is the biggest component (46%[19]) of the costs incurred in bus operations. STUs cannot reduce these costs as staff are paid as per government mandated commissions and regulations. STUs also adhere to labor regulations which warrant work on shifts to prevent long working hours for bus crew. Shift system requires employment of additional crew and staff to ensure bus services are operational at all hours of the day. By paying fair wages and ensuring quality work environment, STUs incur a higher financial burden.
- **Material costs:** Costs of fuel and spare parts is the second major component (30%[19]) of operational costs. STUs cannot reduce this expenditure as prices are determined by the market.
- **Government taxes:** STUs pay direct taxes such as Motor Vehicle Tax and Passenger Tax (levied by the State Government) and indirect taxes such as Excise Duty (by Central Government) and Value Added Tax (by State Government) on fuel. Government taxes form close to 20% of STUs' gross operating costs[45]. The taxes paid by STUs operating rural and urban services was greater than the annual loss reported by them and for city bus STUs it was up to 10% of their annual loss[46].

2. Factors affecting revenues

- **Inability to increase fares:** As passenger fares are the main source of revenue for STUs, it seems intuitive to increase fares to increase income. However, increasing fares beyond a point proves impractical. It does not accommodate the needs of economically disadvantaged and reduces ridership as passengers shift to non-motorized modes or two-wheelers. Any revenue gain through fare increase is eliminated by reduction in ridership.
- **Insufficient reimbursements against concessional fare & free passes:** State Governments provides concessional fares and free passes for travel to students, senior citizens, the disabled, freedom fighters, sports person etc. under its welfare policies. Although the discounted amount is to be reimbursed by the State Government, the STUs are usually not reimbursed for the full amount or receive delayed payments.

3. Additional direct costs for city bus operators

The cost-revenue gap is further widened for STUs operating in cities as traffic congestion and overcrowding increase operational costs due to higher fuel consumption, low vehicle productivity and frequent bus maintenance. These variations are shown in the following analysis that compares data from 36 STUs providing rural and intercity services and 10 STUs providing urban bus services.

1. **Fuel consumption:** In urban areas, buses break and accelerate frequently due to closely spaced bus stops and intersecting traffic. Buses also idle more due to traffic congestion. These factors lead to higher fuel consumption and a higher fuel bill.

Table 4: Fuel efficiency (kmpl) comparison between rural and urban STUs

Year	Rural STUs	Urban STUs
2014-15	4.6	3.1
2015-16	4.6	3.2
2016-17	4.6	3.2

2. **Bus productivity:** Buses in urban areas operate at lower speeds due to traffic congestion. As such they cover lesser distance per day compared to their rural counterparts even though the two operators have the same operating hours. Lower productivity per vehicle results in either reduction in service levels or increase in capital costs for procurement of additional buses to meet the desired service levels. Bus productivity is defined as kms per bus held per day. It is different from bus utilization which is kms per on-road bus per day.

Table 5: Bus productivity (km/bus/day) comparison between rural and urban STUs

Year	Rural STUs	Urban STUs
2014-15	255.6	166.5
2015-16	255.4	160.6
2016-17	264.4	160.3

3. **Passenger loads:** Buses operating in urban areas carry more passengers per bus owing to overcrowding during peak hours. The higher loads increase the wear-tear of buses necessitating frequent maintenance and vehicle replacement and therefore a higher O&M bill.

Table 6: Passenger loads (passenger/bus/day) comparison between rural and urban STUs

Year	Rural STUs	Urban STUs
2014-15	282.0	656.1
2015-16	282.6	610.6
2016-17	299.7	748.6

4. Other indirect capital costs to STUs

Capital expenditure of STUs is also increasing due to two major developments:

1. **Adoption of Bharat Stage (BS) VI buses:** From April 2020 all new bus procurement must comply with BS VI standards. BS VI buses are more expensive compared to previous models. This will increase the capital and the O&M expenditure for STUs. A similar impact was observed on the operational costs of Bengaluru Metropolitan Transport Corporation (BMTC) when it transitioned from BS III to BS IV buses[47]. The annual increase in costs of BMTC was estimated to be equivalent to 3.3% of BMTC's annual turnover.

2. **Move towards Electric Buses:** Transition to electric bus fleet will increase the capital expenditure of STUs as e-buses are more expensive compared to diesel buses and require separate infrastructure for charging and maintenance. Even though government is providing support for electric bus fleet deployment, the bus agencies are incurring costs in establishing infrastructure and staff training on O&M.

While these bus technology improvements are necessary for air quality and climate change gains, there are financial implications for STUs in achieving these gains. To meet the financial cost of upgrading the technology, transit agencies are likely to scale down their services which will negate any gains due to introduction of the technology in the first place.

5. Impact of COVID-19 pandemic

The COVID-19 pandemic has further impacted the financial performance of STUs. Beginning March 2020, STUs witnessed ridership decline especially on intercity routes due to COVID fears. This was followed by no revenue generation for 54 days (March 24 - May 18, 2020) when the nationwide lockdown was enforced. Even after ease in travel restrictions post lockdown, STUs did not gain back their ridership due to COVID fears, work from home preference and closing of educational institutions. With the onset of second wave of the pandemic in the country in April-May 2021, several bus systems were shut down again as State Governments imposed lockdowns to curb infection.

During this time, the revenue generation of STUs reduced considerably but the operating costs did not decline proportionately. Except for fuel which forms 30% of the overall expenses, STUs continue to incur other expenses - staff salaries, tax payment, loans and interest payments and maintenance costs.

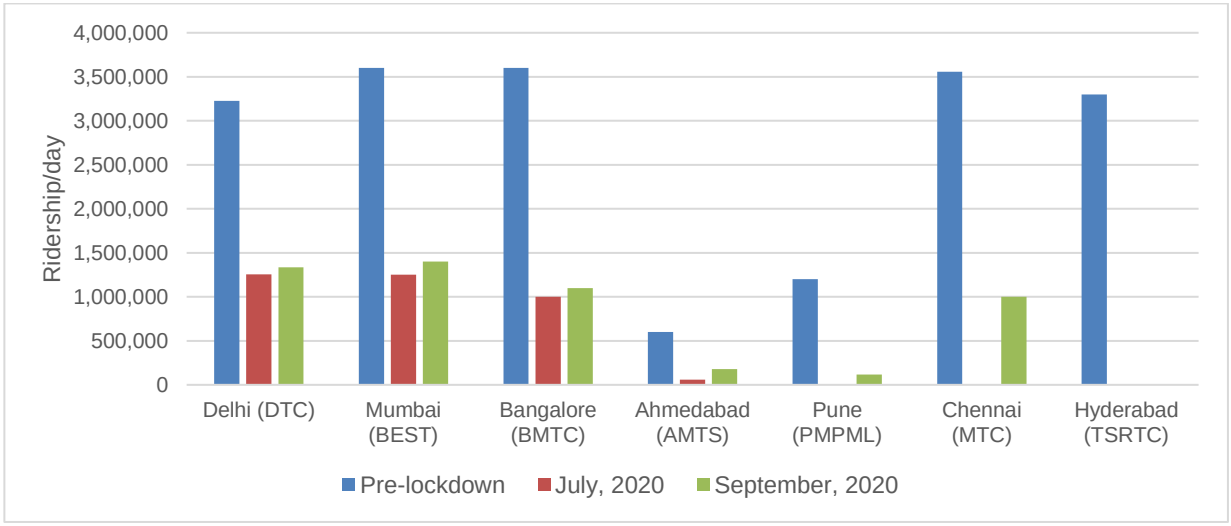


Figure 6: Impact of COVID-19 pandemic on bus ridership (before and after nationwide lockdown)

A comparison between pre- and post-nationwide lockdown operational costs and revenues of STUs operating in Delhi, Mumbai, Bengaluru, Ahmedabad, Pune, Chennai and Hyderabad demonstrates this. These bus agencies did not earn any revenue during the nationwide lockdown as only 2-3% of their fleet was operational. Pune, Chennai and Hyderabad continued to suspend services beyond this. By September 2020 (when this analysis was conducted), all cities except Hyderabad had lifted local travel restrictions and were earning around 30% of the fare revenue they used to collect before the onset of the pandemic.

However, during this time, these bus agencies incurred around 60% of the pre-pandemic operational costs - staff salaries, government taxes and payment to private partners. Cumulatively, between March-September 2020, STUs in these seven cities are estimated to have incurred losses of around INR 3400 crore. The losses are likely to be higher, as this estimate does not include expenditure on interest paid on loans, fuel costs, bus maintenance and COVID related sanitization of buses. These unexpected losses have deepened the financial crisis in STUs. It will take several months for bus ridership to return to pre-pandemic levels and with lesser revenue, losses will accumulate.

b) Ongoing policies and schemes to provide financial support for bus operations

Government of Gujarat, in 2018, initiated the 'Chief Minister Urban Bus Service Scheme'[48]. The scheme provides financial support as viability gap funds (VGF) to transit agencies in urban areas to cover the gap between operation costs and earned revenue. It is applicable in 8 Municipal

Corporations and 22 Class A Municipalities that are operating buses on PPP basis. The scheme does not support bus procurement, staff recruitments and salaries and development of infrastructure. The VGF provided by the state government is INR 12.50 per km which is to be supplemented in equal value by the transit agency. The scheme has now been extended to include support for electric buses in larger cities. So far, 12 cities have availed these benefits to introduce 846 new buses of which 350 are e-buses operational in Ahmedabad.

3.5. Intelligent Transport Systems (ITS)

STUs are using ITS to plan and monitor bus operations and share information with passengers for over a decade now. Due to lack of guidance and technical information, most agencies have adopted the following ITS components either in isolation or in combination: automatic vehicle location systems, passenger information systems, driver monitoring systems, planning and scheduling software, traffic signal priority, automatic fare collection including electronic ticketing machines[32].

This method of introducing ITS has not resulted in any substantial benefits for the STUs even when they have incurred substantial costs in procuring and deploying the system. During JNNURM, the capital costs increased by 15% to accommodate support for ITS. ITS has the scope to introduce tremendous value-addition but most STUs are unable to utilize it properly because of[32]:

1. Lack of understanding within STUs about the implications of procuring a certain technology in a fast-changing ecosystem and its capabilities to specify correct terms to vendors providing ITS
2. Lack of advanced analytic solutions that are applicable to the public transport industry as existing solutions are designed for freight logistics
3. Lack of knowledge among vendors on the needs of public transport operations, which significantly affects the utility of the product
4. Lack of technical and financial resources for O&M of ITS technology within the agency

3.6. Technical capacity limitations

Currently, the approach adopted by STUs to plan, develop and scale their bus systems is driven by the funds available with them. There is lack of proactive planning and assessment to meet the travel demand in an efficient and systematic manner. The current operations of buses follow fixed schedules which are not revised as per the changing travel patterns, traffic conditions and user expectations. The lack of proactive holistic planning leads to implementation of services that do not respond to customer needs and are inefficient in operations. This in turn leads to low ridership and financial losses for the STUs. Additionally, as stated earlier, there is lack of trained manpower to negotiate with private sector on equipment procurement and PPP projects. The private sector in turn lacks capacity to engage with the public sector on bus operations and ITS implementation.

4. REQUIREMENTS FOR BUS SYSTEMS OF 2031

As highlighted in previous section, there is a huge deficit in existing bus fleet and support infrastructure, STUs have low cost recovery to be able to invest in improvements of bus systems, there is inefficient adoption of PPP models, high cost of technology adoption and lack of technical capacity within the public and private sector to procure, plan and manage bus services. There is a need to fill these gaps and plan for future bus transport demand. This section estimates the requirements for developing bus systems by the year 2031.

4.1. Bus fleet requirements

Based on the 'bus availability' standards of 30-60 buses per lakh population proposed by MoHUA and sector experts, there is a requirement to operationalize 5.85 lakh buses in the country by 2031. Around 3.38 lakh of these buses will be offset by the BAU procurement patterns of public and private operators. Over and above this, there is a need to add another 2.46 lakh buses by 2031.

Table 7: Number of buses to be added by 2031

	Urban	Rural/Intercity	Total
Projected population for 2031[49] (a)	55.9 crores	91.7 crores	147.6 crores
No of buses/lakh population as per proposed standards (b)	30-60	40	
No of buses required to be operationalized by 2031 (c) = [(a*b)/100000]	2,18,090	3,66,659	5,84,749
No of buses expected in 2031 as per BAU procurement patterns of operators (d)	-	-	3,38,356
No of buses to be added by 2031 (e=c-d)	**-**	**-**	**2,46,393**

4.2. Support infrastructure requirements

- **Depots:** Existing standards propose one bus depot for every 100 buses[50]. Accordingly, there is a need to develop 2,464 new depots to accommodate the 2.46 lakh buses to be added by 2031.
- **Terminals:** Existing guidelines specify different methods to estimate the number of terminals required for operating a bus service. For this assessment, a requirement of one terminal for every 200 buses has been assumed. Accordingly, 1,232 new terminals will be required by 2031

Table 8: Number of depots and terminals to be added by 2031

Support Infrastructure	Numbers
Depots (f)	2,464
Terminals (g)	1,232

4.3. Bus operations requirements

Costs of operating buses need to be factored in while planning bus systems. For this assessment, bus operations are measured as number of kms to be performed by buses over their lifecycle. The 2.46 lakh buses will cover 16,550 crore kms in 10 years. Of these, 4,963 crore kms will be operated in urban areas and 2,773 crore kms will be operated in cities with population more than 10 lakh.

The number of kms to be performed by buses is calculated by assuming that a bus operating in urban area completes 180 kms per day and a bus operating in rural/intercity segment completes 250 kms per day. This assumption is based on the existing bus productivity (no of kms/day/bus) of 8

STUs operating in urban areas and 26 STUs operating in rural/intercity segment. Additionally, it is assumed that one bus operates for 300 days in one year and has a life span of 10 years.

Table 9: Number of kms to be performed by new buses by 2031

Parameter	Urban	Rural/intercity	Total
No of new buses to be added by 2031 (a)	91,895	1,54,497	2,46,393
Kms to be performed by each bus/day (b)	180	250	-
No of days of operations (c)	300	300	-
Life span (years) of one bus (d)	10	10	-
Total Kms to be performed by 2.46 lakh buses by 2031 *(in crores)* (A = a*b*c*d)	**4963**	**11,587**	**16,550**

Table 10: Number of kms to be performed by new buses in cities with population>10lakh by 2031

Parameter	Number
No of buses to be procured for cities with population>10 lakh by 2031 (e)	51,359
Kms to be performed by each bus/day (f)	180
No of days of operations (g)	300
Life span (years) of one bus (h)	10
Total Kms to be performed by 51,359 buses by 2031 *(in crores)* (B = e*f*g*h)	**2,773**

4.4. ITS requirements

ITS offers numerous benefits as it helps STUs plan, manage and monitor bus systems. Going forward, the approach should be to minimize the procurements costs for ITS and maximize benefits for STUs. This can be achieved by establishing a centralized system with backend support for data collection and analysis. This will reduce the investments at the STU level, bring uniformity in data collection and help monitor the performance of the STUs.

4.5. Technical capacity requirements

Transit agencies and the private sector responsible for operations of bus systems lack capacity to undertake scientific and data-based planning and monitoring of the bus systems, design efficient depots and terminals, implement PPP project development, etc. Going forward, as the scaling of bus systems in undertaken, technical capacity building initiatives are also required to train staff within bus agencies and private sector.

5. FINANCIAL REQUIREMENTS BY 2031

This section estimates the financial investments that will be required to meet the costs of: i) procuring 2.46 lakh buses; ii) developing 2464 depots and 1232 terminals; iii) implementing a centralized ITS; iv) training over 1 lakh human resources and; v) operating buses. The costs of last component i.e. operating buses is calculated under three scenarios:

1. Scenario 1: Considers cost of operations of 2.46 lakh buses to be added over the next 10 years.
2. Scenario 2: Considers cost of operations of 0.92 lakh buses to be added and operated in all urban areas over the next 10 years (including cities with population more than 10 lakh)
3. Scenario 3: Considers cost of operations of 0.51 lakh buses to be added and operated only in cities with population more than 10 lakh over the next 10 years.

These scenarios are considered because cost recovery varies between rural/intercity and urban operations. It is in urban areas, especially cities with population more than 10 lakh, that STUs have extremely poor cost recovery - loss of approximately INR 25/km - and inevitably need external financial support compared to other segments. The cost recovery of STUs operating in rural/intercity segment - loss of INR 10/km - can be improved by introducing financial reforms discussed in later section of this report.

Table 11: Assessment of financial requirement by 2031 requirements

S No	Component		Units	Cost/unit (INR)	Total Cost (INR crores)
1	Buses (Nos)		2,46,393	0.60 cr.	1,47,836
2.1	Depots (Nos)		2,464	20 cr.	49,279
2.2	Terminals (Nos)		1,232	20 cr.	24,639
3	ITS				7,392
4	Technical Capacity (Nos)		2,000	0.025 cr.	50
	Sub Total (a)				**2,29,196**
5	Bus Operations (no of kms)	Scenario 1 (b)	16,550	10/km - 25/km	2,39,932
		Scenario 2 (c)	4,962	25/km	1,24,059
		Scenario 3 (d)	2,773	25/km	69,335
	Grand Total (Scenario 1) (A = a + b)				**4,69,128**
	Grand Total (Scenario 2) (B = a + c)				**3,53,254**
	Grand Total (Scenario 3) (C = a + d)				**2,98,530**
	Assumptions: *1. The cost/unit for buses is for a BS VI non-AC 12 m diesel bus* *2. ITS cost is assumed as 5% of the total cost of bus procurement* *3. One technical capacity training will include 50 participants*[51] *4. VGF is assumed at: INR 10/km for rural/intercity operations and INR 25/km for urban operations. This is based on the average difference in CPKM and EPKM for 26 STUs operating in rural/intercity segment and 8 STUs operating in urban segment, respectively.*				

The total cost of procuring and operating all 2.46 lakh buses (scenario 1), developing infrastructure, implementing ITS and building capacity is estimated to be INR 4.7 lakh crores. If costs of operating buses is considered only for buses to be operated in all urban areas (scenario 2) or buses to be operated in cities with population more than 10 lakh, the budget is estimated to INR 3.5 lakh crore and INR 3 lakh crore respectively.

6. RECOMMENDATIONS

A Central Government led funding program with support from State Governments can help in meeting the requirements of bus systems by 2031. The proposed program needs to create an ecosystem that encourages improvement in performance of bus systems and reduces the financial dependence of STUs for financial support on the Governments. The program is proposed to achieve the following objectives:

1. Provide financial support for bus and infrastructure augmentation, operations, technology integration and technical capacity building to improve the quality of bus services
2. Enact reforms in policies and processes to enable long-term financial autonomy of STUs to plan and scale their systems without Government support

The financial support provided through the proposed program need to be linked to a 'vision plan' submitted by participating bus agencies. The vision plans will need to highlight short-, medium- and long-term growth strategies for bus systems till 2031 on requirements for bus fleet and support infrastructure, optimization of existing and planning of new bus services, adoption of centralized ITS, adoption of performance measurement mechanisms, involvement of private sector, estimation of operational costs and revenue, estimation of technical workforce for the proposed requirements and their training needs assessment and funding requirements. Additionally, this plan needs to include details on: i) reforms that the state/city governments will facilitate to improve self-sufficiency of STUs and ii) institutional arrangement (state-operated bus service or a PPP arrangement) for operationalizing the bus systems. A Central Government appointed committee can evaluate the vision plans submitted by participants and sanction grants accordingly.

The program is proposed to comprise of three main components:

4. **Funding:** Financial support for bus procurement, support infrastructure development, bus operations, ITS implementation and technical capacity building.
5. **Trainings:** Capacity building trainings on data-based service planning and monitoring, design and management of support infrastructure, management of PPP contracts and use of ITS
6. **Reforms:** Policy reforms to enable financial autonomy of STUs, making land available for support infrastructure, enhancing the private sector participation and providing greater support for STUs operating in urban areas

6.1. Funding

It is recommended that the proposed program provides capital funding to cover the procurement costs of all 2.46 lakh buses, development costs of 2,464 depots and 1,232 terminals, implementation costs of a centralized ITS and training costs for 1 lakh staff in STUs. Financial support to cover the costs of operating buses needs to be provided in form of VGF to bus operators operating buses in urban areas on a priority basis. The financial outlay of the proposed program is estimated to be INR 3.5 lakh crore over a period of 10 years.

1. Components of funding

1. Bus procurement

The capital funding for bus procurement is estimated to be INR 1.5 lakh crores. This support needs to be extended to STUs who chose to operate their systems themselves. For STUs/SPVs who adopt PPP for operations, funding needs to be extended based on the terms of the PPP arrangement.

2. Support infrastructure

The capital funding required for developing depots and terminals is estimated to be INR 0.5 lakh crores and INR 0.25 crores respectively. Depot development has traditionally been led by the public sector. This trend is likely to continue as it is difficult to attract PPP in depots due to their non-commercial nature[43]. Conversely for terminal development, private sector can be leveraged through robust PPP arrangements. For this, the guidelines of the ongoing 'Development of Bus Ports in States/UTs on BOT/HAM basis' scheme by MoRTH can be adopted.

3. Bus Operations

As mentioned earlier, financial support in the form of VGF needs to be extended to bus agencies operating bus services in urban areas for operating buses procured through the proposed program. The total VGF required for STUs operating in urban areas is INR 1.24 crores. The VGF support needs to be linked to the performance of operators on pre-decided performance measurement indicators. These indicators are not discussed in this report.

4. ITS

A centralized ITS in the form of a Business Intelligence Tool and a standardized Bus Transit Data Repository can help minimize procurement costs and maximize benefits. The total cost of implementing such a system is estimated to be INR 7,392 crores. STUs will need to incur additional costs for hardware procurement.

5. Capacity building

The estimated cost of training over 1 lakh staff within STUs over a period of 10 years is INR 50 crores. The detailed trainings required are discussed in the next section.

2. Stakeholder roles

The funding requirements for the program are proposed to be distributed among the stakeholders in the following manner:

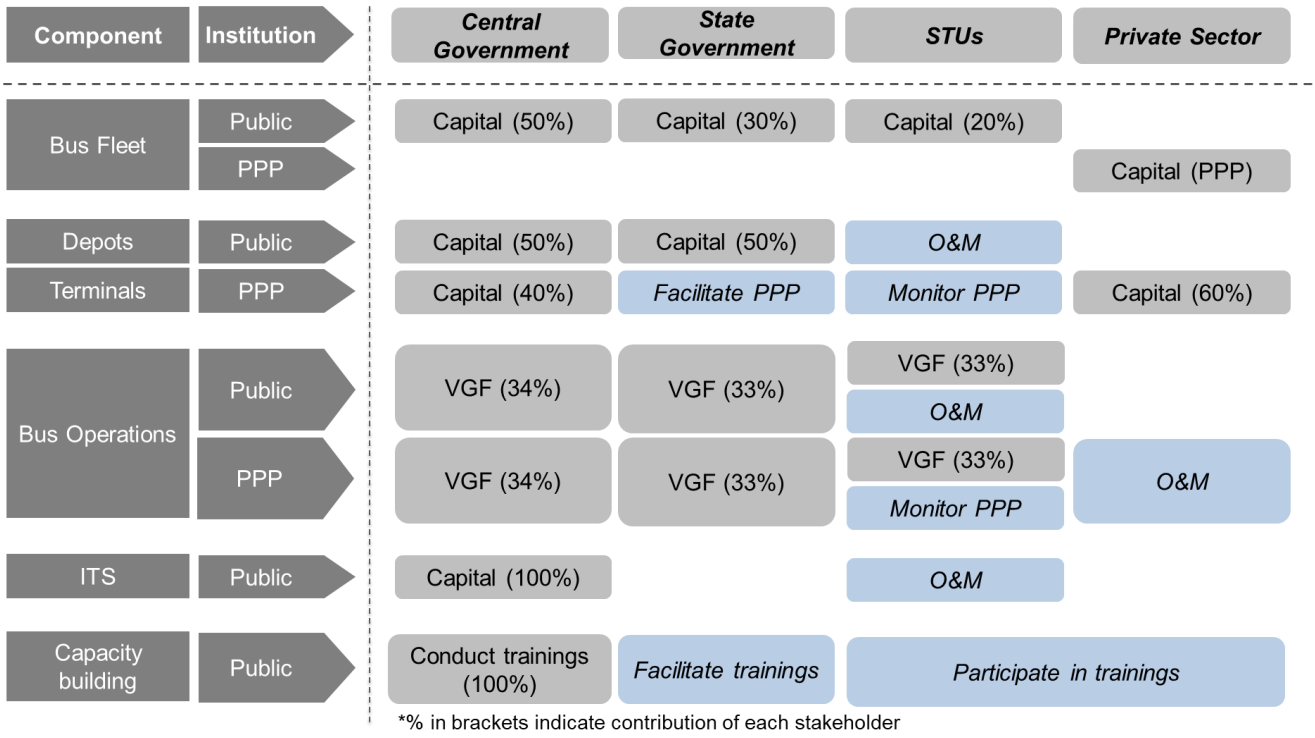


Figure 7: Stakeholder roles in meeting the financial requirement of the proposed program

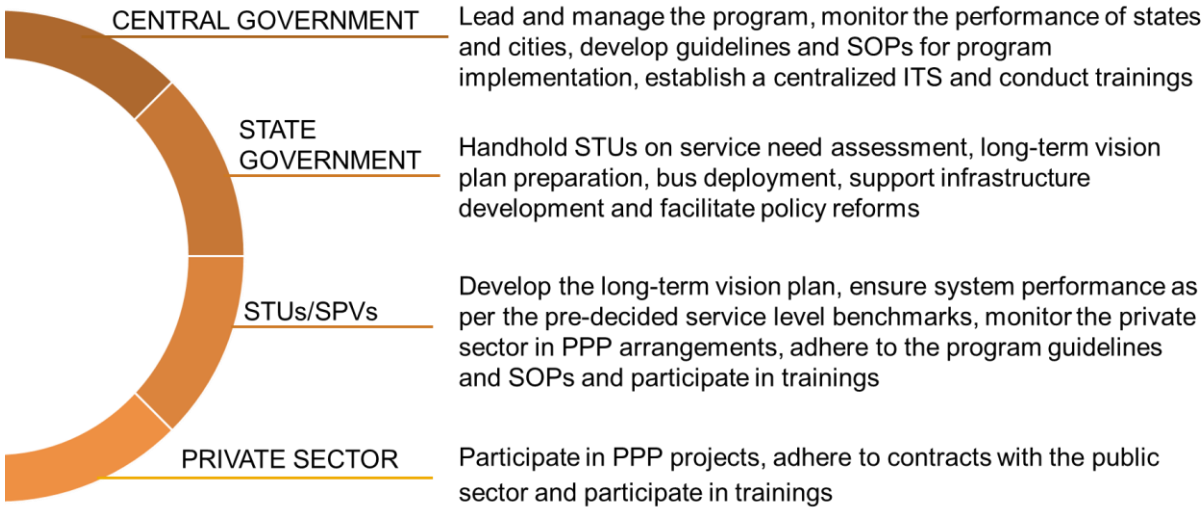
Accordingly, the financial contribution of each stakeholder will be:

Table 12: Financial contribution of stakeholders

Component	Institution	Share of each stakeholder (INR crores)				Total cost (INR crores)
		Central Govt.	State Govt.	STUs	Private sector	
Bus Fleet	Public/ PPP	73,918	44,351	29,567		1,47,836
Bus Depots	Public	24,639	24,639	-	-	49,279
Bus Terminals	PPP	9,856	-	-	14,784	24,639
ITS	Public	7,392	-	-	-	7,392
Technical Capacity	Public	50	-	-	-	50
Bus Operations	Public/PPP	42,180	40,940	40,939		1,24,059
Total Cost		**1,58,035**	**1,09,929**	**70,507**	**14,784**	**3,53,254**

3. Stakeholder responsibilities

The responsibilities of different stakeholders will include:



6.2. Trainings

Along with the funding support to STUs, systematic capacity building initiatives will be required for both the public and private sector on various aspects of bus operations. The trainings can be administered through the existing Centre of Excellences (CoE) of Government of India such as Central Institute for Road Transport (CIRT) or by establishing Association of State Road Transport Undertakings (ASRTU) as a CoE for all bus systems related issues or by involving external organizations with experience in planning of bus services.

The key capacity building trainings need to focus on following topics for public and private sector:

1. Service planning and monitoring:
    - Data-based planning for operations, management and monitoring of the bus services
    - Design, development and management of depots and terminals
    - Develop, manage, enforce and monitor PPP contracts
    - Develop and manage contracts on asset procurement from private sector
2. Use of ITS hardware and the centralized Business Intelligence Tool and Transit Data Repository

6.3. Reforms

Policy reforms are required to ensure that STUs gain self-sufficiency over the time-period of the proposed program and can scale their bus systems without support from the Government. Following policy reforms are proposed to enhance the financial autonomy of STUs, improve private sector participation, ensure land is available for support infrastructure and greater support for STUS in urban areas. The disbursement of grants needs to be linked to enactment of these reforms by states and cities.

1. Financial self-sufficiency of STUs

Funding through the proposed program will provide the initial push for developing bus systems. But, in the long-term, STUs should be able to scale their bus systems independently. This can be done by strengthening the financial health of STUs by enacting the following reforms:

- **Operationalizing State and Urban Transport Funds**

Financial grants under the proposed program need to be linked to operationalization of transport funds at the state and city level with dedicated resources for bus transport. Previous studies have identified that the revenue for these funds can comprise of contributions by the Central and State Governments, direct beneficiaries - users of public transport, indirect beneficiaries - non-users who benefits from public transport and other sources such as vehicle registration charges, parking charges, advertisement charges, green tax, etc.[52] The National Urban Transport Policy identifies a cess on petrol and diesel, a betterment levy on landowners and an employment tax on employers as potential income sources for a transport fund.

- **Reducing or phasing out the existing Government taxes levied on STUs**

Reduction or phasing out of existing taxes levied by the Government, that form up to 20% of the gross operating costs of STUs, will result in financial surplus for certain STUs and self-sufficiency for others. This will reduce STUs' dependence on government grants as gains from tax exemption can be invested in improving or augmenting the bus systems. Tax reductions and exemptions can help STUs operating in rural and intercity segment to recover their costs from farebox revenue and eliminate the need for VGF for bus operations. The major taxes that have the maximum financial burden on STUs and need to be reduced include:

1. MV Tax by State Government: The existing MV Tax, levied by the State Transport Authority (STA) on vehicle registrations, forms a major share in taxes paid by the STUs. Losses for STA, resulting due to reduction in this tax for STUs can be offset by increasing MV Tax on personal vehicles. This measure will also help check the uncontrolled growth of private vehicles. The exact proposals for changes in MV Tax can be identified at the state level.
2. Passenger Tax by State Government: Few states extend passenger tax, levied on the revenue gained by commercial vehicles from transporting passengers, to STUs even though they do not operate purely on commercial terms. This tax, that treats STUs as commercial entities, should be phased-out. The losses for the State Government arising from reduction of this tax can be offset by slightly raising taxes on other commercial vehicles such as private buses and taxis.
3. Excise duty on fuel by Central Government: Excise duty on fuel purchased by STUs should be abolished or directed back to the STUs. Removal of excise duty for STUs will have minimum impact on total tax collection and can be offset by a modest increase in excise duty for retail consumers. This step will also reduce fuel demand for personal vehicles and facilitate a mode shift toward buses.
4. User fee on highways by Central Government: User fee levied on vehicles for using any section of national highways should be waived for public transport buses. Normally, bus operators transfer these charges to passengers making their travel expensive. Relaxing of toll charges for

buses will make bus transport cheaper and faster for passengers. The losses can be recovered through higher charges for private vehicles especially on highways that connect major cities as more private vehicles use these highways.

- **Generating revenue from non-farebox revenue sources**

STUs, under existing operating conditions, are heavily dependent on ticket and pass sales for revenue generation. To improve their self-sufficiency, State Government through adequate policy support need to encourage bus agencies to generate revenue from non-farebox sources such as land and property development, advertisements and parking.

2. Land for Support Infrastructure

Development and expansion of support infrastructure by STUs is hindered by the unavailability of land especially in urban areas where land is a scarce commodity. Financial support can be leveraged to obligate states/cities to allocate land for developing depots and terminals. States and cities can allocate land in two ways:

- Earmarking land in the development plans based on future estimation of public transport needs. This land should not be clubbed with land allocated for other transport purposes
- Using land banking techniques to aggregate land parcels for future development or sale

It is therefore necessary that public agencies undertake a long-term planning exercise with a vision on their expansion and chalk out the requirements for support infrastructure. This can be used to inform the planning process and develop strategies for land procurement.

3. Private sector participation

Private sector can be leveraged to generate financing for bus systems. As not many PPP projects in the past have been successful, the following interventions are suggested to make the process easier for all stakeholders.

- **PPP for development of support infrastructure:** As support infrastructure requires special technical skills and expertise, STUs/SPVs will need to establish a separate cell withing the organization with dedicated staff to plan, design and implement terminals and monitor the performance of the private partner. Capacity building will also be required for both the partners on terminal design and operations.
- **PPP for bus operations:** Based on the learnings from past examples, State Governments need to appoint one institution that is responsible for decision making on all aspects of bus operations. Additionally, the technical capacity within the public and private partners need to be strengthened to ensure efficient system planning, setting service level benchmarks and operating and monitoring services at a city scale. This process can be facilitated by the Central and State Governments through development of model contract documents that can be adopted by STUs to prepare and monitor their own contract agreements.

4. Greater support to city STUs

- Dedicated road infrastructure for bus operation in urban areas through BRTS and/or dedicated bus lanes with priority at traffic signals will help increase vehicle speeds. This will help improve fuel efficiency, fleet utilization and maintenance of buses. As buses will run faster, they will attract more users and reduce fuel expenditure for bus operators.
- Establishment of separate bus agencies that cater specifically to urban areas and do not fall under the ambit of state-wide operators will help improve service level in urban areas. STUs with mandate to provide both rural and urban services, in the past, have ignored city bus services due to the heavy losses incurred in urban areas.

7. CONCLUSION

Bus-based public transport systems play an important role in meeting passenger transport demand in India. Buses are the low-cost mobility option for lakhs of Indians to access their jobs, education and health care. They also help in curtailing carbon emissions, traffic congestion, fossil fuel consumption and provide safe mobility.

Despite these benefits, buses have grown at a slower pace compared to the growth in transport demand. Currently, buses form less than 1% of the total vehicle population in the country. In terms of bus availability, there are around 10.8 public buses per lakh population and around 14 private buses per lakh population. This is far less than the standards proposed by experts for a good quality bus system. Compared at state level, there is a greater disparity in availability of buses. It is also important to note that 22% of the existing fleet operated by STUs is overaged, leading to operations of unsafe and uncomfortable buses and reducing their attractiveness for use. The disparity in service provision also extends to cities. Around 65% of the total urban bus fleet is concentrated in 9 mega cities (population more than 40 lakh), even though they house only 25% of the total urban population.

There are also gaps in provision of support infrastructure, integration of intelligent technologies and technical capacity of the private and public sector to operate an efficient bus system that can meet the needs of the customers. These shortages have created a poor image of bus transport, discouraging use of buses and resulting in a rapid increase in use of personal vehicles.

To retain and improve the mode share of buses, there is a need to redirect focus and investments by Governments to improve bus services. Proactive investments from national and state funds in bus systems can help in reducing the negative externalities of the passenger transport segment. It will help achieve national goals on climate change mitigation, energy demand reduction, air quality improvement, road safety improvements and ensuring mobility for all. Government investments are also required because STUs are facing immense financial losses.

Going forward, by the year 2031, there is a need to procure additional 2.46 lakh buses to meet the public transport demand. These buses will need development of 2464 depots and 1232 terminals to ensure smooth operations. There is also a need to support the operations of these buses especially in urban areas as city bus agencies have low cost recovery. Of the 2.46 lakh buses, around 92,000 buses will operate in urban areas and cover 4,963 crore kms over their life span of 10 years. There is also a need to implement a centralized ITS and build technical capacity to operate, manage and monitor these buses. The total investment required for this is estimated to be INR 3.5 lakh crore.

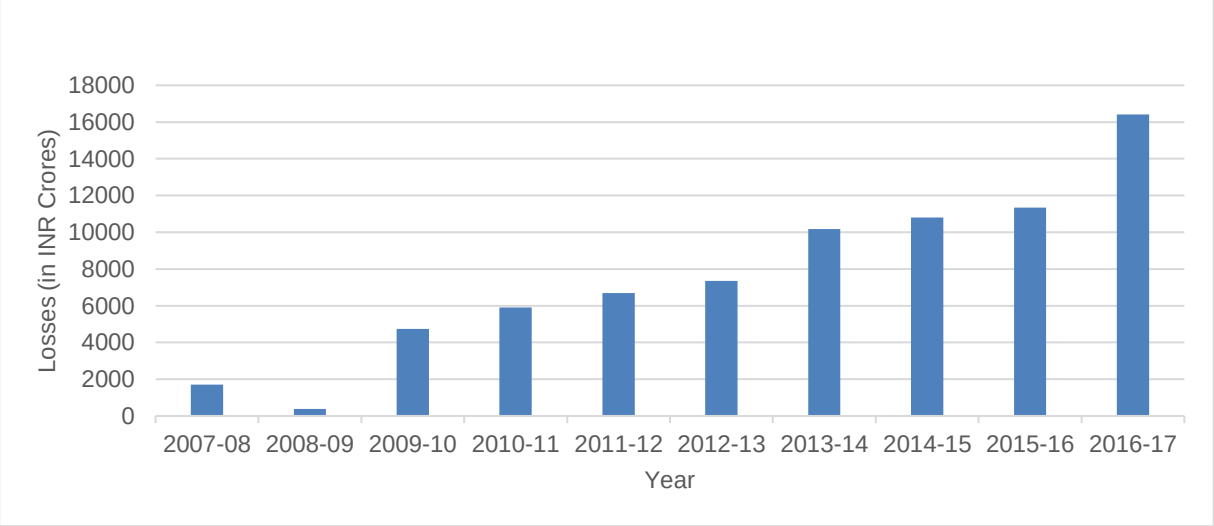
A funding program led by the Central Government, with support from State Governments, STUs and private sector can help in meeting the requirements of 2031. The program is proposed to aim to provide technical and financial support to STUs and enact reforms that ensure financial independence of the STUs in the long term. It needs to link long-term planning goals for STUs with regards to fleet procurement, creating support infrastructure, bus operations, ITS and technical capacity building initiatives with the grants. Through financial support and policy reforms, states and cities will be able to build customer-oriented bus systems that attract users away from personal vehicles onto public transport modes.

8. ANNEXURE

1. Mode share of buses in major Indian cities

S No	City	Bus trips in motorized trips, 2007-2011 (%)
1	Surat	16
2	Mumbai	18
3	Ahmedabad	22
4	Delhi	29
5	Chennai	39
6	Bengaluru	46

2. Financial losses incurred by STUs[19]



3. Classification of STUs[19]

S No	STU Type	Example
1	Corporation Setup	Assam State Transport Corporation, Himachal Road Transport Corporation
2	Governmental Departmental Setup	Chandigarh Transport Undertaking, State Transport Haryana
3	Company Set up	Tamil Nadu State TCL, Puducherry RTCL, Pune MPML
4	Municipal Undertakings	Ahmedabad Municipal Transport Services, Brihanmumbai Electric Supply and Transport Undertaking
5	Other Government Departments	Delhi Tourism DC, Himachal Pradesh TDCL

4. Proposed standards for extent of supply/availability of public transport

Different studies suggest different methodologies to calculate the number of buses required to adequately serve the public transport demand. It depends on mode share, presence of rail or other public transport modes, bus capacity, vehicle utilization, average trip length of bus journeys undertaken by each inhabitant of the city[53] As per MoHUA, the extent of supply of buses in urban areas depend on the trip lengths and city size. Large size cities have large trip lengths; hence they need more buses to serve the same number of passengers in comparison with smaller cities[38].

City Type	Population	No of buses/lakh population for LoS* 1	No of buses/lakh population for LoS 2	No of buses/lakh population for LoS 3	No of buses/lakh population for LoS 4
Mega cities	> 40 lakhs	> 60	40 - 60	20 - 40	< 20
Metro cities	10 – 40 lakhs	> 40	25 - 40	10 - 25	< 10
Other cities I	2 – 10 lakhs	> 30	20 - 30	10 - 20	< 10
Other cities II	< 2 lakhs	> 30	20 - 30	10 - 20	< 10

*LoS: Level of Service

5. Presence *of organized bus public transport in urban areas*

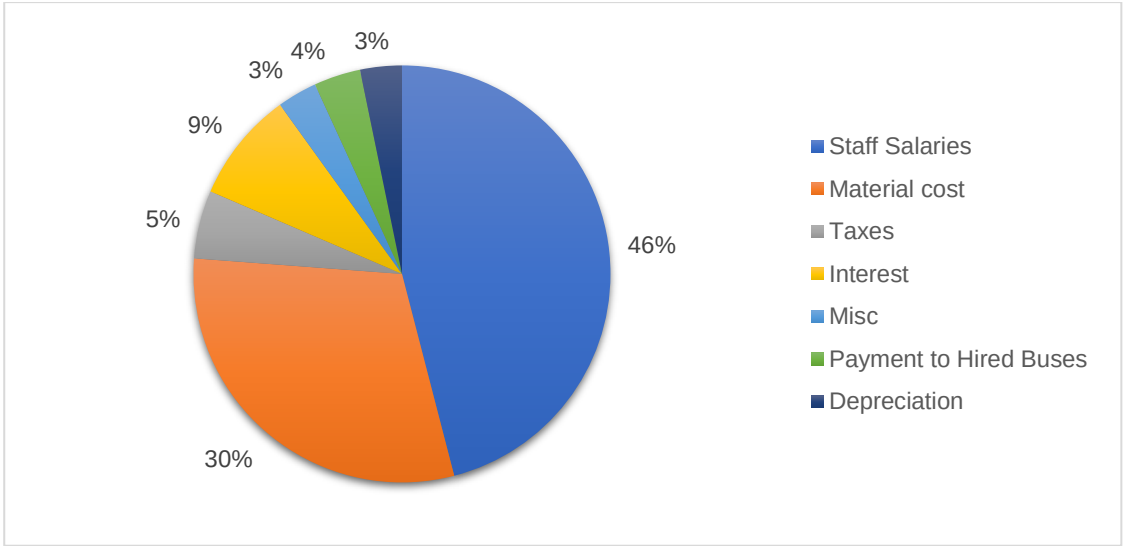
S No	Urban Settlement Category (as per census)	Population (in crores)[54]	No of settlements	No of settlements with organized bus service	No of buses
1	All urban settlements	37.7	7935	(Not know)	46,000*
1.1	Class I Towns/UAs *(population more than 100,000)*	26.49	468	127*	(Not known)
1.2	Cities with population more than 10 lakh	16.07	53	52*	36,142*

*estimated based on data collected from websites of STUs/SPVs

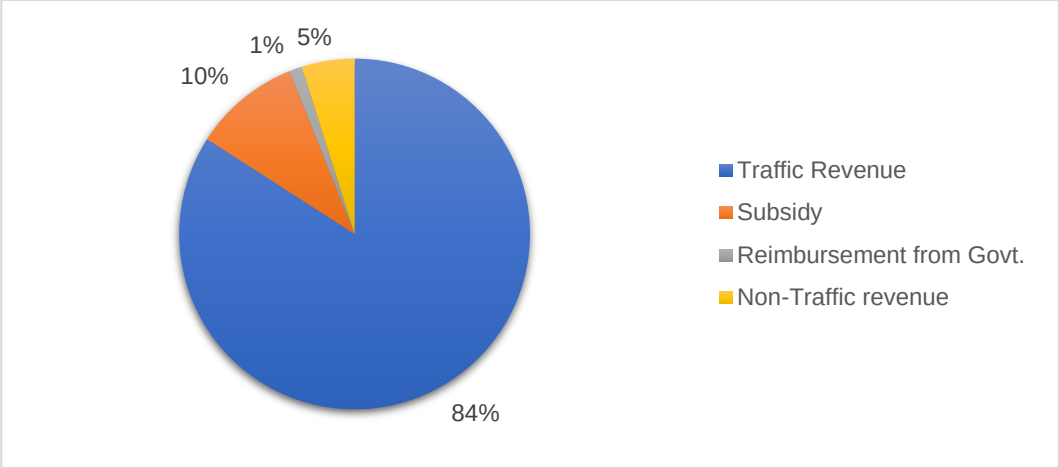
6. Cost recovery by STUs: 2016-17[19]

	STUs operating on intercity/rural routes	STUs operating in urban areas
Total Cost (INR in crores)	54792.43	14480.87
Total Revenue (INR in crores)	44707.23	7018.3
Profit/Loss (INR in crores)	-10085.2	-7462.57
Cost Recovery	81.5%	47.2%

7. Operational costs of all STUs: 2016-17[19]



8. Revenue earned by all STUs: 2016-17[19]



9. Types of taxes levied on STUs by Central and State Governments[46]

S No	Tax	Area of Levy
1	Advertisement Tax	Revenue from advertisements placed on buses/at stations
2	Central Excise Duty	Purchase of new buses and/or chasses, Purchase of spare parts, Diesel consumed
3	Customs Duty	Imported buses or spare parts, Diesel consumed
4	Entry Tax	Same as (2)
5	Labour Cess	On building and construction work carried out by a contractor
6	Motor Vehicle Tax	Operation of buses on roads (road tax)
7	Municipal Levies	As defined by the municipal body
8	Octroi	Same as (2)
9	Passenger Tax	Revenue earned from transporting passengers
10	Property Tax	Immovable properties owned by the SRTU
11	Service Tax	Chartered services, Commercial revenue
12	Stamp Duty	Acquisition of land
13	Value Added Tax	Same as (2), also on scrap items and minor civil bills

10. Detailed analysis of bus fleet in various States and UTs[19]

S.No.	State Name	STU Name	No of buses		Population (Census 2011)	Buses/ lakh population	No of people per bus	No of over age buses		% of over aged buses
				Total					Total	
1	Maharashtra	MSRTC	18634	25704	112374333	22.87	4371.86	3418	3650	14.20%
		PMPML	2021					92		
		TMTU	445					76		
		NMMT	462					0		
		KMTU	132					54		
		SMTU	39							
		KADMTU	222					10		
		BEST	3749					0		
2	Andhra	APSRTC	11833	22295	84580777	26.36	3793.71	1033	2768	8.73%
3	Telangana	TSRTC	10462					1735		16.58%
4	Gujarat	AMTS	896	8540	60439692	14.13	7077.25	1	269	3.15%

		GSRTC	7644					268		
5	Uttar Pradesh	UPSRTC	12083	12083	199812341	6.05	16536.65	751	751	6.22%
6	Karnataka	KnSRTC	8326	24095	61095297	39.44	2535.60	2115	5893	24.46%
		NEKRTC	4549					1064		
		BMTC	6165					1395		
		NWKRTC	5055					1319		
7	Kerala	KSRTC	5953	5953	33406061	17.82	5611.63	753	753	12.65%
8	Rajasthan	RSRTC	4863	4863	68548437	7.09	14095.92	880	880	18.10%
9	Haryana	STHAR	4122	4122	25351462	16.26	6150.28	102	102	2.47%
10	TN	TNSTC KUM	3832	22533	72147030	31.23	3201.84	2482	14512	64.40%
		TNSTC MDU	2593					1761		
		TNSTC VPM	3596					2278		
		TNSTC CBE	3228					1508		
		TNSTC SLM	2222					1511		
		TNSTC TNV	1897					1057		
		MTC	3980					2982		
		SETC TN	1185					933		
11	Punjab	STPJB	605	2851	27743338	10.28	9731.09		133	4.67%
		PUNBUS	1209							
		PRTC	1037					133		
12	WB	NBSTC	805	2557	91276115	2.80	35696.56			
		SBSTC	661							
		CSTC	577							
		CTCL	327							
		WBSTC	187							
13	Bihar	BSRTC	576	576	104099452	0.55	180728.22		0	
14	Goa	KDTC	508	508	1458545	34.83	2871.15	26	26	5.12%
15	Assam	ASMSTC	3000	3000	31205576	9.61	10401.86	137	137	4.57%
16	Odisha	OSRTC	455	455	41974218	1.08	92251.03	48	48	10.55%
17	Andaman	ANST	268	268	380581	70.42	1420.08		0	
18	Puducherry	PRTCL	142	142	1247953	11.38	8788.40		0	
19	Himachal	HTDC	26	3194	6864602	46.53	2149.22	556	556	17.41%
		HRTC	3168							
20	Uttarakhand	UTC	1401	1401	10086292	13.89	7199.35	102	102	7.28%
21	J&K	JKSRTC	692	692	12541302	5.52	18123.27		0	
22	Nagaland	NGST	216	216	1978502	10.92	9159.73	178	178	82.41%
23	Tripura	TRPTC	81	81	3673917	2.20	45357.00		0	
24	Sikkim	SKNT	242	242	610577	39.63	2523.05	10	10	4.13%
25	Meghalaya	MEGTC	52	52	2966889	1.75	57055.56		0	
26	Mizoram	MZST	49	49	1097206	4.47	22391.96	9	9	18.37%
27	Arunachal	ARPST	255	255	1383727	18.43	5426.38	139	139	54.51%
28	Delhi	DTC	4023	4023	16787941	23.96	4172.99	239	239	5.94%
29	Chandigarh	CHNTU	567	567	1055450	53.72	1861.46	121	121	21.34%
	Total		**151317**					**31276**		

The status of States and Union Territories whose assessment is not include in the above analysis:

1. Madhya Pradesh: The State Government, in 2008, scrapped the Madhya Pradesh State Road Transport Corporation responsible for providing public transport services. As such, public-owned bus systems are absent in the state with exception of city bus services in Bhopal, Indore, Jabalpur and Ujjain. Services in other parts of the state are provided by private operators[55].
2. Chhattisgarh: Only Raipur and Bilaspur operate city bus services. In remaining areas services are provided by private operators with a fleet size of 1,300 buses (with valid permits)[6]. During JNNURM, the State received 451 buses and nine SPVs were formed to operation these buses[56]
3. Manipur: The Manipur State Road Transport Corporation was scrapped in 2003. The government has re-introduced buses under Manipur State Transport (MST) on few inter-district and city routes in Imphal. Private operators have been providing services in the state.
4. Jharkhand: Jharkhand procured 190 buses through JNNURM for Ranchi and other cities of similar size. The buses in Ranchi, Jamshedpur and Dhanbad, in absence of Government managed or operated intercity bus services were transferred to Jharkhand Tourism Development Corporation, which rented them out to private operators[57].
5. Dadra and Nagar Haveli and Daman and Diu: These UTs do not have any bus service and are served by MSRTC.
6. Lakshadweep: There is no bus service in Lakshadweep.

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