# THE COST OF URBAN COMMUTE

## BALANCING AFFORDABILITY AND SUSTAINABILITY OF PUBLIC TRANSPORT


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MacArthur Foundation

We are grateful to the MacArthur Foundation for institutional support in preparing this document


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Material from this publication can be used, but with acknowledgement.

Citation: Centre for Science and Environment 2019. *The Cost of Urban Commute: Balancing Affordability and Sustainability*, New Delhi

Published by:
Centre for Science and Environment
41, Tughlakabad Institutional Area
New Delhi 110 062
Phone: 91-11-40616000
Fax: 91-11-29955879
E-mail: sales@cseinida.org
Website: www.cseindia.org

Printed at Bravo Printex, New Delhi

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# 1. WHY THIS STUDY?

The scale of transformation needed to augment reliable and efficient public transport services in Indian cities is massive and will be unprecedented. Cities are experiencing rapid growth and urban expansion, changing economic and job profiles. Consequently, the demand for travel is exploding. Cities are under pressure to find sustainable solutions to sustain staggering number of travel trips daily. The trip numbers can be as high as four crore a day (in Delhi and Mumbai). If a greater share of these trips moves to personal vehicles, enormous pollution (and carbon) can get locked in the infrastructure, and that cannot be undone easily. To avoid this, at least 85–90 per cent of daily travel has to be in the form of public transport. Several city mobility plans or master plans have (or are in the process of) planning for such a scale and target. But executing such plans will require transformative changes including well integrated, efficient and affordable public transport options with a focussed fiscal strategy.

It is ironic that at a time when travel demand is exploding in cities, public transport ridership is sliding. Service providers are running into losses. Investments are tardy and services are becoming unaffordable for many. Official forecasts show that the investments needed in public transport are humongous. The National Transport Development Policy Committee has estimated that by 2031, Rs 10,900–18,500 billion will be needed for urban transport, out of which public transport alone will hog 55 per cent.

At the same time, the existing undersupply of public transport is unable to sustain itself financially. Fiscal strategies will be needed to keep public transport services affordable for a majority of urban commuters. But massive investment gaps are expected to perpetuate undersupply of public transport services.

How will Indian cities address the twin challenges of 'affordability' and 'financial sustainability' of public transport systems? Policies will have to be defined to determine who pays for the modernization and what fares should be charged. Should only users of the systems pay, even for fixed costs like depreciation and load repayment, etc.? Or should costs also be recovered from the society at large benefitting from improved public infrastructure and decreased pollution?

This challenge of augmenting investments in public transport systems and yet keeping the overall journey cost for commuters affordable is not well understood. Take the example of the Delhi Metro Rail Corporation (DMRC). It raised its fares twice in 2017. It is estimated that the increase in fares varied from 25 per cent to 117 per cent, depending on the length of the journey. The immediate result was fall in Metro ridership, as is evident from its own data. The sudden drop in ridership of the Delhi Metro—approximately by 3.9 lakh passengers between April 2017 and April 2018, is only symptomatic of lack of policy for pricing of all transport services and lack of strategy for funding and increasing ridership of these systems.

The argument that the Metro is a special service for a specific income class and the income group for which it became unaffordable may use bus services instead does not hold, as integrated strategies demand that for public transport to be viable, all modes should be affordable. To a commuter, what matters is the overall journey cost that is determined by the cumulative effect of several interchanges between different modes.

It is an accepted fact that periodic fare hikes are needed in all systems to keep them solvent, to prevent inefficiencies, and to raise money for upgradation and maintenance. While individual systems will try to balance their fare and non-fare revenues to meet their operational and fixed costs, especially with rising pressure of modernization, the government will also have to come up with strategies for urban transport funds, and create a more enabling policy framework. Linking resource mobilization for investments with revenue generation and affordability will require substantial policy focus. Fares are adjusted to recover increase in costs for fuel, maintenance and wages, but there is a limit on how much can be passed on to the commuters. Some part of operational costs and the larger capital costs (depending on the type and scale of the system) are also expected to be mobilized through non-fare means.

If these challenges are not addressed, public transport services will become increasingly unaffordable, investments wasteful and systems sub-optimal. Also, without a sound financial sustainability plan, the systems themselves cannot be modernized and expanded to meet clean and low-carbon mobility targets.

Therefore, in response to the turmoil over Metro fare hike in Delhi, Centre for Science and Environment (CSE) decided to initiate a diagnostic analysis of what it takes to keep public transport and overall journey costs affordable for all city dwellers so that new investments in modern systems—be it the Metro, bus rapid transit system or modern and electric buses—can ensure an effective shift in ridership from personal vehicles to public transport in Indian cities.

CSE, in technical collaboration with Ahmedabad-based Coordinates Consulting, initiated this assessment to examine possible answers to the following (and more such) questions:

- How does one define and account for affordability in public transport while investing to modernize or expand the systems?


VIKAS CHOUDHARY / CSE

**Expansion of public transport is crucial to meet growing travel demand and curb motorization in cities**

- What should be the fare setting and revision mechanism?
- How should the integrated journey cost be reflected within public transport fares?
- What are the best practices for recovering costs outside fare revenue?
- Who other than direct users can and should be asked to pay for public transport?

This study has focussed on overall commuting costs of travel by different and combined modes daily. It has assessed the expenditure an individual makes while using different systems in Delhi, Bengaluru and Ahmedabad that also includes cost of accessing a system. This estimate is not about cost of Metro trips per day alone. Journeys for most residents in Delhi or other cities is not merely about two metro trips a day but interchanges and additional costs incurred to access public transport systems. Usually, city governments and Metro service providers do not account for this fact.

This assessment has thrown up several important questions and insights into fiscal planning for public transport. Some of the key highlights of the assessment are as follows.

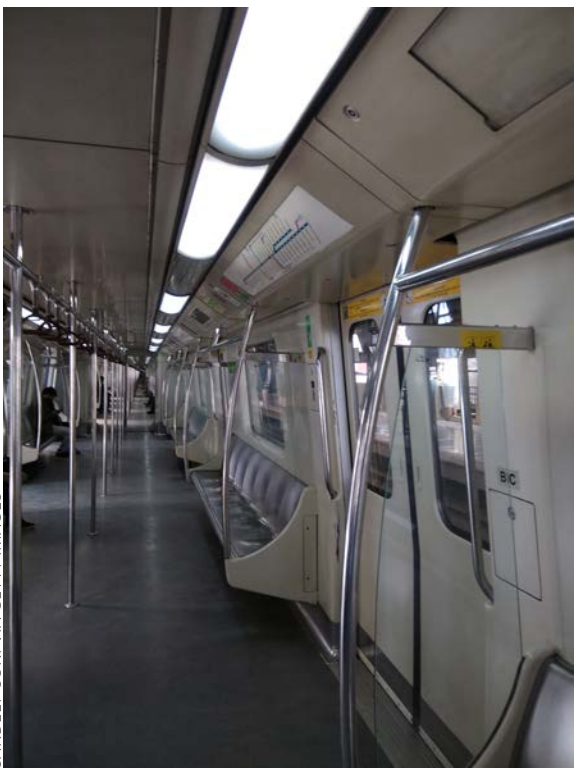
**Why was fare hiked by the DMRC suddenly?** Could it be that the gap between operating expenditure and fare revenue as well as debt liability had become so wide that it prompted this sudden and shocking increase after a long time? The study compared the report of fourth Fare Fixation Committee (FFC) with the annual reports of DMRC to analyze the rationale for the fare hike. Fare revenues were found to be adequate to meet the operating expenditure of DMRC upto 2016–17. A fare hike was still recommended by the FFC. CSE analysis showed that there was an attempt to meet debt servicing expenses plus recover asset replacement cost through an augmentation in fare revenues. The FFC argued in favour of the keeping a ratio called 'cash available for depreciation' positive and healthy to justify the fare hike. What this means is a surplus should be maintained after meeting all expenses and debt liability. This raises larger policy questions for all metros. Can debt liability and asset replacement cost be recovered through fare income? Should not the larger society, and not commuters alone, be responsible to meet capacity creation costs?

**Why did DMRC's forecast of operational expenses mutate all of sudden, justifying the fare hike?** Was this sudden mutation of operational expenses the only reason for the fare hike? Based on data available till 2016–17, fare revenue was adequate to meet operational expenditure. However, the fourth FFC has made a forecast showing a dramatic increase of 74 per cent in projected operational expenditure from 2017–18 onwards. DMRC has held that this is due to Phase III (100 km) of the Metro and revisions in the industrial dearness allowance (DA). The Committee concludes that without a fare hike, there will be a huge operational loss.

The truth is huge operational surpluses are projected to be generated due to the fare hike. Why was there a need to hike the fares so that a large operating surplus could be generated? It appears DMRC hopes to recover almost half of its depreciation costs from this operating surplus. This could be used to pay off the Japan International Cooperation Agency (JICA) loan, whose repayment has kicked in recently after the ending of the moratorium period of 10 years for principal repayment.

Moreover, these projections do not account for the loss of ridership due to the fare hike. Might DMRC have been better off letting natural augmentation of revenue plus the revenue accruing from Phase III protect it, to a large extent, against higher increase in marginal costs?

Again, it is indeed possible that Phase III would have increased marginal costs at a rate higher than marginal revenues. In future too, DMRC's costs may increase with expansion of the Metro



SANDEEP SONI VIA GETTY IMAGES

**Public transport systems need to be affordable to ensure they do not lose ridership**

to lower density areas with sparse ridership. Will the requirement of an expanding Metro as a public service be undermined by considerations of revenue returns? It is a larger policy question for all Metro rail as well as other upgraded systems, including those that are bus-based.

**What is affordable?** This is the critical question. How can modern public transport services remain affordable for the majority without a policy when massive investments are expected? There is no absolute threshold to define affordability of public transport, but globally it is accepted that not more than 10–15 per cent of household incomes should be spent on transport for it to be termed affordable. Alternatively, a cap of 10 per cent income spent on transportation by the poorest 20 per cent of the population is accepted as a benchmark of affordability.

If the criteria of 15 per cent of income spent on transport is considered as the upper cap of affordability, then almost one-third (34 per cent) of Delhi's population stands excluded from basic non-air conditioned (AC) bus services. Now consider the middle income groups—about 30 per cent of the population that earn between Rs 12,500 and Rs 42,000 a month. After accounting for integrated journey costs, based on a conservative estimate that a person using a Metro is likely to spend 25 per cent of the total journey cost to get to the Metro station or to travel from the Metro station to the destination, these income groups spend between 9 and 14 per cent to use AC bus and Metro rail services, making them close to unaffordable for them.

Out of the nine metropolitan cities across the world that have an operational public transit system (bus, tram or Metro) with a per trip cost (for a 10 km trip) of less than half a US dollar (US $), the Delhi Metro remains the second most unaffordable system in terms of the percentage of income needed to spend to travel by it.

Such spending comes at a huge social cost. For poor people, higher spending on transport leads to lower spending on housing, health and education, letting them spiral into greater poverty. As per CSE's calculations, unskilled daily wage labourers in Delhi will spend, on an average, around 8 per cent of their income on travel by a non-AC bus, 14 per cent by an AC bus and 22 per cent by the Delhi Metro. Comparative figures are even higher for Bengaluru and Ahmedabad. If one counts the cost of making interchanges (at the 25 per cent rate derived previously), the total journey cost becomes even more unaffordable.

If the total journey cost were to be around 3–4 per cent, as it is in Singapore, the person could save upto Rs 50 daily. This could mean around 1.5–2 litre of milk every day for the

family. A month's worth of such savings could mean life insurance coverage for a year for four members of the family under the Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) scheme.

**How will India address funding and subsidy for public transport?** Currently, the subsidy cost for each passenger trip by the Metro is enormous. This is particularly true for Metro systems in smaller cities. The difference between cost on the one hand and fare revenue on the other hand per passenger trip is Rs 50 for the Jaipur Metro, Rs 78 for the Lucknow Metro and Rs 28 for the Kochi Metro. Without a fiscal and overall strategy for improving ridership of integrated systems, how can these systems hope to stay afloat?

Given the price sensitivity of Indian commuters—in both poor and middle income groups—we will have to devise locally appropriate systems and create institutional and technological ecosystems to ensure affordable fares and subsidy delivery. How the combination of fiscal support for operators and users will work needs to be worked out. It is also important to address the hidden subsidy that personal vehicles like cars and two-wheelers enjoy. In many ways, two-wheelers are the cheapest mode and travel by cars is also financially competitive with integrated journey costs by public transport. This rationalization is critical to make public transport work. Costs of operating improved public transport cannot be met through fare hikes alone, because that will only catalyze a modal shift to private transport. Subsidies may be needed to meet the deficit to keep public transport affordable per se and vis-à-vis private modes. In India, this subsidy is typically provided to the operator, be it the Metro corporation or State Transport Undertakings (STUs). However, this creates its own challenge, as it does not incentivize improvement in the efficiency of the Metro or STU system, as they know that they can fall back on the subsidy to cover their shortfalls.

**Realities of public transport operators also need to be factored in—costs are increasing for operators but there is limit to fare increase; usage is reducing too.** It is important to factor in the realities of the public transport operators too—whether Metro or bus. Even when some bus operators have access to automatic fare revision systems, they hesitate to use it, for reasons of affordability. Ahmedabad's bus rapid transit (BRT) system is a typical example. Fares have not been increased since 2013 despite legal provisions for an annual increase. In the absence of any larger fiscal strategy this also creates problems for the organization. Eventually, without any other strategy in place, they will reach a stage when shock-increases will become inevitable, as has happened in the case of DMRC.

Bengaluru Metropolitan Transport Corporation (BMTC) uses a slightly different fare revision mechanism for its buses. A fare revision is triggered when the total value of impact (in aggregate terms) due to change in fuel prices and DA crosses a threshold of Rs 0.25 per passenger km. If it is below that, the organization tries to make up for it through productivity improvement. This is an interesting practice worth replicating, as it ensures that the penalty of a transport organization not being productive and efficient is not paid for by the passengers in the form of increased fare. DMRC has decided to include a productivity factor in the calculation of its next FFC.

**New urban transport policies are underfunding sustainable mobility.** Even under the current urban transport programme, the scope of investments is limited and inadequate. According to the twenty-second report of the Standing Committee on Urban Development (March 2018), under the Smart Cities Mission the scale of spending is still low. Since 2014–15, the percentage share of overall annual allocation for the total scheme out of all MoHUA schemes has varied between as low as 8 per cent in 2015–16 to a maximum of 27 per cent in 2014–15 to upto the most recent share of 15 per cent in 2018–19. Of the total allocation to the scheme, the share of urban transport projects is around 21 per cent, which is expected

to finance smart parking, intelligent traffic management, integrated multimodal transport, improved walkability, better overall public transport and a whole gamut of other services.

However, according to information available from the Ministry of Housing and Urban Affairs (MoHUA), road infrastructure (including parking) has the largest share (32 per cent) in this allocation, followed by transit infrastructure that gets 29 per cent and active transport—walking and cycling—that gets the lowest 14 per cent. About 22 per cent funds are set aside for Intelligent Transportation Systems (ITS). As overall spending has remained low, each element is underfunded.

Similarly, till date, of the projects under Atal Mission for Rejuvenation and Urban Transformation (AMRUT), only 7.4 per cent are under urban transport and constitute only 1.75 per cent cost of projects. This is a significantly lower amount compared to share of emissions in cities. The AMRUT scheme has allocated 10 per cent of its annual budget to cities for 'Incentive for Reforms' programme that could help promote urban reforms.

**Imbalance in funding—bus transport, the prime mover, is neglected.** While the buzz is around attracting investments to the sector—both public and private—there is no strategy to stop the slide in ridership in diverse public transport systems. The overall share of public transport fell from 64 per cent in 2001 to 54 per cent in 2010 in Delhi. Within this, bus services are particularly affected. Since 2013–14, DTC bus ridership is declining at an average annual rate of 7.75 per cent, leading to a cumulative drop of 31 per cent by 2017–18. Even BMTC, that has witnessed ridership growth in the past decade, is now facing accumulated losses leading to withdrawal of buses from low-revenue-generating routes, thus creating service deficit. Daily ridership of Brihanmumbai Electric Supply and Transport (BEST) buses is reported to have gone down to its lowest ever, a sharp fall of 40 per cent in the past seven years. Ahmedabad BRT, having expanded its network from a 35 km corridor to a 125 km corridor, has not seen a corresponding upswing in its passenger traffic. Several cities are finding it difficult to run their BRT system. Cities like Vijaywada, that made an early transition to BRT, have stopped operating the system. Clearly, there is dearth of strategies to make buses work for cities. Poor last minute connectivity for public transport, cheap or free parking, subsidized road taxes for cars, and lack on integration and operational reforms are big barriers to the success of buses.

STUs, public bus authorities, carry a vastly higher number of passengers per day compared to Metro systems. In 2017, in Chennai, STU buses carried 88 times more commuters than the Metro; in Bengaluru, 12 times; in Jaipur, 11 times; in Lucknow, 2.4 times; and in Delhi, 1.1 times. If one adds the number of passengers being carried by private buses in these cities, the difference would become even starker.

Yet, funding of the bus system has remained weak. The share of Metro projects in the budgetary allocation of MoHUA increased from 12 per cent in 2009 to 54 per cent in 2017. There is no commensurate increase in the funding of buses. Investments in Metro projects in 2017 were approximately 3.6 times higher than 2010 numbers. A disproportionately high amount of this money is spent by governments on subsidizing Metro systems in Tier II cities. State governments are expected to fund buses.

According to the National Transport Development Policy Committee, urban India would require approximately 196,000 buses with an investment of Rs 1,181 billion by 2031. So far only two schemes have focused on improving bus transport—the older Jawaharlal Nehru National Urban Renewal Mission (JnNURM) and the recent Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles in India (FAME) policy that has funded electric buses in 10 cities.

LOKMAN ILHAN/ANADOLU AGENCY/GETTY IMAGES

**Transit Oriented Development, like the one attempted in the case of Transmilenio, Bogota is an effective tool to ensure the sustainability of a public transport system**

**Without a clear strategy to improve ridership, many Metro projects remain suboptimal.** Many Metro projects have remained suboptimal because of ineffective and inadequate planning and lack of inter-modal integration. The difference between actual and projected ridership in most Metro projects raises questions about their operational sustainability. Existing ridership figures of Jaipur, Lucknow and Chennai Metro rail systems, for instance, show a deficit of greater than 1,000 per cent compared to projected ridership. Metro rails are long-term capital-intensive projects that require integration of mode and land use to realize their benefits. Increasingly, programmes are focussed on urban rail that leaves a majority of cities, especially small- and medium-sized cities, with no transit system. Currently, there are 425 km of Metro rail systems operational in 10 cities, namely Bengaluru, Chennai, Delhi, Gurugram, Hyderabad, Kochi, Kolkata, Jaipur, Lucknow and Mumbai. Approximately 700 km of Metro rail is under construction.

**Global benchmark for Metro affordability.** This study has reviewed the affordability index for transport systems from the UBS study. UBS is a notable global financial institution that annually puts out the cost of living in cities around the world. For comparison, this study has selected cities with systems that have fares less than half a US dollar for a 10 km trip (all rail-based system in all the nine selected cities). Indian cities have been compared with other cities in the developing world as they have similar social and economic realities. Developed countries, with much higher per capita income levels, work in a different affordability paradigm not comparable to Indian cities.

CSE used the same UBS data to look at the percentage of income spent on rail-based systems in some of these cities. The percentage of income required to use the Metro stands at 2.9 per cent in Hong Kong, 4.6 per cent in New York, 5.2 per cent in Seoul, 5.3 per cent in Beijing, 5.7 per cent in Shanghai and 6.6 per cent in Paris. Even London is marginally better than Delhi, with percentage of income spent on travel by Metro standing at 13.4 per cent, compared to Delhi's 14 per cent. Therefore, DMRC's argument about Delhi Metro being more affordable than cities with large Metro networks does not hold much ground.

In fact, in most of these cities, there is no interchange (changing modes during journey) penalty, with the second trip being free on another mode once the fare has already been paid to a system, thus bringing down journey costs considerably. Their policy recognizes the value of considering overall journey cost and does not penalize the passenger for making an interchange to reach the destination. Can commuters of Indian cities also benefit from such an integrated system?

**There is a need of a fiscal strategy for modernization of integrated public transport systems and supportive ecosystems for affordable services.** Big investments are possible only with innovative fiscal strategies to mobilize additional resources. Such investments cannot be sustained only with farebox collections and advertisement. The Metro Policy 2017, National Transit Oriented development Policy (TOD) 2017, and state-level TOD policies have provided for non-fare revenue through land value capture, etc. There is considerable global experience with polluter pay and user pay principles like congestion and emissions pricing, and road and parking pricing to generate additional revenue from the direct and indirect beneficiaries of public transport who enjoy attendant benefits. As this is a very new area of fiscal governance, it will require strong guidance and a legal framework for it to work correctly, particularly in the case of TOD-based systems. It should not be reduced to a real estate-led development instead of public transport-led development. The fiscal strategy will have to be supported by a transit-oriented compact urban form to bring jobs, homes and recreation together to reduce distances to curtail automobile dependence

## STEPS TO BE TAKEN

Urban transport investment plans need to take into account that Indian cities are still far from reporting stabilization, and effective and substantial shifts towards public transport systems. There is no clear strategy for such shifts even when master plans and city mobility plans of several cities have targeted at least 80–90 per cent public transport ridership around 2020 and 2025. Global experience shows that it is very difficult to arrest and reverse slides in public transport ridership. Yet some rich cities like London, Paris and cities in Scandinavia have reported improvements in public transport usage, and walking and cycling modal share. The economics of this transition will have to be addressed along with strategies for urban and transportation planning.

- Develop an ecosystem of alternate sustainable means of finance for public transport authorities
- Commit to multi-year subsidy support for public transport linked to productivity improvements by the authorities
- Adopt scientific fare adjustment mechanisms
- Contain private vehicle proliferation through mode integration
- Use integrated demand aggregation to solve the last mile problem
- Introduce congestion charges along with rationalized parking policy
- Use technology to improve fare collection efficiency
- Introduce demand-side disincentives and taxation
- Rationalize taxes to reduce burden on public transport
- Outsource services for which there is a service provider market with strong guarantees
- Link public transport to viable models in order to ease its access to market funding
- Upgrading to clean fuel technology should be accompanied by efforts to help financial health of public transport authorities
- In the long-run, move towards demand-side subsidies

# 2. THE CONTEXT

Urban transportation is intimately linked with issues of air quality, public health and climate change. Positive transformations in the sector will, therefore, result in co-benefits vis-à-vis these issues. This holds particularly true for public transport.

Action to upgrade and modernize public transport services have started at varying scales and with differing levels of effectiveness. This translates into the upgradation of bus systems and adoption of BRT systems. It also translates into wider adoption and penetration of Metro rail systems. Although a huge deficit in public transport services persists in India, cities are attempting to tackle these problems with a wide array of innovative solutions. However, these solutions have had limited success and have created their own set of problems. For example, Delhi has an extensive Metro rail network that is expanding at a decent pace, but the city is struggling to create an efficient bus transport system. In other cities, for example Bengaluru, the trend has been reversed. Buses are leading the way and Metro rail has been relegated to serve a minute section of the commuter population. Originally, Metro systems were confined to only megacities but now they have penetrated smaller cities like Jaipur and Kochi. Another strategy followed by cities like Ahmedabad and Kochi is integrated public transport systems to provide commuters a range of options.

The success and failure of these initiatives remain contingent on two key parameters:
1. Affordability and inclusiveness of public transport services
2. Financial sustainability of public transport systems

Affordability of public transport services has two components. First, it needs to be seen as a public service which must be well within the means of the poorer sections of the society. Second, public transport must be cheap enough for people to prefer it over private modes


MEETA AHLAWAT / CSE

**An affordable public transport system is key to reversing rampant motorization in cities**

of travel. In many Indian cities, using a two-wheeler is substantially cheaper than public transport. On the other hand, public transport systems need to be financially sustainable, not only to meet current travel demands but to also have the ability to expand and modernize with time. These seemingly contrasting aspects together determine to what extent public transport continues to serve the larger population, thereby preventing it from shifting to personal modes that also aggravate congestion and increase pollution and heat-trapping emissions.

The economics of public transport, therefore, becomes a critical aspect of the larger transition to clean and low carbon mobility. Typically, all public transport systems rely on fares as well as a range of non-fare revenue streams (advertisement, real estate, consultancy, etc.) to meet their costs. For different public transport modes, the ratio of fare revenue or non-fare revenue to operating costs as well as the range of available non-fare revenue sources varies. While fare revenue is in part dependent on the state's fare setting and revision policies, non-fare revenue is partially dependent on the specific agency's competence to utilize all non-fare revenue streams. Finally, these operations take place within the larger ecosystem of taxes and subsidy (to public transport as well as other modes such as cars) that tends to vary across the geography of India.

As a result of this jigsaw puzzle, different cities and systems have had different experiences and varying degrees of success in managing their finances. For example, BMTC operates with relatively high bus fares and couples this revenue with that accrued from other streams. So it was able to make profits until recently. Some other systems, like West Bengal Transport Corporation (WBTC) and Delhi Transport Corporation (DTC), have struggled with low fares and non-frequent fare revision as well as minimal utilization of non-commercial revenue. Still other systems have experienced flashpoints. For example, Delhi Metro revised fares twice within a matter of months in 2017 to catch up with increasing operating costs and debt liability. The revisions snowballed into a major political issue. Given the pace at which cities are investing in capital-intensive rail-based public transport systems in India, the Delhi Metro fare revision hubbub could just be a sign of things to come and a warning to address such issues before they get out of hand.

This context and caveat is the point of intervention of this study. It explores certain key questions. To understand the entire economics of public transport, to figure out what is happening with public transport and why, and to gauge where we are likely headed, these questions are critical:

- How does one define affordability in public transport? Why is it important and how does one account for it in planning and deploying a public transport system?
- What should be the fare setting and revision mechanism for a public transport system? How should it take into account various issues concerning organizational productivity, relative level of service and affordability, apart from the obvious imperative for cost recovery? What are some of the prevailing practices today in Indian and global urban centres and where is the room for improvement?
- How does the ecosystem of taxes within which a public transport system operates have a bearing on fare levels, and how can fares be rationalized?
- How should the integrated journey cost be reflected within public transport fare, and why is it important to do so?
- What best practices exist across cities and systems for recovering costs outside fare revenue? Who other than direct users can and should be asked to pay for public transport? What barriers exist for scaling up these practices? What cost components should be recovered through fare or other means?
- What should be the mechanism for transmitting the subsidy to public transport? Should

subsidies be paid to operators or directly to users (commuters)?
- Are viability gaps in transport inevitable? If yes, how do we learn to be comfortable, as a government, and as a society, with them? Who should bear the burden of the viability gap?

To answer these questions, a carefully designed research approach has been deployed, with a pragmatic attitude towards lack of available and updated data, not to mention lack of sufficient cross-case study research on the subject. The study has carefully selected several public transport systems across India and around the world. These systems meet threshold criteria of at least 10 years of operation, more than one lakh (0.1 million) daily ridership, and over 100 km of route length (see *Table 1: Public transport systems selected for the study*).

## Table 1: Public transport systems selected for the study

| Country | Public transport system | Years of operation | Approximate average daily ridership (million) | Route length (for Metro rail) (km) | Buses under operation | Type of organization |
|---|---|---|---|---|---|---|
|  | Delhi City Bus | 70 | 3 | - | 5,578 | STU under Road and Transport Act, 1950 |
|  | Delhi Metro | 15 | 2.8 | 277 | - | Public Sector Company under Companies Act |
|  | Ahmedabad BRTS | 10 | 0.15 | - | 230 | 100 per cent subsidiary company of Ahmedabad Municipal Corporation |
|  | Ahmedabad City Bus | 71 | 0.7 | - | 750 | Transport Committee formed as per Bombay Provincial Municipal Corporations Act, 1949 |
|  | Bengaluru City Bus | 21 | 5 | - | 6,400 | Fully owned subsidiary of KSRTC |
|  | Singapore Bus Systems | SBS: 45<br>SMRT: 14 | 3.9 | - | > 5,000 (combined) | Limited Companies<br>Regulated by Land and Transport Authority (LTA)—Government of Singapore Agency |
|  | Singapore Metro | 31 | 3.1 | 200 | - | LTA |

| Country | Public transport system | Years of operation | Approximate average daily ridership (million) | Route length (for Metro rail) (km) | Buses under operation | Type of organization |
|---|---|---|---|---|---|---|
|  |  Hong Kong Metro | 39 | 4.8 | 218 | - | MTR Corporation Ltd— Public Limited Company |
|  |  London Bus System | 19 | 6 | - | 8,500 | Transport for London— Government Department |
|  |  London Metro | 155 | 5 | 400 | - | |
|  |  Bogota BRTS | 18 | 2.2 | - | 2,000 | Office of the Mayor— Bogotá |

*Note: *The Road Transport Corporation Act, 1950*
*Source: Websites of respective public transport systems and other web-based sources*

The selected systems were studied for their fare revision and affordability practices besides their financial state, source of funding and methods of apportionment of their capital and operating costs. Data was mainly sourced from fare revision reports, financial statements, funding agreements, research and studies on public transport systems, and some articles and news items. Summarized data was also used for other bus systems in India registered with Association of State Road Transport Undertakings (ASRTU). Studies based on global Metro member associations such as CoMET and Nova were also used. No primary surveys of passengers were conducted but interviews were conducted for some systems. Besides these, a large number of research studies on the subject were consulted for understanding the theoretical underpinnings of the debate. While more research could reveal more evidence, we believe that it will only strengthen the conclusions drawn here.

# 3. AFFORDABILITY

In basic terms, 'affordability' refers to an individual's ability to purchase goods and services. The affordability of transportation can be defined as the extent to which an individual or household can financially afford to travel when and where they want.[1] Transportation affordability can be measured by evaluating people's financial ability to travel using public transport systems.

Generally speaking, researchers have focussed on defining affordability of transportation in terms of the percentage of income people spend on it. However, researchers and policy makers disagree over the exact proportion. Typically, the proportion of household expenditures devoted to transport by 20 per cent lowest-income households can be considered a measure of affordability of public transport systems.[2] One group of researchers consider that there is an affordability problem with public transport when more than 10 per cent households spend more than 15 per cent of their income on work-related trips.[3] The South African government established 10 per cent income as a policy benchmark in its 1996 White Paper on Transport Policy.[4&5]

However, if we go only by the actual percentage of income spent on transportation, it may not always present a clear picture. For example, while studies have shown that it is not clear that households spending less than 10 per cent of income (or expenditure) on transport are necessarily better off than people that spend more,[6] it may be because the high cost of public transport is forcing poorer sections of the society to walk or cancel trips altogether. If this is true, it will also skew the data by showing that a smaller percentage of population spends above the threshold of affordability on transportation. A study carried out by Carruthers, Dick and Saurkar in 2005 uses a fixed basket of trips to estimate an affordability index.[7] They define affordability as 'the ability to make necessary journeys to work, school, health and other social services, and make visits to other family members or other urgent journeys without having to curtail other essential activities.' Operationally, they use the percentage of monthly per capita income (or the per capita income of the lowest quintile of the income distribution) required to make sixty trips per month in each city.

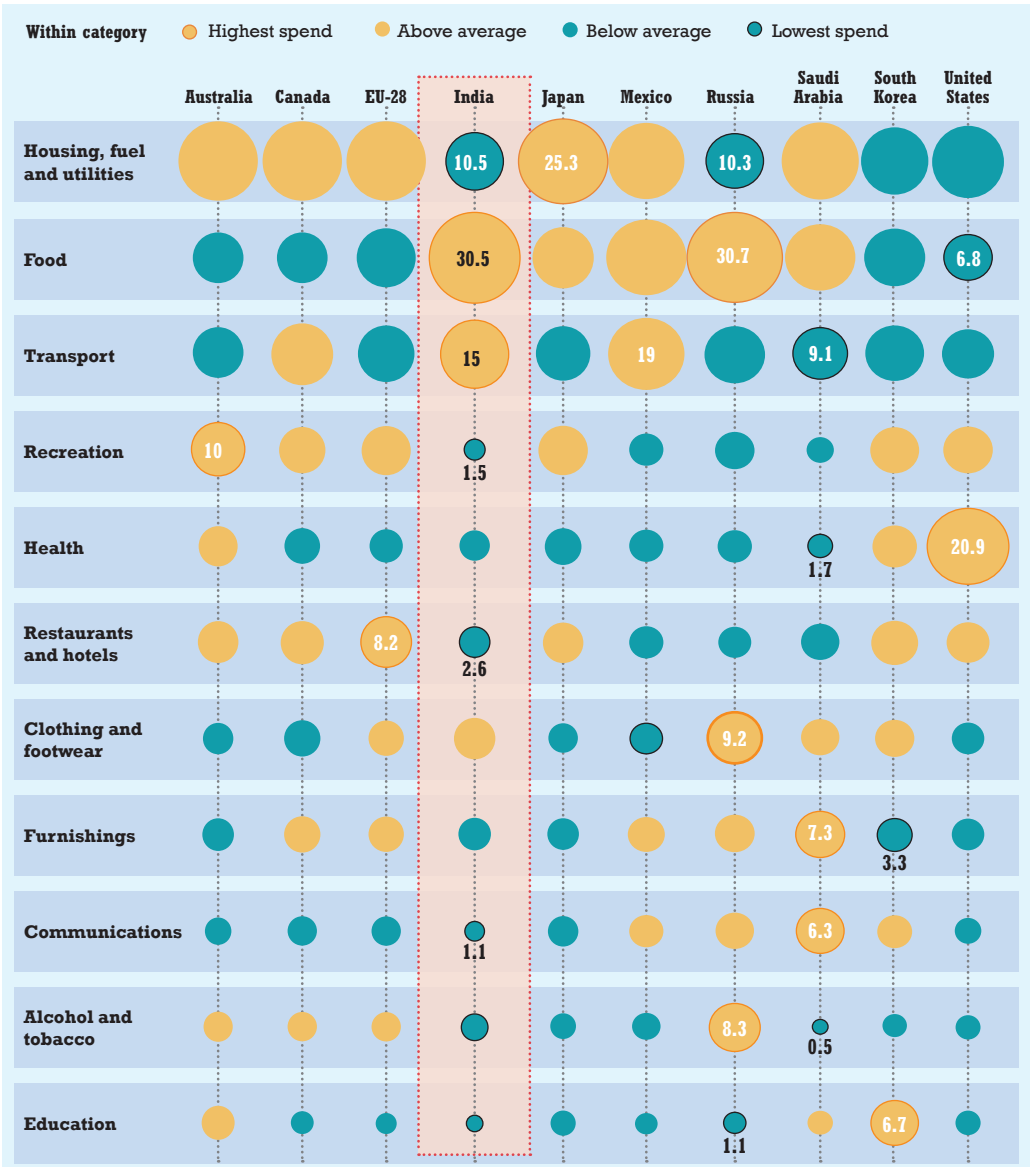
Various studies have, thus, adopted the threshold of 10–15 per cent income spend on transportation as the upper cap for a system to be called affordable. Further discussions with academics and experts can help refine this definition.

## AFFORDABILITY IN THE INDIAN CONTEXT

Based on these widely accepted definitions, an assessment in the Indian context reveals that, on an average, almost 15 per cent household income in India is spent on transportation. This is the upper cap of most definitions of affordability and exceeds some other affordability caps (see *Table 2: Item-wise household spending in various countries*).

Indian households spend the highest percentage of income on food, and the second highest on transportation. Higher spending on transportation leads to lower spending on housing, and health and education services. This hampers the inclusive growth of the society.

## Table 2: Item-wise household spending in various countries*




*Note: * 2013 figures*

*Source: Eurostat, Director General of European Commission*

This point becomes clearer on a closer examination of public transport systems of three selected cities, i.e., Ahmedabad, Bengaluru and Delhi. An unskilled daily wage labourer in Delhi has to spend around 8 per cent income on transportation if they travel by a non-air conditioned (AC) bus, 14 per cent by an AC bus, and 22 per cent by the Delhi Metro. The corresponding figures for Ahmedabad (19 per cent if travelling by the premium BRTS services) and Bengaluru (19 per cent if travelling by an AC bus, and 13 per cent by a non-AC bus) are equally unflattering (see *Table 3: Percentage of income spent on transport in selected Indian cities*).

## Table 3: Percentage of income spent on transport in selected Indian cities

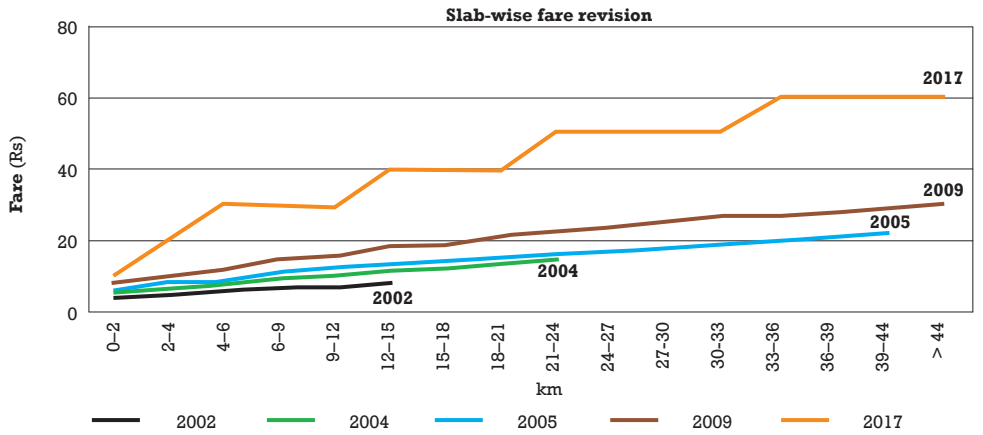
| Name of the city | Minimum wages (Rs per day)* | | Monthly income (Rs)** | | Average trip length (km)*** | Fare | | Monthly Expenditure on PT (Rs) ***** | Percentage of transportation expenses over total income | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Skilled | Unskilled | Skilled | Unskilled | | Mode of public transport | Fare (Rs per trip) **** | | Skilled | Unskilled |
| Delhi | 648 | 534 | 16,848 | 13,884 | 12.9 | Non-AC bus | 15 | 1,170 | 7 | 8 |
| | | | | | | AC bus | 25 | 1,950 | 12 | 14 |
| | | | | | | Metro | 40 | 3,120 | 19 | 22 |
| Bengaluru | 565.54 | 471.95 | 14,704 | 12,271 | 11.9 | Non-AC Bus | 20 | 1,560 | 11 | 13 |
| | | | | | | AC bus (*Suvarna*) | 30 | 2,340 | 16 | 19 |
| | | | | | | AC bus (*Vajra*) | 60 | 4,680 | 32 | 38 |
| Ahmedabad | 329.2 | 312 | 8,559 | 8,112 | 9.71 | BRTS | 20 | 1,560 | 18 | 19 |
| | | | | | | City bus | 12 | 936 | 11 | 12 |

*Sources: * Minimum wage Notification of Delhi, Karnataka and Gujarat as in April 2018*
*** Estimated considering 26 working days in a month*
**** Census 2011*
***** Prevailing Fare of 2018*
****** Considering three trips per day by accounting two working trips and one non working trip by dependent*

Except in case of non-AC bus services in Delhi, the lower income group needs to spend more than 10 per cent monthly income on premium transportation services in all three cities. If the costs of integrated journeys (including interchanges at a conservative estimate of 25 per cent of the system cost) are considered, the proportion of income spent on transportation rises further. Additional trips required to access schools and health facilities increase these costs significantly. This indicates that premium public transport services are beyond the reach of lower-income groups—a sizeable majority in any city.

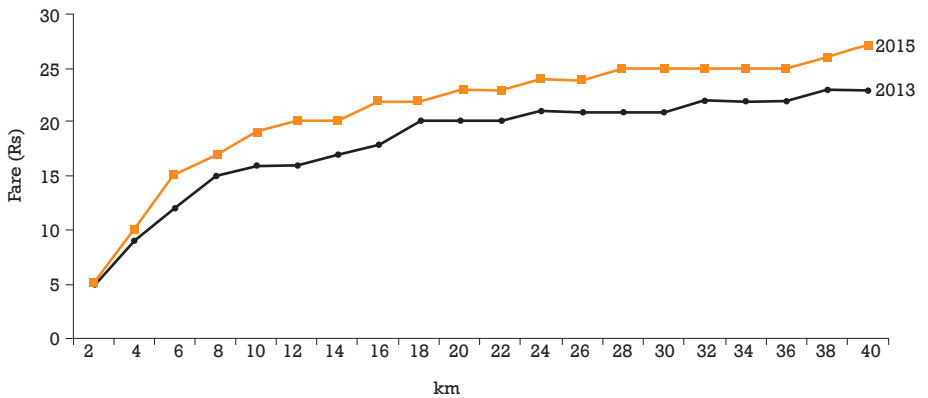
It is pertinent to note here that journey fares beyond the level of affordability promotes a modal shift to private vehicles, particularly two-wheelers or, even worse, create a large pool of population that cannot afford any kind of motorized transport. Fares for passenger services in the Delhi Metro can be revised according to the recommendations by the FFC constituted by the Central Government. This process is guided by the Delhi Metro Railway Act, 2002. Four such FFCs have been constituted since the inception of DMRC. All of these committees have been chaired by retired High Court judges with one member representing the Central Ministry of Housing and Urban Affairs (MoHUA) and another member representing the government of National Capital Territory (NCT) of Delhi. Fare revisions for Ahmedabad BRTS and BMTC, Bengaluru are governed by the fare revision formula fixed and notified by the respective state governments (see *Graph 1: Fare revisions of Delhi Metro*; *Graph 2: Fare revisions for non-AC buses of BMTC* and *Graph 3: Fare revisions of BRTS, Ahmedabad*).

## Graph 1: Fare revisions of Delhi Metro



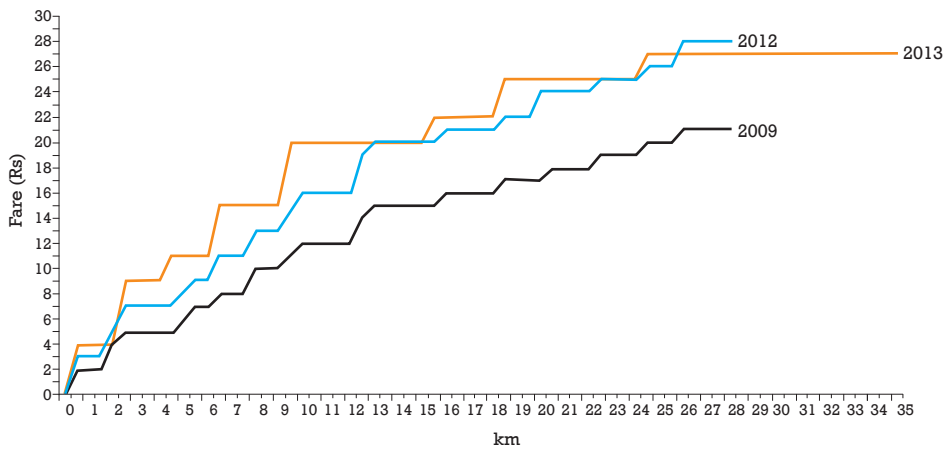

*Source: Fourth Fare Fixation Committee Report*

## Graph 2: Fare revisions for non-AC buses of BMTC




*Source: BMTC*

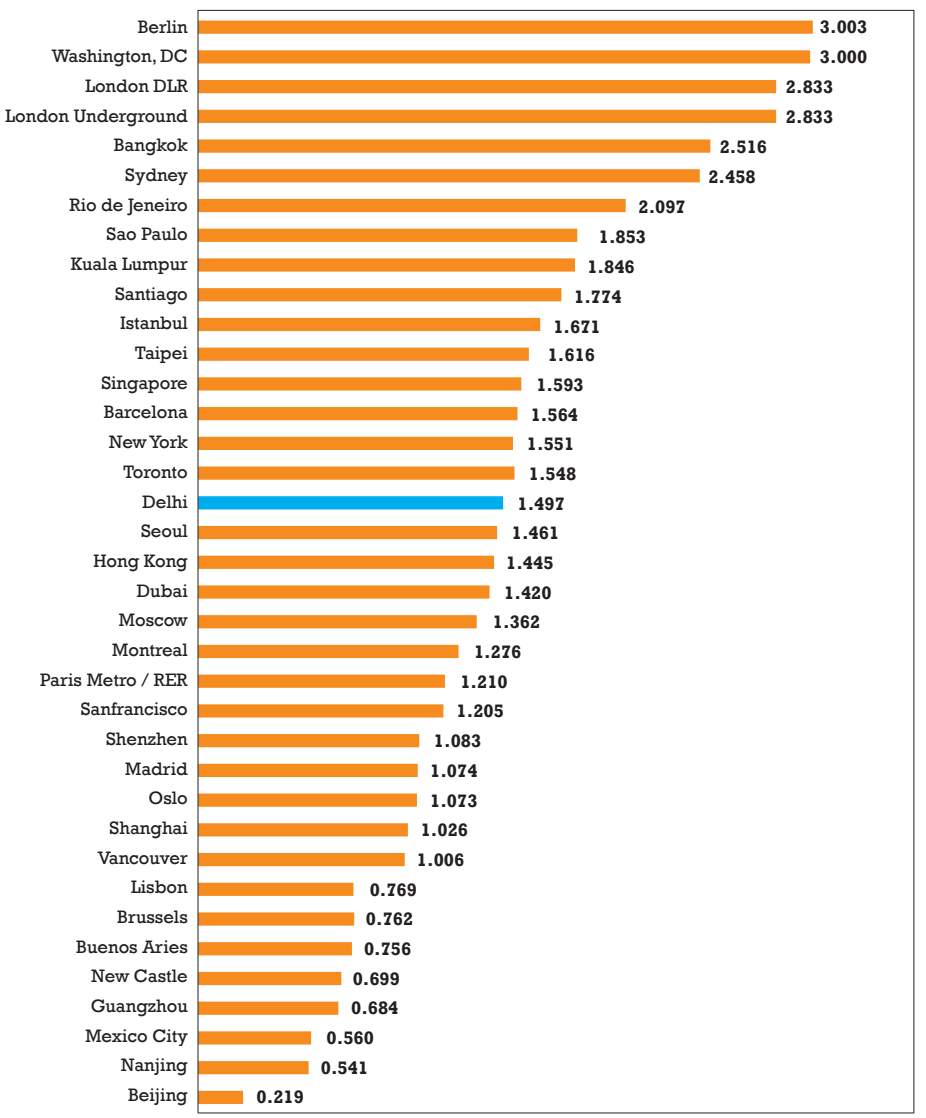
## Graph 3: Fare revisions of BRTS, Ahmedabad




*Source: CEPT University and Ahmedabad Janmarg Limited*

A comparison between different members of the CoMET and Nova Metro Systems is quite insightful. (Comet and Nova are Metro membership organizations comprising 37 members.) Metro fares for a 10 km trip for commuters travelling by CoMET and Nova Metro systems have been compared using purchasing power parity. Of the 37 members of CoMET and Nova Metro systems operational in different cities across the world, Delhi Metro's fare is higher than 20 (see *Graph 4: Comparison of fare of members of CoMET and Nova Metro system using purchasing power parity*).

## Graph 4: Comparison of fare of members of CoMET and Nova Metro system using purchasing power parity*




** In US $*

*Source: CSE analysis*[8]

**Table 4: Comparison of affordability of Metro systems in India**

| City | Minimum wages (Rs per day) | | Monthly income (Rs) | | Average trip length (km) | Metro fare (Rs per trip | Monthly expenditure on public transport (Rs) | Percentage of transportation expenses over total income | |
|---|---|---|---|---|---|---|---|---|---|
| | Skilled | Unskilled | Skilled | Unskilled | | | | Skilled | Unskilled |
| Delhi | 648 | 534 | 16,848 | 13,884 | 12.9 | 40 | 3,120 | 19 | 22 |
| Bengaluru | 565.54 | 471.95 | 14,704 | 12,271 | 11.9 | 35 | 2,730 | 19 | 22 |
| Mumbai | 541.38 | 495.23 | 14,076 | 12,876 | 12.27 | 40 | 3,120 | 22 | 24 |
| Hyderabad | 461.63 | 318.62 | 12,003 | 8,284 | 9.0 | 35 | 2,730 | 23 | 33 |
| Chennai | NA | | | | 8.41 | 40 | NA | | |

*Source: Minimum wage notifications of Delhi and Karnataka as in April 2018, websites of paycheck and labour news providing labour-related legal information. Average trip length has been taken from Census 2011*[9]

Delhi Metro's fare is higher than the prominent Metro systems of Asian cities such as Beijing, Dubai, Guangzhou, Hong Kong, Seoul, Shanghai, and Shenzen. It is even higher than fares of Metro systems in cities in developed countries, like Brussels, Madrid, Oslo, Paris and San Francisco. Having analyzed the members of CoMET and Nova, it is relevant to assess affordability of Metro systems operational in Indian cities (see *Table 4: Comparison of affordability of Metro systems in India*).

Metro systems in Indian cities charge Rs 35 or Rs 40 per trip. Unskilled and skilled daily wage labourers have to spend around 20 per cent of their income on transport, if integrated journey cost is considered. This is higher than the global benchmark of 10–15 per cent, making travel in Indian Metro systems unaffordable for lower income groups.

## AFFORDABILITY IN THE CONTEXT OF FARE ADJUSTMENT POLICIES

Given the adverse findings on affordability, it becomes necessary to assess how public transport systems across India look at affordability, and to what extent they account for it in their fare policies. A review of the public transport system of the selected three cities reveals there is barely any accounting for affordability (see *Table 5: Parameters of fare revision in public transport systems in the three cities*). We have reviewed data to understand how the three systems—Metro, bus and BRT—take affordability into account. It turns out that increase in dearness allowance (DA) and inflation as measured by the wholesale price index (WPI) and consumer price index (CPI), etc. are used to justify increase in fares. Affordability in terms of share of income (as per global benchmarks) used up in commuting, or willingness-to-pay surveys are not given due importance.

## Table 5: Parameters of fare revision in public transport systems in the three cities

| City | Public transport system | Time interval at which fare is revised | Legal basis | Parameters of fare revision | How affordability is taken into account |
|---|---|---|---|---|---|
| Delhi | Metro | No fixed interval. Revised as per the recommendations of FFC constituted by the Central Government | Provision of constitution of FFC as per Delhi Metro Railway (Operation and Maintenance) Act, 2002 | • Costs (energy, staff, maintenance and others)<br>• Affordability | • Comparison of fare increase with per cent increase in DA and minimum wages<br>• Commuter surveys (only Fourth FFC undertook such a survey in the form of advertisement at stations. Sample size was 498 vs a daily ridership of 28 lakh) |
| Bengaluru | Bus services | As and when the combined effect of changes in diesel prices and DA exceeds Rs 0.25 per passenger km | As per a state government's order of 30 September 2000 | Fuel costs and DA | • Increase in DA is considered to represent increase in wages<br>• Setting low fare for non-premium services<br>• Affordability Index, willingness-to-pay surveys, etc. are not considered |
| Ahmedabad | BRTS | Annual | A Gujarat government notification of 2 January 2012 | Fuel cost and WPI | • Fare revision is linked with WPI<br>• AJL has been able to revise fare only twice since it commenced operations ten years ago |

*Source: CSE analysis based on fare revision mechanism of the three systems*

# DELHI—COUNTING CHICKEN BEFORE THEY HATCH

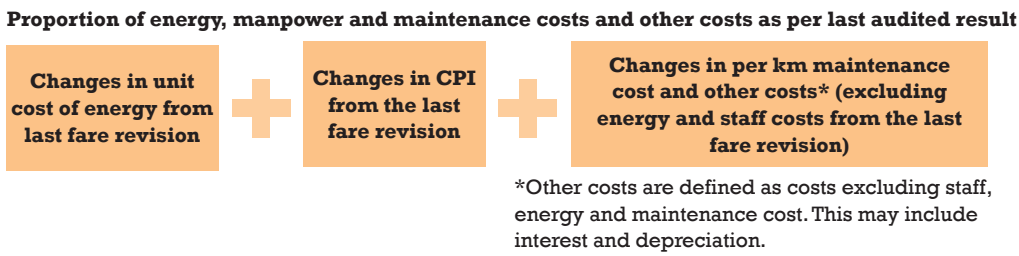

VIKAS CHOUDHARY / CSE

**Will the expansion of Delhi Metro come at the cost of excluding the poorer sections of society?**

DMRC's fare policy (as per the Fourth Fare Fixation Committee's Report) justifies increase in fare due to increase in DA, inflation as measured by consumer price index (CPI), etc., and increase in minimum wages (to justify affordability). Increase in DA is a valid parameter for an operator to justify increase in costs. Generally, it cannot be extrapolated to justify affordability as it ignores the realities of affordability for people employed in the informal economy. Robust willingness-to-pay surveys and estimation of income profiles of users are not conducted to adequately inform the fare revision process and the likely consequences. Only the fourth FFC undertook a willingness-to-pay survey by putting advertisement at stations, but a sample size of 498 vs a daily ridership of 28 lakh cannot be said to have provide adequate data. Often, official increase in minimum wages is not observed on the ground.

Fare Fixation Committees that revise Delhi Metro's fares are ad hoc, as per the provisions of the Metro Act. An independent and permanent committee that continuously reviews all parameters using passenger surveys, data from the transit authorities and other sources is needed. Otherwise, the ad hoc committees will continue to indulge in fire-fighting rather than taking the long view. Case in point is the fourth FFC using CPI and capping fare increase at 7 per cent per annum. Instead of introducing a 'productivity factor' into the calculations now, it has left the matter for the next FFC to decide. A productivity factor would shift some of the onus of reaching

## Figure 1: Annual fare revision mechanism suggested by the Fourth Fare Fixation Committee




*Source: Fourth Fare Fixation Committee report*

financial maturity to Metro authorities, goading them towards the use of new and innovative methods to make money, while unburdening commuters of a portion of the fare hike, making the Metro a viable and attractive option to them (see *Figure 1: Annual fare revision mechanism suggested by the Fourth fare Fixation Committee*).

If the 7 per cent cap on annual fare hike, as suggested by the fourth FFC, is taken into account, per trip (considering an average trip length of 12.9 km) cost in DMRC would be Rs 31 in 2017 (as it was Rs 18 in 2009). This is lower than the Rs 40 actually recommended by the Committee after the second fare hike in October 2017.

Again, if DMRC's own contention of 30 per cent of its commuters being in the Rs 20,000 per month income bracket is used, then affordability ratios are not convincing (see *Table 6: Affordability ratios for 30 per cent commuters of DMRC*).[10]

If the integrated journey costs, including last mile costs, are considered, then commuters in the bracket of Rs 20,000 monthly income have to spend 19.5 per cent of their monthly income on transport, making it unaffordable. However, the percentage increase in fare has been justified by the fourth FFC by linking the fare increase to increase in DA (see *Box: Affordability according to fourth Fare Fixation Committee report*).

## Table 6: Affordability ratios for 30 per cent of commuters of DMRC

| Particular | Details |
|---|---|
| Monthly income of 30 per cent commuters of DMRC as per the Fourth Fare Fixation report | Rs 20,000 |
| Average trip length as per Census 2011 | 12.9 km |
| Fare for average trip length | Rs 40 |
| Affordability Index | Rs 40 (per trip) x three trips per day x 26 days = 15.6 per cent of Rs 20,000 |
| Integrated Affordability Index (taking into account last mile costs as 25 per cent of the main trip cost) | Rs 50 (per trip) x three trips per day x 26 days = 19.5 per cent of Rs 20,000 |

*Source: CSE analysis*

## Affordability according to the fourth Fare Fixation Committee report

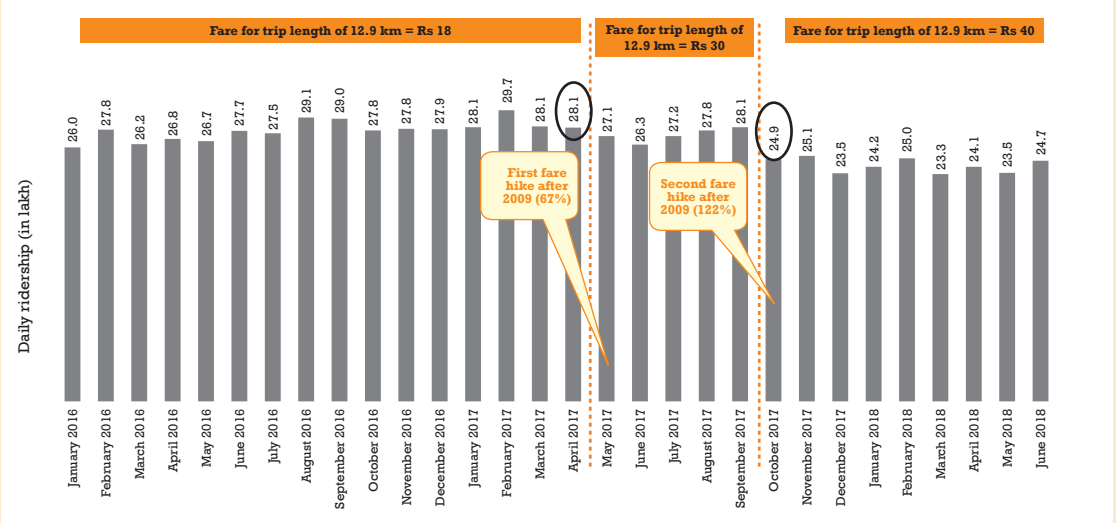
**6.4.2: Affordability of fare:** The ridership of the Metro and any other public transport system is extremely sensitive to the fare. An affordable fare is critical for attracting ridership which, in turn, in key to the business viability and also to serve the commuters' need. In any public utility transport project, it is very difficult to satisfy every section of the society and there will always be certain amount of hue and cry from various sections. However, considering long-term sustainability of providing Metro rail service to the public, it is necessary to have a fine balance between affordability and financial sustainability.

**7.10: 1:** The average increase in the fare structure recommended by the Committee staggered in two Phases is about 51 and 27 per cent respectively. The Committee noted that since the last fare revision in 2009, the Industrial DA has increased by 95.5 per cent (112.4 per cent in March 2016 vs 16.90 per cent in 2009), and the Central DA has increased by 103 per cent (125 per cent in March 2016 vs 22 per cent in 2009). The Committee further noted that the minimum wages applicable for unskilled, semi-skilled and skilled workers have increased by 143.21 per cent, 158.1 per cent and 166.68 per cent respectively during the same period. In addition to this, the government of National Capital Territory of Delhi (GNCTD) recently proposed an increase in the minimum wages applicable for different category of workers by 50 per cent and government of India has also hiked the minimum wages for unskilled non-agricultural workers by 43 per cent. Therefore, the proposed fare revision is affordable.

*Source: Fourth Fare Fixation Committee of Delhi report. Edited for style and consistency*

**As a result of not accounting for affordability of an entire journey, including last mile connectivity costs, DMRC risks losing patronage. This was observed in the post fare hike period (*see Graph 5: Decline in DMRC's daily ridership in the post-fare hike period*).**

## Graph 5: Decline in DMRC's daily ridership in the post-fare hike period



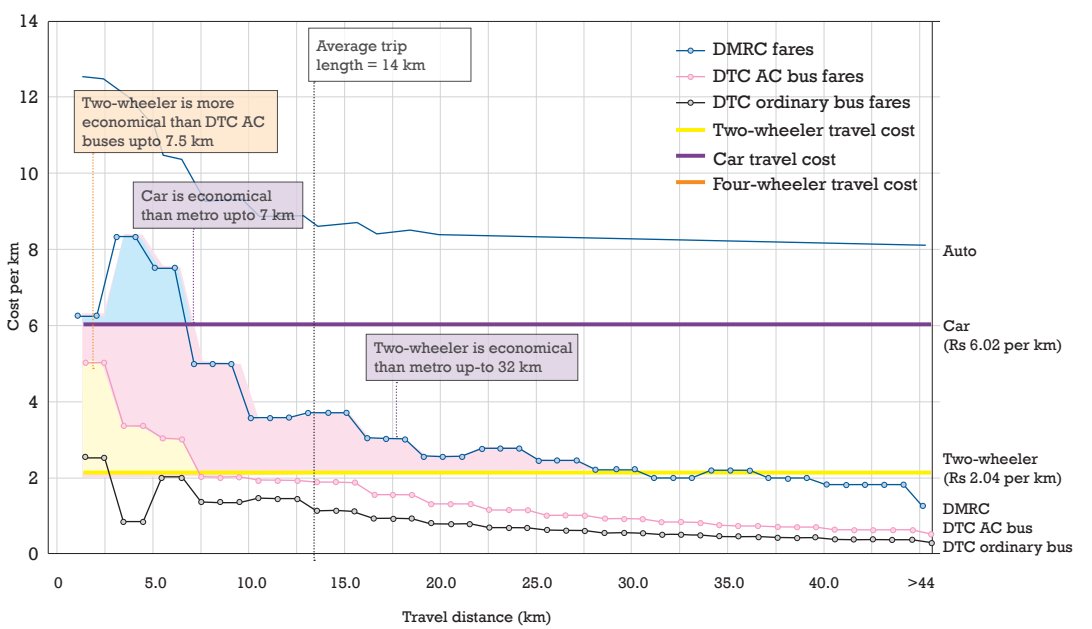

*Source: DMRC's replies to RTI queries dated 9 August 2018 and 28 September 2018*

DMRC has hiked fares twice since 2009. The first fare revision was implemented in May 2017 and the second one in October the same year, with a combined rise of 91.5 per cent over the 2009 fare. As a consequence, daily ridership started to decline immediately. Even after nine months (when this review was done), daily ridership had not been restored to the pre-hike levels. Instead, it continued to plummet through 2018. For instance, by May 2018 it had declined by 4.6 lakh and 5.5 lakh from September 2017 and September 2016 respectively. This caused a modal switch to buses and personal vehicles. During the same period, daily ridership of DTC and cluster buses had increased by almost 2 lakh and crossed the 40 lakh mark.[11]

Decline in ridership is due to the lagged effect of demand elasticity. An analysis of travel cost by different modes substantiates the fact of demand elasticity (see *Graph 6: Mode-wise travel cost*). It is evident that two-wheelers are the cheapest mode of transport, cheaper than even DTC buses for the average distance of 7–10 km. Delhi Metro is costlier to use than two-wheelers and cars upto 32 km and 10 km travel distance respectively, if marginal costs of two-wheelers and cars are considered.

One way to prevent ridership decline is to create a system of regular price hikes. This will ensure that organizations will not let losses grow and inefficiency creep in till they reach a point where a shock-worthy hike becomes inevitable. But it might not always work, since abrupt and large fare hikes are not always ground in sound economics. For example, even before the fare hikes, fare revenue of the Delhi metro was enough to meet operational expenditure (see *Graph 7: Expenditure on operations vs fare revenue of DMRC*).

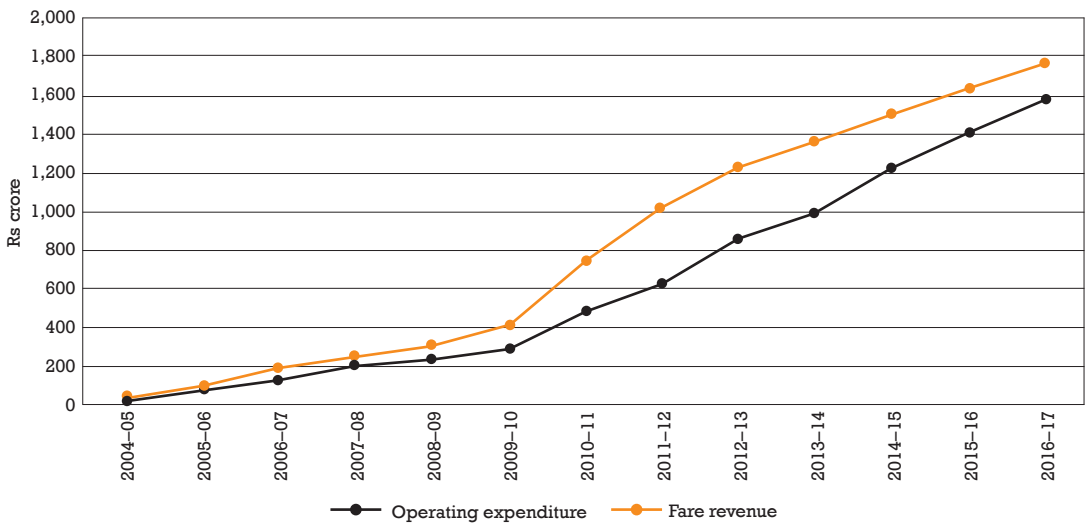
## Graph 6: Mode-wise travel cost*




** Rs per km*

*Source: CSE analysis*[12]

## Graph 7: Expenditure on operations vs fare revenue of DMRC



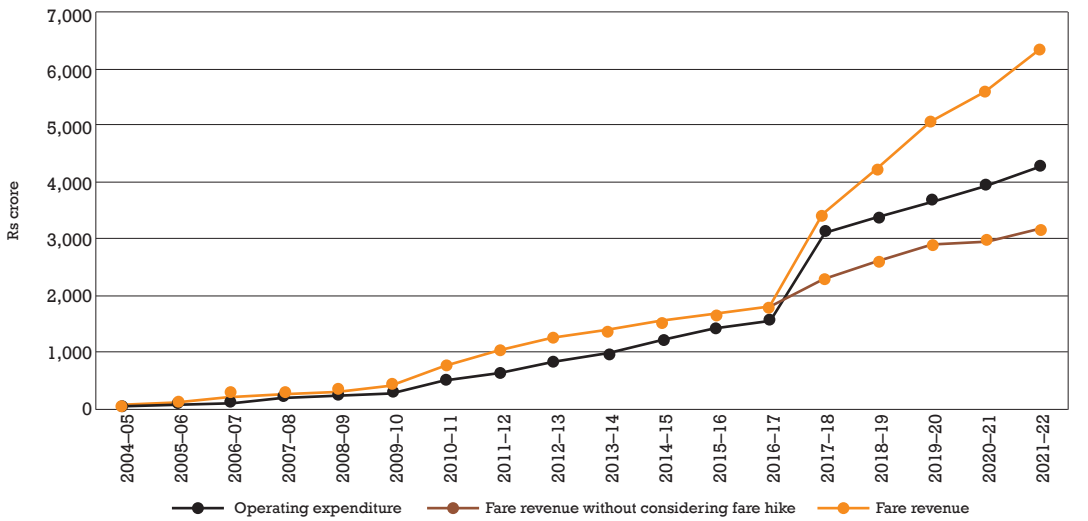

*Source: DMRC annual reports upto 2016–17*

The question then is why did the fourth FFC recommend a fare hike? Well, a comparison points out that the operating profit, after considering net income from non-fare revenue, was Rs 757 crore for 2015–16 (operating profit for 2015–16 was Rs 243 crore). However, an attempt to recover debt servicing expenses for the JICA loan (Rs 587 crore—principal + interest) in 2015–16) plus depreciation cost for asset replacement prompted a sudden fare hike of 91.5 per cent in 2017 (from 2009 fare levels). The FFC argued in favour of keeping a ratio called 'cash available for depreciation' positive and healthy to justify the fare hike. This implied that a surplus should be maintained after meeting all expenses and debt liabilities. The rationale provided for this is to make available adequate surplus for asset replacement after meeting all expense and debt liability to ward off negative consequences of deterioration of services in case assets do not get replaced in time. While timely asset replacement is an important factor, it would not be logical to recover its cost through only fare income. The larger society (and not the commuters alone) should be made responsible to meet capacity creation costs.

A closer examination of the data reveals that even if only the actual fare revenue (upto 2016–17) was considered, it was enough to meet DMRC's operational expenditure. A substantial fare hike would not be justifiable. The fourth FFC went around this problem by forecasting a 74 per cent increase in operating expenditure from 2017–18 onwards. DMRC held that this will be due to the Phase III (100 km) and industrial DA revision. So if fare was not hiked, there would be huge operational losses. In this context, the operational sustainability with and without the fare hike, using ridership figures specified in the report by the fourth FFC , has been analysed (see *Graph 8: DMRC's expenditure on operations vs fare revenue with and without the fare hike*).

It is clear that revenues far exceed operating expenses. Huge surplus revenue will be generated due to the fare hike (impact of loss in ridership not considered). What was the need to generate surplus at the risk of losing ridership? DMRC hopes to recover almost half of its depreciation costs from the operating surplus. This could be used to pay off the JICA loan, the repayment of which has kicked in recently due to end of the moratorium of 10 years for principal repayment.

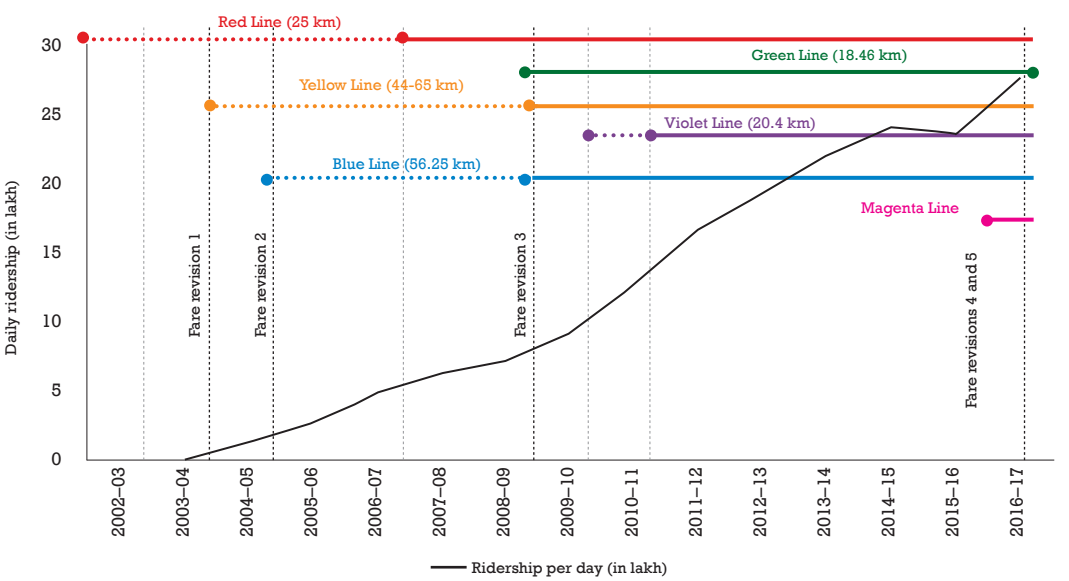
## Graph 8: DMRC's expenditure on operations vs fare revenue with and without the fare hike




*Source: DMRC annual reports and fourth FFC report*

It is necessary to examine the argument that Phase III would have increased marginal costs at a rate higher than marginal revenues (see *Graph 9: Impact of network expansion on DMRC's ridership*). DMRC's ridership, barring a brief stagnation around 2014–15, has constantly increased with or without network expansion. So some natural increase plus increase due to Phase III would have protected it, to a large extent, from higher marginal costs.

## Graph 9: Impact of network expansion on DMRC's ridership

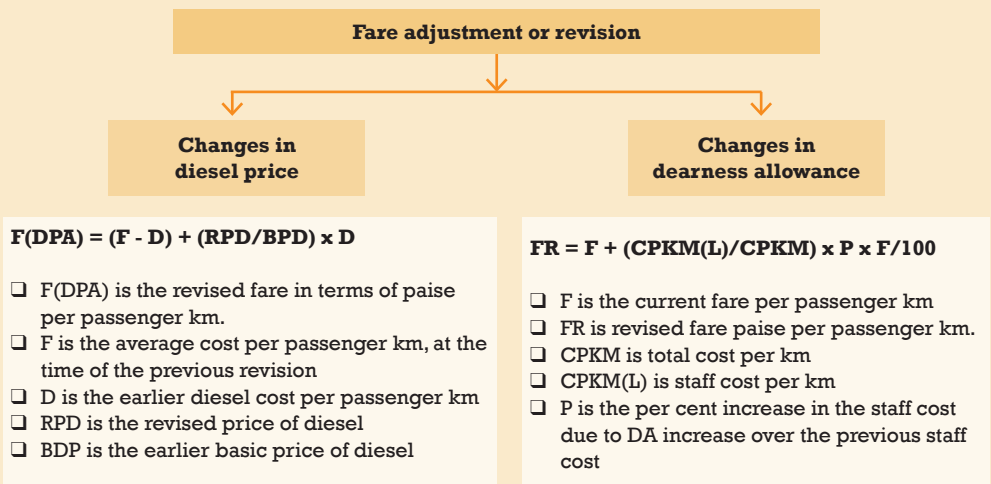



*Source: DMRC annual reports*

# AHMEDABAD AND BENGALURU—FINE FORMULAE, POOR IMPLEMENTATION

While DMRC constitutes ad hoc FFCs for fare revisions as per the Metro Act, BMTC and Ahmedabad BRTS have fixed fare revision formulae notified by the respective state governments. BMTC uses a unique fare revision mechanism (see *Figure 2: Fare revision formula of BMTC*). A fare revision is triggered when the total value of impact due to change in fuel prices and DA crosses a threshold of Rs 0.25 per passenger km. As long as the impact stays below that, the organization tries to make up for it through productivity improvement. This is a valuable practice that needs to reflect in fare revision practices across cities, as it ensures that commuters are not penalized for organizational lack of productivity and efficiency. (DMRC has agreed to consider a productivity factor in the calculations of the next FFC.)

## Figure 2: Fare revision formula of BMTC

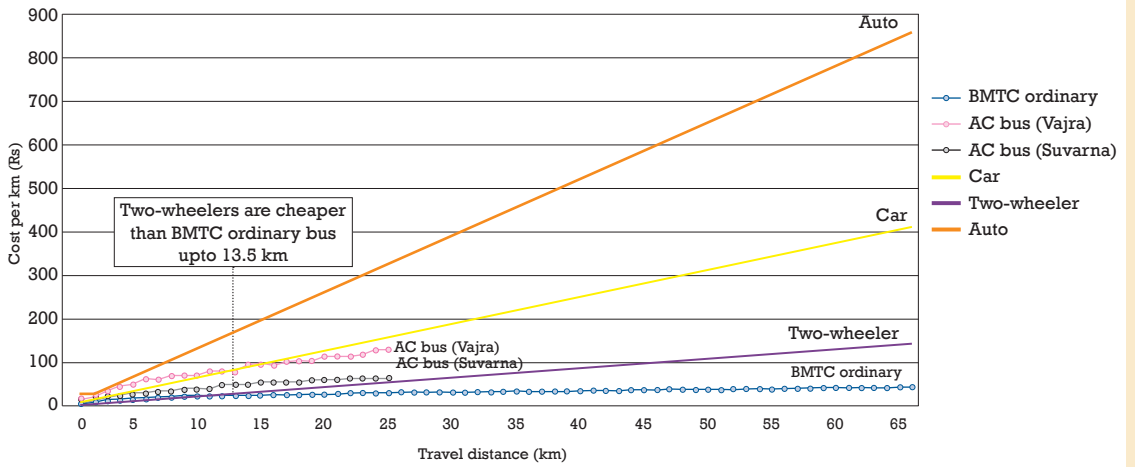



*Note: Fare revision triggers if the combined effect of changes in diesel price and DA on fare exceeds Rs 0.25 per passenger km*

*Source: BMTC*

The last fare revision by BMTC was implemented in 2014–15. BMTC witnessed an 8 per cent decline in ridership immediately after the fare revision.[13] Data pertaining to ridership in ordinary and AC buses during pre- and post-fare hike period could have thrown more light on demand elasticity but it is not available. Total daily ridership of BMTC declined to 45 lakh in 2017–18, compared to 51.3 lakh in 2014. The reduction in ridership is on account of increase in vehicular numbers, specifically two-wheelers (70.28 lakh) and four-wheelers (13.58 lakh).[14] Interestingly, the population of Bengaluru is 84.43 lakh as per the 2011 Census, matching the vehicle population. Many other factors such as higher disposable income, introduction of Namma Metro, app-based cabs, illegal taxis and the comparatively high fares of BMTC (as against two-wheelers) also contributed to the decline in ridership. In this context, a cost comparison of two-wheelers and four-wheelers with BMTC buses demonstrates that two-wheelers are cheaper than even ordinary buses upto 13.5 km (see *Graph 10: BMTC fare vs cost of travelling by other modes*).

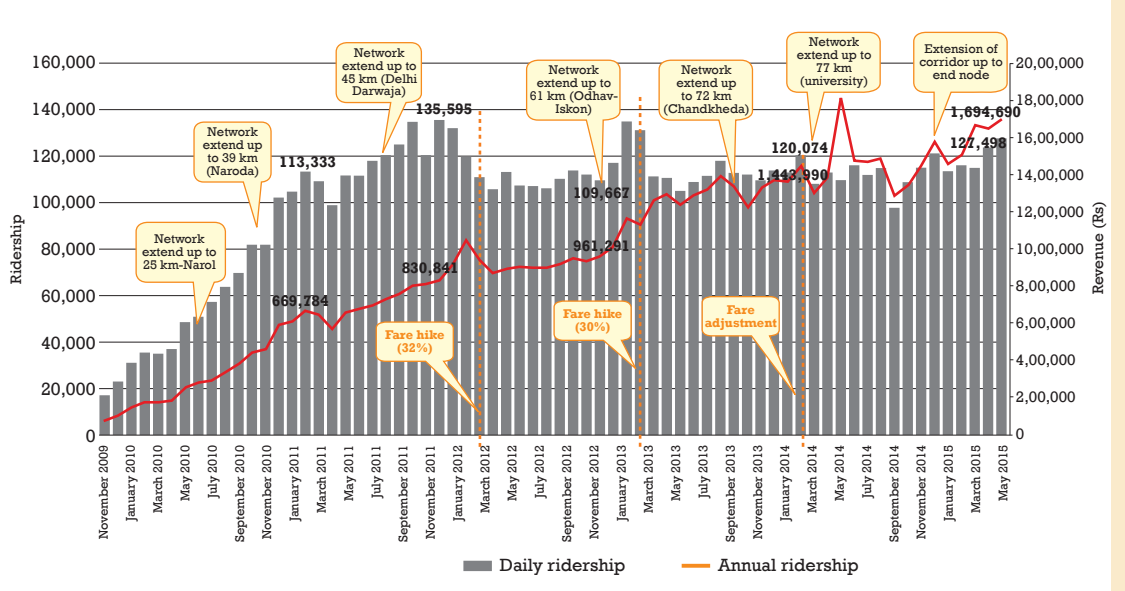
## Graph 10: BMTC fare vs cost of travelling by other modes




*Source: CSE analysis*[15]

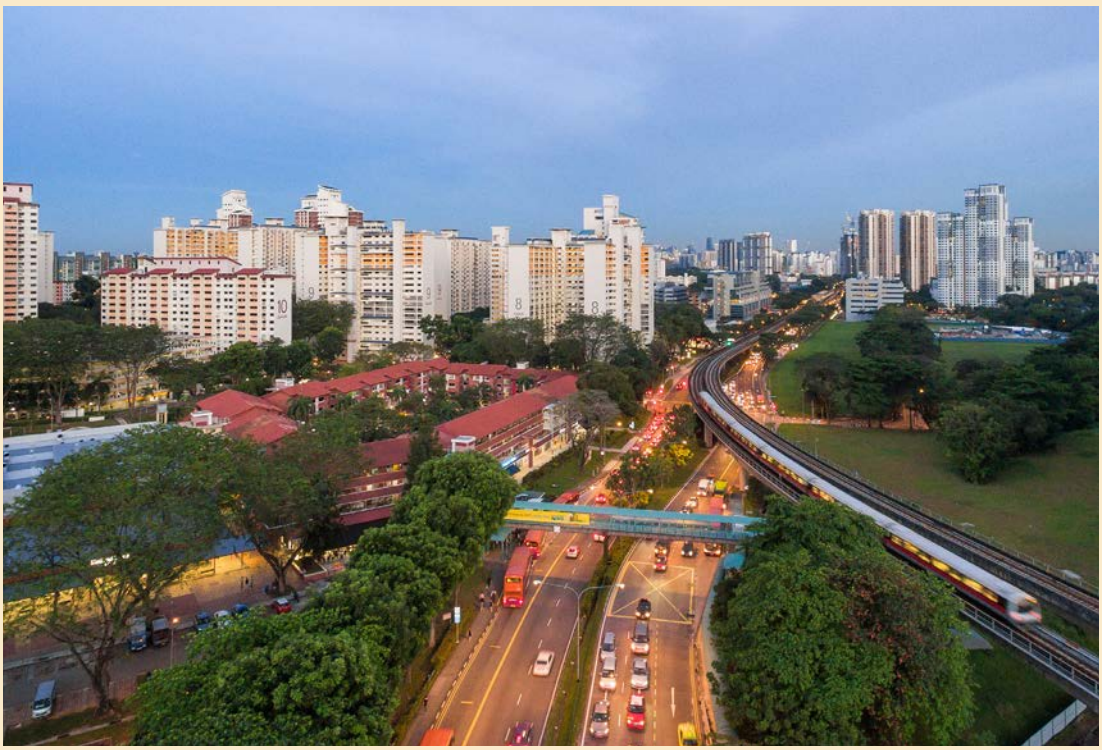
Most public transport systems are witnessing a trend of stagnating patronage, with the marginal costs of system expansion exceeding the marginal revenue generated. Ahmedabad BRTS is a typical example. A legal provision has allowed Ahmedabad BRTS to automatically raise fares annually; it has chosen not to since 2013. This has allowed its ridership to stabilize and grow marginally even without network expansion. But the system continues to bleed financially (see *Graph 11: Impact of fare revision on ridership of Ahmedabad BRTS*). Eventually, the BRTS will reach a stage where things go out of hand and shock increases become inevitable.

## Graph 11: Impact of fare revision on ridership of Ahmedabad BRTS




*Source: CEPT University*

# SINGAPORE—IDEAS GALORE



GETTY IMAGES

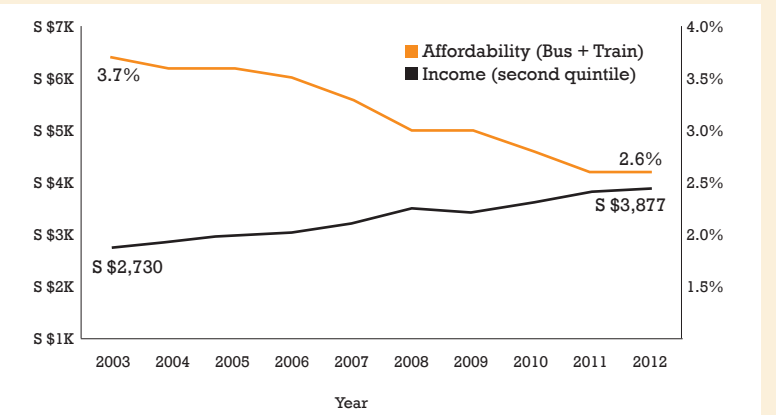
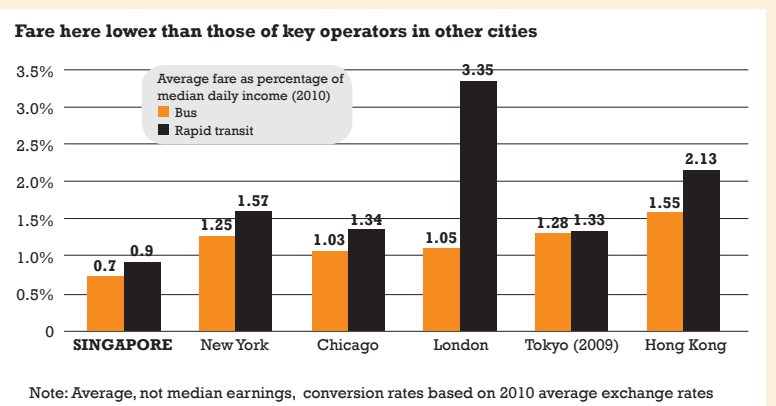
**Singapore has one of the best public transport systems in the world**

Indian cities are caught in a conundrum. Periodic fare revisions are necessary, but they have almost inevitably led to loss in ridership. But not hiking fares results in a heavy financial burden which can only be unloaded with a shocking thud of sudden and large fare increases. In search for solutions and the prefect formula, Indian cities can take a look at what Singapore has done.

In Singapore, the percentage of income poorer households spent on transport fell between 2003 and 2012 to 2.6 per cent. Singapore has an independent body for fare adjustment that has calculated that 60 per cent households do not have access to private transport and keeps the affordability factor for this section in mind in administering the revision formula. The system also accounts for a productivity factor in the formula (see *Box: Fare revision in Singapore*).

It is pertinent to mention here that while India has proudly taken to the best practices in Metro rail projects in technical areas, it has not been the case with fare revision mechanisms. These mechanisms are evolving and public transport in Indian cities needs to adopt and evolve as best as it can if it is to be sustainable while weaning people away from private modes.

## Fare revision in Singapore

| Affordability concerns | Details |
|---|---|
| **Does an independent permanent body recommend fare adjustment?** | Yes, an independent body—Public Transport Council (PTC) regulates public transport fare. PTC regularly undertakes income and willingness-to-pay surveys. |
| **Is the productivity of an operator considered in the fare revision mechanism?** | **Fare revision mechanism suggested by PTC (2013–17)**<br><br>Yes, as per the following formula:<br>**40 per cent** Yearly changes in CPI + **40 per cent** Yearly change in wage index + **20 per cent** Yearly change in energy index − **0.5 per cent** Productivity of operator |
| **For whom should fares be affordable?** | • Households without access to private transport (60 per cent public transport users).<br>• It forms the second quintile of income group.<br>• The monthly income of such households ranges from S$1,000–S$4,000. |
| **What percentage of income do people of Singapore spend on transport?** |  |
| **Singapore fares compared to other cities in terms of affordability** | Singapore fares are lower compared to other cities in terms of affordability<br>  |

*Source: CSE analysis based on information available from PTC*

# 4. SUSTAINABILITY

AMARJEET KUMAR SINGH

**To enable a modal shift, modernization of public transport is crucial. For this, financial sustainability is key**

In the context of public transport, sustainability revolves around three major issues:

1. User sustainability (fare costs consistent with user affordability and benefits in terms of time and cost saving, safety and comfort).
2. System sustainability (financial viability for the public authority running public transport).
3. Environment sustainability (net pollution, health and safety impact must be positive).

Financial sustainability is crucial and at the heart of the affordability and sustainability debate (see *Box: What is transport sustainability?*). Therefore, this study assesses financial sustainability of public transport systems of three selected cities—Delhi, Bengaluru and Ahmedabad. Subsequently, it elaborates on how a fare system or revision could help achieve affordability and sustainability.

Financial analysis of Delhi Metro has been discussed in the affordability section.
For BMTC, despite high fares and patronage, fare income can now recover only about 87 per cent of the operating costs (see *Graph 12: Financial analysis of BMTC*).

## What is transport sustainability?

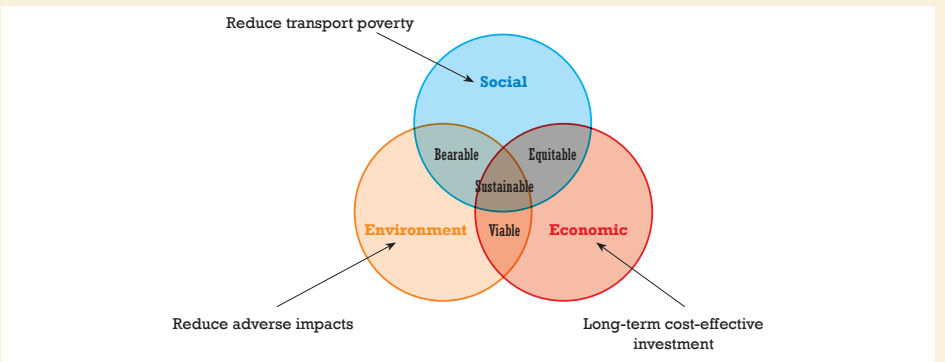
It is not possible to have a single definition of transport sustainability. A review of the existing literature on the subject throws up a range of definitions of transport sustainability. Some of these are as follows:

*'Transport that meets the current transport and mobility needs without compromising the ability of future generations to meet these needs.'* Black (1996)

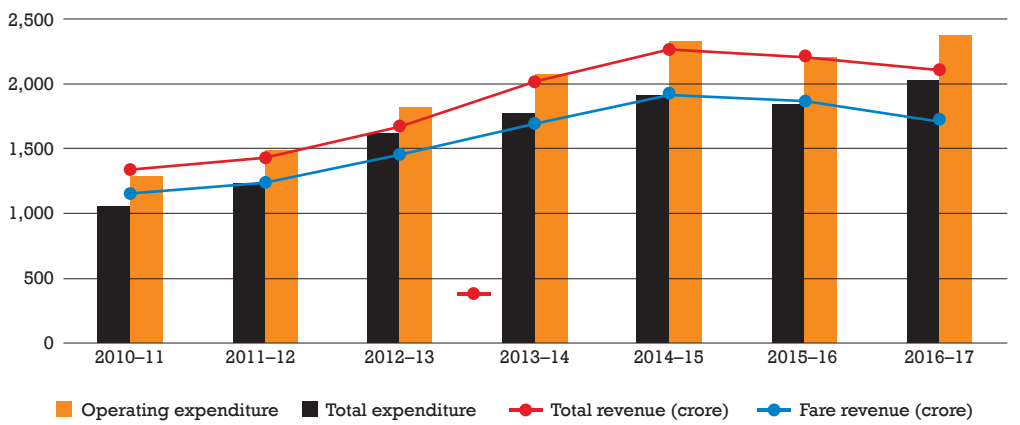
*'Transport and mobility with non-declining capital, including human, monetary and natural capital.'* Herman E. Daly (1992) and D.W. Pearce et al. (1993)

*'Sustainable transport is transportation where the beneficiaries pay their full social costs, including those that would be paid by future generations.'* Lee Schipper (1996)

This broadly indicates that financial sustainability of a transport system could be defined as its ability to plan and provide for meeting its capacity addition and operation expenses, drawing this from all beneficiaries of the system, including non-users.

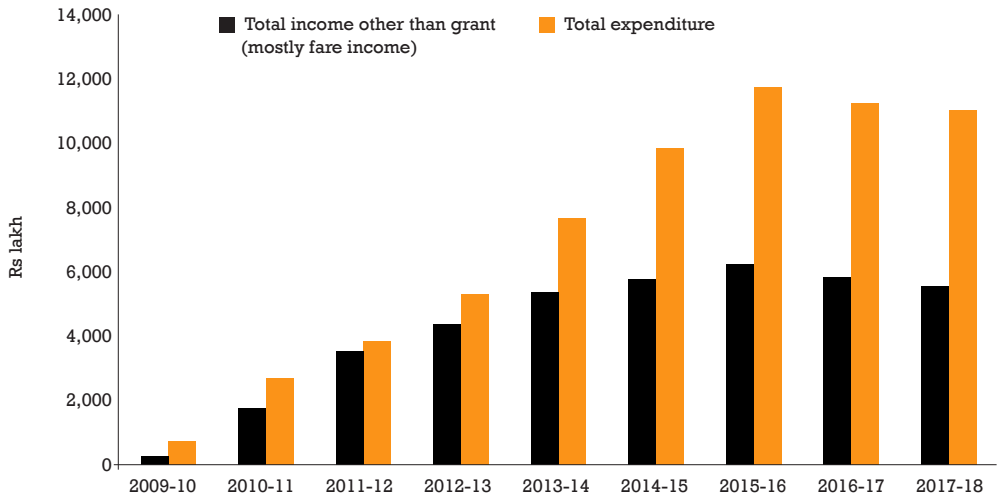



## Graph 12: Financial analysis of BMTC




*Source: BMTC reports*

## Graph 13: Financial analysis of Ahmedabad BRTS




*Source: Audited financial statements of AJL obtained from Ministry of Corporate Affairs' website*

In case of Ahmedabad BRTS, a relatively new service, operating expenditure remains out of reach of the total revenue. The system has not revised its fares since March 2013 (see *Graph 13: Financial analysis of Ahmedabad BRTS*).

An analysis of different Indian cities reveals that India's bus-based public transport systems remain nonviable and unable to recover operating costs. Operating cost recovery is not even 50 per cent in some systems. Bus systems in the peninsular states have fared much better due to high asset usage (high number of boardings per bus per day or, in layman terms, higher occupancy). Excessive operating deficits do not allow for accumulated earnings for capacity creation (see *Table 7: Viability gap between bus systems of different cities* and *Table 8: Select financial parameters of STUs plying in metropolitan cities*).

## Table 7: Viability gap between bus systems of different cities*

| Agency | Cost per km (Rs) | Earnings per KM (Rs) | Viability gap |
|---|---|---|---|
| Ahmedabad Municipal Transport Services | 58.38 | 26.56 | -31.82 |
| The Brihan Mumbai Electric Supply and Transport Undertaking (BEST) | 77.53 | 53.75 | -23.78 |
| Bengaluru Metropolitan Transport Corporation (BMTC) | 36.99 | 35.42 | -1.57 |
| Chandigarh Transport Undertaking (CTU) | 47.55 | 30.64 | -16.91 |
| Delhi Transport corporation (DTC) | 120.67 | 37.57 | -83.1 |
| Metro Transport Corporation (Chennai) (MTC) | 39.76 | 36.38 | -3.38 |
| Navi Mumbai Municipal Transport (NMMT) | 45.92 | 39.51 | -6.41 |

*Note: *2013–14 figures*

*Source: Association of State Road Transport Undertakings, 2014*

## Table 8: Select financial parameters of STUs plying in metropolitan cities*

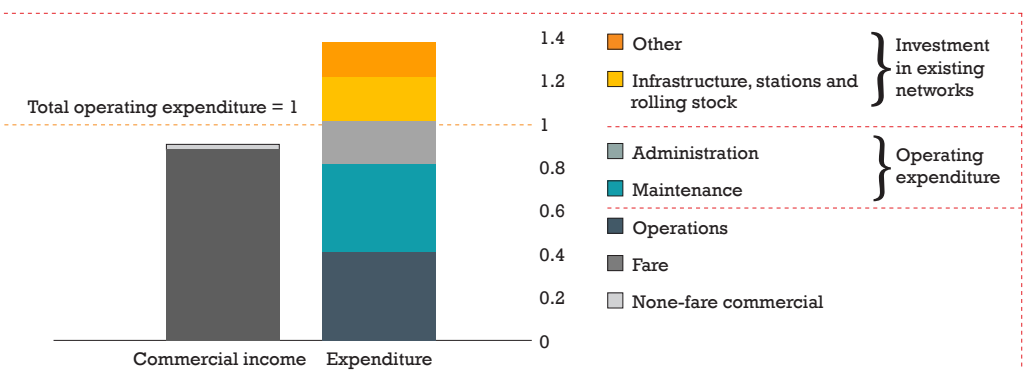
| Name of the state road transport undertaking | Total revenue (Rs lakh) | Total cost (Rs lakh) | Surplus or deficit (Rs lakh) |
|---|---|---|---|
| Ahmedabad Metropolitan Transport System | 13,011 | 35,413 | **-22,402** |
| BEST Undertaking | 1,50,856 | 2,35,503 | **-84,647** |
| Bengaluru Metropolitan Transport Corporation | 2,25,684 | 2,32,175 | **-6,491** |
| Calcutta State Transport Corporation | 7,241 | 23,191 | **-15,950** |
| Chandigarh Transport Undertaking | 11,107 | 18,140 | **-7,033** |
| Delhi Transport Corporation | 1,11,321 | 5,10,468 | **-399,147** |
| Metro Transport Corporation Limited (Chennai) | 1,37,652 | 1,59,599 | **-21,947** |
| Pune Mahanagar Parivahan Mahamandal Ltd | 70,738 | 87,507 | **-16,769** |
| Total (SRTUs plying in metropolitan cities) | 7,27,610 | 13,01,996 | **-574,386** |

*Note: *2014–15 figures*
*Source: Review of Performance of SRTUs 2014–15*

Globally, some bus systems are able to recover operating costs from fare revenues. This is mainly due to asset use efficiency in terms of higher occupancy or higher fares (that are affordable because of higher average income of patrons) However, such examples are rare. Most public transport systems have to rely on other methods to remain viable.

In case of Metro systems around the world, a study aided by Comet and Nova members shows that systems are able to recover about 89 per cent of their operating costs from farebox and advertisement or retail revenue. This does not generate any surplus required even for improvements in existing networks. Other than usual operation and maintenance expenses, recurring capital investments in existing networks is a huge expense. Capital grants, operating revenue gap support and concessionary fare support are common sources of funding. Other sources such as congestion charges in London, employment tax in France and fuel levy in Canada have provided dependable cash streams to these metros.

## Graph 14: Total operating expenditure and income from CoMET and Nova Metros*




*Note: *Data from 1994–2009)*
*Source: Richard J. Anderson, Improving Fares and funding policies to support Sustainable Metros, 2011*

## Table 9: Issues and mitigation measures for fare revision

| Issue | Possible mitigation measure |
|---|---|
| Convincing inclusion of affordability in fare revision absent | • Make it mandatory to take into account affordability within a limit<br>• Make periodic surveys to understand income groups mandatory |
| Recovery of depreciation and interest from passengers through fares | Capital cost should have alternative funding sources such as budgetary support or other non-fare incomes such as property |
| No productivity target or factor | Productivity factor must be factored into the formula |
| Fare elasticity not factored into revenue projections | Elasticity and its impact must be estimated |
| Non-fare income sources insufficiently explored | A framework for capturing non-fare income to be worked out and implemented |
| Merging of fare slabs | Impact of merging of slabs on fare augmentation effects to be included in the projections |
| Fares or costs of competing modes like two-wheelers not taken into account | Fares of other modes to be considered |
| Fare seasonality, time of the week and day fare variations not explored | Should be explored using improved knowledge of demand patterns |

*Source: CSE*

Available studies indicate that operating deficits are inevitable in public transport operations. Thus, systems can focus on either higher patronage or higher coverage as a policy stance. Systems focussing on patronage respond mainly to busy routes with higher capacity. Consequently, coverage of sparsely populated and peripheral areas suffers. On the other hand, systems focussed on coverage offer services to even low-density areas without regard for ridership. However, they struggle to recover expenses as revenue is less abundant. Achieving a balance between these two approaches is the key to achieving sustainability and affordability and fare systems and revisions play a crucial role in it. Fare revision exercises need to improve on several counts (*see Table 9: Issues and mitigation measures for fare revision*).

# TAXATION AND PUBLIC TRANSPORT

Tax regimes also affect sustainability of operations of public transport. Many taxes and levies accrue on different sub-sectors of public transport (see *Table 10: Taxation and public transport*).

## Table 10: Taxation and public transport

| | Taxes/Levies/Charges | Central | State | Local body |
|---|---|---|---|---|
| *Development of immovable assets* | Goods and Services Tax<br>Stamp duty<br>Property tax | | ● | ● |
| *Procurement of movable assets** | Goods and Services Tax<br>Custom duty | ● | ● | |
| *Vehicle registration*** | Motor Vehicles Tax<br>Registration charges<br>Stage or contract carriage permit<br>Municipal tax | | ● | ● |
| *Operations* | Fuel tax, surchage and duty<br>GST (operation cost and fares)<br>Passenger tax**<br>Advertisement tax | ● | ● | ● |

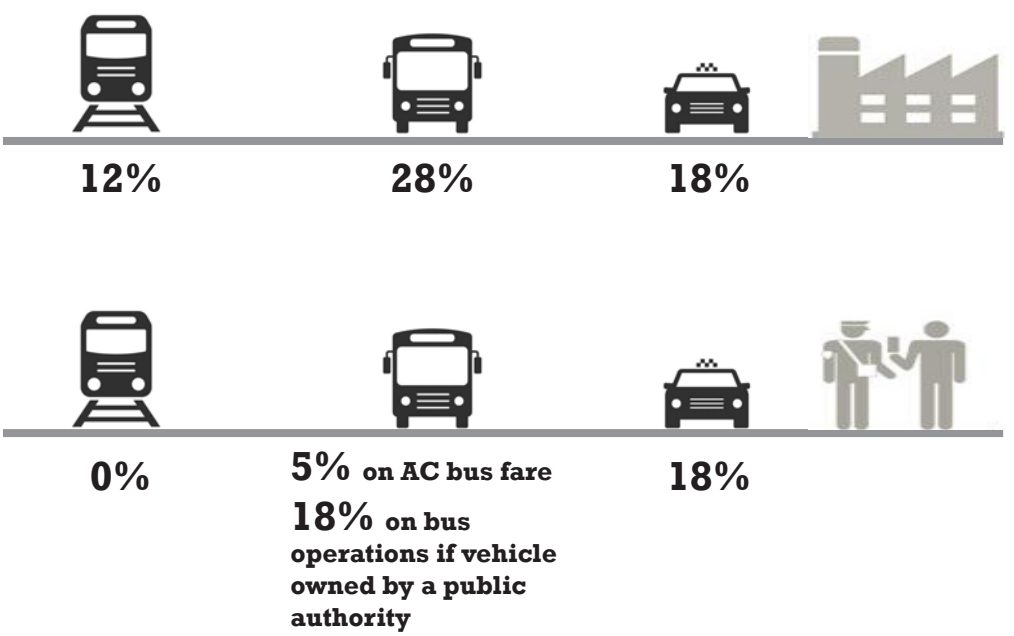
*Note: * Movable assets include buses and wagons; **Applicable to buses only*
*Source: CSE analysis*

Public transport authorities pay taxes on purchase of any property in the form of stamp duty. Later, they pay property tax on such assets. They also pay goods and services tax (GST) or import duties on purchase or import of manufactured rolling stock. They also pay motor vehicles tax, registration charges, contract or stage carriage tax, and municipal tax during registration of vehicles. During operation, they pay tax on fuel, passenger tax, GST on fares or operations cost (if the operation has been outsourced), and advertisement tax on advertisement revenue. These taxes are over and above the normal taxes on business entities such as income tax, works contract tax and capital gains tax.

According to a study, various taxes paid by the bus-based public transport systems together accounted for 19 per cent operation cost before the introduction of GST.[16] The proportion would be higher under the GST regime. The proportion of tax for STUs was around 10 per cent revenue in 2015.[17] Thus, expenditure of public transport systems could be reduced by upto 10–15 per cent if they are granted assorted tax breaks.

An example of such tax relief can be seen in terms of tax exemptions granted to Metros. Delhi Metro was exempted from a variety of taxes during its development including property tax, works contract tax, income tax, capital gains tax, and customs and excise. Besides, it is exempted from payment of electricity duty and gets power at a special rate. In 2013, DMRC's tax liability was less than 0.0001 per cent of its revenue or costs.[18] In contrast, bus systems are taxed heavily. Private vehicles, too, are exempted from contract or stage carriage tax and passenger tax. There are also differences in GST rates among the three modes (see *Figure 3: GST on public transport systems*).

**Figure 3: GST on public transport systems**




*Source: Department of Revenue, Ministry of Finance*

Thus, bus systems fall in a higher tax bracket compared to Metro rail and cars. Further, Metro users are exempted from payment of GST while AC bus fares attract GST. Road transport is also subject to a gamut of taxes at the time of vehicle registration (see *Figure 4: Motor vehicle tax in selected cities*).

**Figure 4: Motor vehicle tax in selected cities***

| | Std | Taxi | Pvt. Car |
|---|---|---|---|
| MV Tax | 5,757 Annual | 1,650 Annual | 30,000 Lifetime |

| | Std | Taxi | Pvt. Car |
|---|---|---|---|
| MV Tax | 83,979 Annual | 1,332 Annual | 1,110 Lifetime |

| | Std | Taxi | Pvt. Car |
|---|---|---|---|
| MV Tax | 4,800 Annual | 4,800 Annual | 36,000 Lifetime |
| Passenger Tax | 12,000 Annual | Nil | Nil |
| Municipal Tax | 62,500 Lifetime | 12,000 Lifetime | 12,000 Lifetime |

*Note: * in Rs.*

*Source: VAHAN 4 Ministry of Road Transport and Highways (Central); Transport Department, GNCTD; Transport Department, Karnataka; Commissionerate of Transport, Department of Port and Transport, Gujarat; Ahmedabad Municipal Corporation*

It is surprising that bus-based public transport systems, that carry the highest number of commuters daily, bear the brunt of an irrational taxation system while Metro systems have been provided various concessions and exemptions.

# 5. CURRENT APPROACHES

Public transport authorities are struggling to balance the opposing forces of sustainability and affordability.

Affordability of public transport has deep ramifications. It not only increases usage, thus reducing congestion and pollution, but it also affects a city's land use prices and patterns. It makes it possible for lower-income groups to travel more and farther, allowing them to live away from expensive places near a city's central business district (CBD), thus making precious savings on rent as well. Cities exist because they efficiently exploit agglomeration economics. Affordable fares tend to accentuate these benefits.

Unfortunately, affordable fares also often (though not always) create sustainability issues, particularly for legacy systems such as AMTS, BMTC, DTC, etc. that are saddled with large and inflexible fixed costs in the form of manpower costs. Fare income is not enough to recover the operation costs, let alone capital costs, in a majority of cases. Blaming public transport authorities for this state of affairs would not be erroneous, because barring increase in efficiency, there is precious little that they can do.

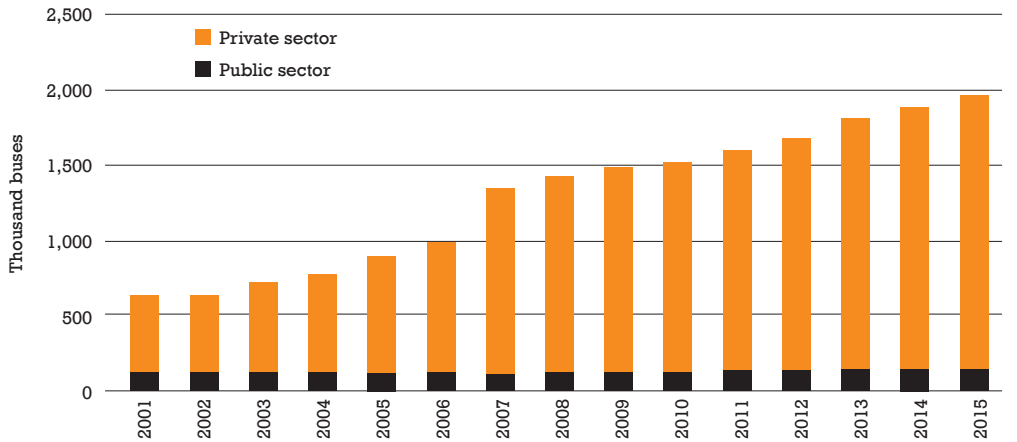
Absence of sustainability constrains the ability of public transport authorities to:

1. Add supply in terms of increasing rolling stock and coverage to newer areas, and intensifying coverage on existing routes by improving headways.
2. Improve quality of existing systems by carrying out enhancements and repairs.
3. Create passenger amenities (say toilets), enhance safety, etc.

UNDEFINED/ GETTI IMAGES

**A financially sound system can invest in modernizing infrastructure to provide better quality service to users**

**Graph 15: Number of buses in India by ownership**




*Source: Data.gov.in*

A balanced approach is the need of the day, particularly to make the huge investments required in public transport count. As per National Transport Development Policy Committee estimates, by 2031, an investment of Rs 10,900–18,500 billion will be required in urban transport, of which approximately 55 per cent would go to public transport. Urban India would require approximately 196,000 buses with an investment of Rs 1,181 billion by 2031.

The number of buses owned by the public sector (mostly SRTUs) has remained almost stagnant in the last 15 years (see *Graph 15: Number of buses in India by ownership*). Presently, the number of buses owned by the public sector in India is roughly 170,000, of which around 30,000 serve urban areas.[19] The population of the top 100 cities in India will be around 17 crore by 2021, based on a 1 per cent per annum population growth rate over 2011 Census numbers. According to Coordinates Consulting, considering an accepted norm of 50 buses per lakh population, the requirement for buses works out to be around 84,000, thus showing a deficit of 50,000 buses. It would take a staggering Rs 25,000 crore to meet this requirement at Rs 50 lakh per bus.

In order to work towards a solution, it is important to first understanding how India and the world fund their public transit.

# INDIAN APPROACHES TO FUNDING PUBLIC TRANSPORT

Public transport funding in India is largely dependent on government sources. There are only a few examples of public–private partnerships (PPP) with mixed success rates. Funding requirement of buses is obviously low compared to Metros.

## Bus-based systems

Buses have been funded mostly by state or urban local bodies (ULB) monies (in the case of established city-level public transport authorities). For instance, in Delhi, most DTC buses have traditionally been funded by the state government. In Bengaluru, buses have been funded mostly by BMTC itself but the clamour for government funding is growing. In

Ahmedabad, buses under both AMTS and BRTS have been funded directly and indirectly by the Ahmedabad Municipal Corporation.

Efforts to give public transport a boost of fiscal measures from the Central government have resulted in schemes like JnNURM that funded an inventory of buses in many cities during 2007–14. However, post-JnNURM, there has been no significant addition to networks or fleet sizes. It may be noted that even under JnNURM, only about 10 per cent funds were allotted to Metro rail and other transport systems (which is only about 67 per cent funds allotted to roads and flyovers). Moreover, in its attempt to subsidize capital investment programmes, JnNURM ended up exposing public transport authorities to unsustainable operational losses. More recently, intelligent transit system costs have been partially funded by the Smart City Programme. However, such schemes have been sporadic and not part of long-term planning. They have also failed to outlive political cycles.

PPP attempts in bus systems can be classified as those attempted on 'net cost contract' (NCC) basis and 'gross cost contract' (GCC) basis. The NCC model was tried in Amritsar, Jaipur, Indore, Ludhiana, Nagpur, Rajkot, Vadodara, etc. The NCC model was found attractive by these smaller cities since their municipal bodies have limited financial resources and NCC places almost zero financial burden on city municipal bodies. However, this model has been almost a complete failure in the absence of a robust fare policy, predictability of revenues and contract enforcement.

GCC models are in vogue in many cities such as Ahmedabad, Delhi, Jaipur, Navi Mumbai, Raipur, Rajkot, and Surat. While GCC has contributed significantly to the reduction in operational costs (compared to public sector operated legacy systems), there is no evidence that it has resulted in any service quality improvements. Further, it still leaves the question of financing open as fare revenues are not enough to meet operational costs. Under the GCC, per km costs have to be paid to the operators irrespective of the revenue.

## Metro-based systems

Rail-based Metro projects are largely funded by government or through government-aided multilateral funding, though the burden of repayment of borrowings is not planned by cities (see *Table 11: How India funds public sector Metros*).

Furthermore, in case of most Metros, the deficit between actual and projected ridership has posed a greater question on their operational sustainability than debt repayment (see *Table 12: Existing and proposed Metro ridership*).

The PPP model has also been tried in a few Metro rail projects (see *Table 13: How India funds PPP Metros*). Mumbai Metro took nearly seven years to build an 11 km line. Private sponsors of the project demanded fare hikes that were too high to be sustainable. The Delhi Airport Metro Express Line (DAMEL) has run into problems as well. Reliance Infrastructure, the concessionaire, invoked the termination clause on the grounds that DMRC failed to correct the technical defects in the civil structure built by it.[20] The Gurugram Rapid Metro is a small system that is facing serious sustainability challenges in terms of meeting operational costs and repayment of debt. Hyderabad Metro, primarily banking on real estate revenues to repay its capital costs, is yet to prove its sustainability.

## Table 11: How India funds public sector Metros

| Project | Length (km) | Status | Total project cost (Rs crore) | Government equity (per cent) | Multilateral debt (per cent) | Other sources |
|---|---|---|---|---|---|---|
| Kolkata Metro (N-S Corridor and Extension) | 16.5 + 8.7 | Operational | NA | 100 | Nil | Nil |
| Kolkata Metro (E-W corridor) | 13.74 | Under implementation | 4,676 | 55 | 45 JICA-official development assistance (ODA) | Nil |
| Delhi Metro (Phase I) | 65.1 | Operational | NA | 30 | 60 (JICA-ODA) | 10 Sub debt by Central government |
| Delhi Metro (Phase II) | 82.11 | Operational | | 44 (Equity, Internal accrual and property development) | 46 (JICA-ODA) | 10 Sub debt by Central government |
| Chennai Metro | 45 | Under implementation | 14,600 | 30 (15 Central and state governments each) | 59 (JICA-ODA) | 11 Sub debt by Central and state governments |
| Bengaluru Metro | 41.7 | Under implementation and operation | 81,56 | 30 (15 Central and state governments each) | 45 (JICA-ODA) | 25% Sub debt by Central and state governments |
| Jaipur Metro | 12 + 23 | Operational | 3,151 (Phase I) 6,581 (Phase II) | 43.3 | 56.7 (JICA) | Nil |

*Source: Detailed Project Reports and Annual Reports for Metro Corporations*

## Table 12: Existing and proposed Metro ridership

| City | Existing | | Projected | | Existing ridership as percentage of the proposed ridership |
|---|---|---|---|---|---|
| | Ridership | Year | Ridership | Year | |
| Delhi | 2,700,000 | 2018 | 3,950,698 | 2016 | - 46 |
| Bengaluru | 314,166 | 2017 | 1,083,000 | 2016 | -245 |
| Mumbai | 380,000 | 2017 | 1,006,000 | 2016 | -165 |
| Jaipur | 17,649 | 2017 | 210,420 | 2014 | -1,092 |
| Lucknow | 25,000 | 2017 | 429,250 | 2015 | -1,617 |
| Chennai | 55,000 | 2017 | 756,466 | 2016 | -1,275 |
| Kochi | 33,570 | 2017 | 381,868 | 2015 | -1,038 |

*Note: Projected ridership is subject to completion of the network*
*Source: Detailed Project Reports and Annual Reports for Metro Corporations*

**Table 13: How India funds PPP Metros**

| Projects | Concessionaire | Project cost (Rs crore) | Viability gap funding | Revenue share | Means of finance | |
|---|---|---|---|---|---|---|
| | | | | | Equity (per cent) | Debt (per cent) |
| Delhi Metro Airport Express Link (Revenue Share Model) | JV of Reliance Infrastructure Ltd and Construcciones y Auxiliar De Ferrocarriles (CAF) of Spain | Total project report: 5,700<br><br>Cost to concessionaire: 2,800 | Nil | Approximately Rs 51 crore per annum and 1–5 per cent share in gross revenue | 30 | 70<br>17.25 year term loans by eight banks |
| Hyderabad Metro—viability gap funding (VGF) model | L&T Metro Rail (Hyderabad) Ltd. | 16,378 | 1,458 (9 per cent TPC) | Nil | 21<br>(Rs 3,440 crore) | 70<br>(Rs 11,480 crore) |
| Mumbai Metro—Versova Andheri Ghatkopar Corridor (VGF model) | Mumbai Metro One Pvt Ltd—joint venture of Reliance Energy Ltd and Violia Transport of France | 2,356 | 650<br>(28 per cent TPC) | Nil | 22<br>(Rs 513 crore) | 50<br>(Rs 1,194 crore) |

*Source: CSE compilation*

# GLOBAL PRACTICES IN FUNDING PUBLIC TRANSIT

A study of global practices shows that transit systems are dependent primarily on government sources not only for capital costs but to also to bridge the operational deficit in order to keep fares affordable. Exceptions are Latin American cities where, by law, the entire cost of operation is recovered from 'technical fare' to be paid by the user of the system with almost no subsidy to the system and operator. This makes the fare unaffordable for the lower-income section and that problem is sought to be resolved through use of direct transfer subsidy to carefully identified beneficiaries.

In order to support capital budget for public transport, governments have evolved various other sources by asking direct and indirect public transport beneficiaries to share the value gained. In London, for instance, one of the major sources for grants is business rates retention, which effectively means property tax charged on businesses like offices, shops, factories, restaurants, etc. The London example shows that almost all capital expenditure can be financed through non-fare income like grants, borrowings and internal accruals while operating expenditure can be financed through fares supported by other income like station property, advertisements and congestion charges.

Singapore's experience provides one of the most enlightened perspectives on fare setting and revision using scientific formulae in order to keep the system both affordable and sustainable. The experience shows that while the city has been successful in keeping fares affordable, (particularly relevant in Singapore which actively discourages private transport through demand disincentives like taxing cars at a very high rate), it has evolved a system of government funding of capital assets and loading only the operational costs on the operators. To do this, Land Transport Authority, the government arm that regulates and manages all land- and transport-related functions, bought back all rail and bus assets from the two operator companies. Now it owns and finances all capital assets while only operations are outsourced

to the operator companies. With regard to bus transport, the government collects fares, sets schedules and subsidizes any shortfall between fare revenues collected and cost of service delivery charged by the operators. In case of the Metro rail, operator companies collect revenue and have to pay an annual licensing charge that can be adjusted beyond a threshold to maintain the operator's earnings margins within a band. This example shows that even the most evolved fare systems are not an answer to ensuring self-sustainability and even in countries with one of the highest per capita incomes, at least the capital assets end up getting financed through government budget. Singapore's evolving fare revision mechanism, while providing many lessons, shows that no mechanism can be considered complete and it has to keep changing with improved understanding. Like London, Singapore also has a long history of congestion charges starting from 1975 as Area Licensing Scheme to the current Electronic Road Pricing. This revenue supports government funding of capital assets.

The Paris transit system (RATP) charges local and national governments a 'compensatory indemnity' for keeping fares below the break-even price. Governments recover this from an employment tax charged on companies employing more than a threshold number of employees.

Another major tool as revenue source is land value capturing through transit oriented development (TOD) as in the case of MTR, Hong Kong (and partly in other cities like London and Singapore). Hong Kong, is the most quoted example of self-sustenance. For more information on the extent to which farebox revenue is supplemented by other sources in selected metros around the world see *Table 14: Range of farebox recovery ratios across Metro projects*).

It must be mentioned that while the ratio is attractive for the poster boy of value capture, Hong Kong, it is adverse for US cities like New York and San Francisco that have earnestly tried a variety of non-fare related instruments such as property development, sale or lease of land, sale of air rights, payroll taxes, etc. Thus, merely trying various financial schemes and instruments is not a pre-condition for generating non-fare incomes (see *Table 15: Summary of sources and instruments used for financing public transit across the world*).

Unfortunately, in India, such examples are often used to deny funds to public transit authorities by governments, passing on the onus of generating funds. It is forgotten that value generation through corridor densification is possible only in compact, land-starved cities meeting certain parameters. For instance, property development integrated with stations in Navi Mumbai took more than a decade to sell off. Similarly, TOD-based ridership projected in Gurugram Rapid Metro never materialized.

## Table 14: Range of farebox recovery ratios across Metro projects

| City | System | Year | Ratio of farebox collections to operating expenses |
|---|---|---|---|
| Hong Kong | MTR Corporation | 2012 | 1.8 |
| London | Underground | 2012 | 0.9 |
| Washington D.C. | Metro | 2012 | 0.7 |
| Montreal | Subway | 2013 | 0.7 |
| Paris | Metro | 2012 | 0.6 |
| New York | City transit (subway and bus) | 2012 | 0.4 |

*Source: Salon, Deborah, Value Capture Opportunities for Urban Public Transport Finance, White Paper*

## Table 15: Summary of sources and instruments used for financing public transit across the world

| Source | Examples |
|---|---|
| Motor fuel taxes<br>• Central and state taxes on vehicles such as GST and excise in some countries<br>• Carbon taxes and cess on conventional fuel | All countries.<br>Cess on fuel: India and US |
| Taxes at the time of vehicle purchase<br>• Vehicle registration and license fees<br>• Vehicle road taxes<br>• Taxes collected on vehicle insurance | All countries |
| User charges<br>• Fares<br>• Tolling and congestion pricing<br>• Parking fees | Congestion tax for cars in Central London and Singapore. San Francisco Municipality Transit Agency recovers 25 per cent operating costs from parking fees |
| Station property value-related<br>• Station and in-vehicle advertisements<br>• In-station property rentals | Almost all large metros around the world |
| Proximity value<br>• Share of fare card transaction charges<br>• System or station naming rights | Octopus Card in Hong Kong Metro, Tokyo Subway Card, Kochi Metro Card, Gurugram Rapid Metro (station naming), Transport for London Emirates (cable car) |
| Value-capture strategies<br>• Station integrated property<br>• Sale of air rights (additional floor area ratio) around stations<br>• Property development by public transport authority (PTA) near corridors<br>• Sale and lease of excess land by PTAs<br>• Cess on property transactions around stations<br>• Business improvement districts<br>• Betterment and impact fees | Delhi Metro, Hong Kong, London, New York Singapore<br><br>Business rates retention (property tax on businesses) in London |
| Employers<br>• Transit-focused payroll (Versement) tax<br>• Specific corporate contributions | Paris (Versement)<br>Bengaluru (Nammo Metro Corporate) |

*Source: CSE compilation*

Global experience with the PPP model has not been very encouraging. A study of around 113 Metro systems concluded that public ownership, development, and operation and maintenance of Metros was a universal phenomenon in contrast with other modes of transport such as roads and ports and that even the 12 per cent cities that had some form of PPP in the sector were only partially successful.[21] PPPs need strong and predictable revenue streams to allow investment recovery. This is not easy for any public transport system to achieve.

# 6. TOWARDS A SOLUTION

Any solution to affordable and sustainable public transport must be based on sound principles of obtaining the costs from all those who benefit from the system and not only from the commuters. There is also scope for charging those responsible for negative externalities like pollution. In general, in analyzing these measures, three main principles are usually identified:[22]

1. Beneficiary pays
2. Polluter pays
3. Spreading the burden of a public good over the wider society.

On the basis of these principles, the beneficiaries and polluters, and the cost allocation has been identified.

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They are the most obvious beneficiaries but clearly not the only ones. They should pay part of the operations cost but loading the entire operations cost on them would make the fares unaffordable. Usually, public transport occupancy is in the range of 60–70 per cent available capacity due to peak or off-peak demand patterns and needs to cover socially important low ridership routes in the network. Taking this as an indicator, the income from fares, along with station advertisements and station property rentals, should be expected to cover around two-thirds of the operations cost. The cost of keeping balance unoccupied capacity available is a social cost that should be passed on to other beneficiaries.

## PRIVATE VEHICLE OWNERS

Private vehicle owners benefit from public transport in terms of lower congestion on roads they use owing to modal switch by public transport commuters. They must be charged for this service. In addition, they need to be charged to rationalize use of road spaces to partly recover cost of road construction. This justifies higher taxes on private vehicles through a combination of instruments such as green cess on fuel, higher taxes on new vehicles, a cess on vehicle insurance collected, congestion tolls and parking charges. Moreover, carbon emissions can be taxed through a carbon tax. However, the combined effect of each measure must be weighed to ensure it does not exceed benefits. The balance operating cost can be garnered through these measures.

## PROXIMITY ESTABLISHMENTS

The third set of beneficiaries from public transport is the businesses, residents, and institutions located within a walkable or cyclable distance from public transport stations. Access to public transport allows employees to reach work places easily. In the absence of such facility, employers would have had to pay higher to their employees to cover their transport costs. Thus, in a way, employers are subsidized by public transit. Hence, there is a case for recovering part of the cost from them. Further, properties in proximity of public

transport facilities experience rise in prices. A part of this value can be captured using standard value capture tools. Since this set of beneficiaries benefit by the mere presence of public transport near them and are not concerned with the volumes of usage upto a point, their contributions must be poured into capacity creation. However, the source would be too meagre for that purpose. Hence, it can be applied to the next best thing—service and quality improvements and sub-system renewals—that require incremental capital expenditure; for instance, a new passenger information installation, or replacement of an aging signalling system etc., drivers training programme, productivity improvement exercises, etc. If a part of the funds are left over, they can be used for capacity additions.

## SOCIETY AT LARGE

The larger society benefits immensely from the presence of public transport systems in a variety of a ways such as health benefits from reduced emissions and mitigation of climate change; productivity improvements from improved labour mobility; savings in terms of reduced fuel usage and, hence, lower oil imports; equality of access to all income groups; increased opportunity and decreased isolation particularly for women, the elderly and students; saving time of hundreds of people due to faster transit; and so on. Public transport benefits indirectly through the creation of jobs and income.

A study by the American Public Transport Association concluded that investments by the society in public transport can lead to significant economic growth 'as a consequence of both the short-term stimulus impact of public transportation outlays and a longer-term, cumulative impact on economic productivity'.[23] The study goes on to say that while benefits would arise with every investment, for an illustrative US $1 billion investment in public transport sustained over a 20 year period, there would be a US $3.7 billion addition to the GDP.

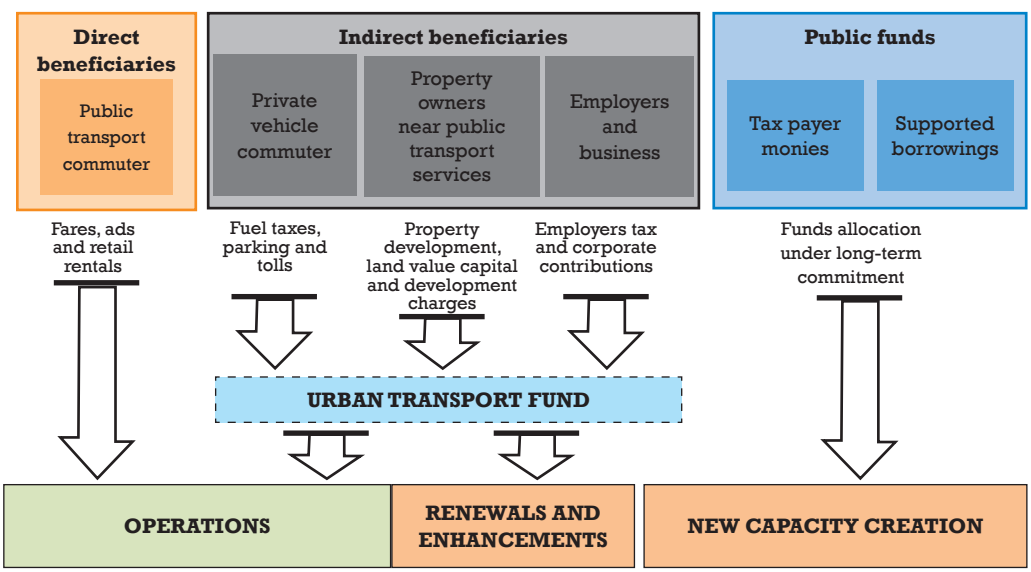
Thus, the wider society hugely benefits from investments in public transport. These benefits flow to one and all, and even to those who never use public transport. This presents a case for use of tax money to establish and improve public transport. Such monies are best spent in creating public transport, rather than in operating it, since operation costs can be apportioned to direct beneficiaries whose action requires the system to operate. Thus, government funds must ideally be used for meeting capital costs of public transit. In order to ensure that subsidies are not wasted, misdirected or misused, such funds must be linked to the productivity improvements of public transport authorities when granting for network expansions or augmentation or replacement of rolling stock (see *Table 16: Apportioning public transport costs to different beneficiaries* and *Figure 5: How public transport costs can be apportioned to different beneficiaries*).

## Table 16: Apportioning public transport costs to different beneficiaries

| Beneficiary category | How they benefit | Specific price paid | Examples of recovery instruments | What part of cost should it cover? |
|---|---|---|---|---|
| Passengers | Access to transport | Fares | • User charges<br>• Station advertisements<br>• Station property rentals | At least two-thirds of operating costs |
| Private vehicle owners | Decongestion | Nil | • Green cess on fuel<br>• Tax on new vehicles<br>• Cess on insurance collected per annum<br>• Congestion charges | Part of balance operating costs |
| Establishments near stations | Mobility access for residents, employees, students, etc. | Nil | Land value capture instruments as per context | • Part of balance Operating cost plus<br>• All service improvements |
| Larger society | All above plus pollution reduction and productivity increase | Taxes | • General Taxes<br>• Support for borrowings<br>• Support for levy of other charges | 90–100 per cent capital costs |

Source: CSE

## Figure 5: How public transport costs can be apportioned to different beneficiaries




*Source: Coordinates Consulting*

As a specific suggestion, funds from indirect beneficiaries must be pooled into a public transport fund. This fund can be used to apportion available resources to different modes and public transport authorities according to predictable formulae. Some other suggestions are as follows:

1. Regular revision in fares will yield higher operational income and will also cushion the shock of random and higher fare increases
2. Some part of the Central Road Fund may be used primarily for urban transport by contribution to an Urban Transport Fund

3. A 7.5 per cent additional tax on petrol vehicles and additional 20 per cent cess on personalized diesel vehicles at the time of purchase can be directed to a National Urban Transport Fund
4. An additional 4 per cent of a vehicle's insured value may be collected (over and above the insurance of 3 per cent already being collected). This will provide a potential Rs 40,000 crore in the first year in India's urban areas

Governments must commit to meeting all capital costs in the form of grants and subsidies (except in case of compact, land-starved cities where other sources could partially contribute), while operational costs can be met from a variety of user and beneficiary sources. While the Central government will need to work out greater policy details for sustained schemes, states can begin with smaller schemes in the right direction. In this context, Rajasthan has made a head start in terms of having an operational Transport Fund (see *Box: Rajasthan transport infrastructure development fund*). Unfortunately, the fund has recently apportioned a very large sum for the Jaipur Metro to the prejudice of the bus system. Another recent scheme of the Gujarat government is subsidizing capital cost by outsourcing bus operations in cities on a gross cost basis (see *Box: Gujarat scheme for public transport capacity augmentation*).

## Rajasthan Transport Infrastructure Development Fund

In line with the guidelines issued by Ministry of Housing and Urban Affairs (MoHUA) (erstwhile MoUD) for funding of urban transport systems through Urban Transport Fund (UTF), government of Rajasthan created the Rajasthan Transport Infrastructure Development Fund (RTIDF) vide a notification dated 29 February 2012. The key objectives of the fund are as follows:

- To provide organized and safe public transport.
- To create required infrastructure for a better public transport system.
- To fund the viability gap in operations and to provide loans to assist local bodies in the creation of better transport systems in cities.
- To provide loan for arrangement of better fuels, i.e., LPG and CNG, to minimize pollution.

Three-fourths of the funds received under RTIDF are utilized by ULBs while the rest can be used by the transport department.

Sources of fund are:

1. Cess on motor vehicle tax
2. Cess on registration of vehicles
3. Cess on stamp duties
4. Funds from state and Central governments
5. CSR funds from corporate entities.

By 2013–14, fund inflow under RTIDF was more than Rs 250 crore.

So far, the funds are mainly utilized as:

1. Subsidy to bus service special purpose vehicles (SPVs) of Jaipur and Ajmer (upto 30 per cent and 10 per cent of purchase cost respectively) for procurement of buses and to meet operational deficit
2. Funds of Rs 9 crore for construction of bus shelters in Jaipur
3. Funding for development of depots and parking spaces in Jaipur

Further, it has been decided that 25 per cent revenue accrued to RTIDF from cess on registration of vehicles, and stamp duty, etc. will accrue to the proposed dedicated Jaipur Metro Fund created to boost the Metro development project.

### Gujarat scheme for public transport capacity augmentation

Government of Gujarat has floated a new scheme titled Chief Minister's Urban Bus Service Scheme (CMUBS) for funding public transport creation in the state's cities. Under this scheme, instead of providing direct funding for purchase of buses, the state government provides funds to cities to meet the viability gap arising from operation of city buses under the gross cost contract scheme. A budgetary allocation of Rs 280 crore was made to this scheme for 2018–19.

CMUBS is applicable to eight municipal corporations and 22 municipalities each with a population over 1 lakh. Under the scheme, cities are entitled to get a grant equal to 50 per cent per km viability gap incurred by them for operations and maintenance of buses, capped at Rs 12.5 per km. The gross cost per km should be a competitively discovered rate and should include capital cost of the buses. Buses will have to be operated with fuels approved by the National Green Tribunal or Gujarat Pollution Control Board. The type of buses can be chosen by the concerned ULB as per its need, i.e., mini, midi or standard as required. To apply, a detailed project report or a feasibility report will need to be submitted. Such buses will have to be operated through PPP or outsourcing mode only. They cannot be owned or purchased by the city ULB. The ownership of the buses shall lie with the operator.

This scheme is the first to recognize the inevitable presence of viability gap in city operations and attempts to address the issue. In the process, it also encourages outsourcing of bus operations so that legacy issues related to manpower, in-house bus maintenance facilities, etc. do not creep up. Further, the extent of capping at Rs 12.5 per km indicates that the government wishes to subsidize the cost of purchase of the buses and nothing more. On the downside, while the government has agreed to continue the funding on a multi-year basis, there is nothing that prevents it from stopping the budgetary support the next year. Moreover, the scheme does not link the funds to any performance parameters or promises of service improvements. Perhaps these features can be considered under the next version of the scheme.

## KEY LESSONS AND THE NEXT STEPS

Due to their unavoidable social role, most public transport systems struggle against cost recovery. While this is not to say that public transport authorities should not try to make the two ends meet, the core issue remains one of poor affordability of higher fares over which authorities have little control. Governments, both at the Central and state levels, must recognize this as a broader issue. Sporadic programmes, such as JnNURM, provide only a partial and temporary solution. What is required is multi-year financial and non-financial support under a sustained multi-pronged programme for improvement.

Some of the policy-level initiatives, both short- and long-term, need to be explained and detailed. The following list is not intended to be exhaustive, as it constantly needs to evolve based on experience. However, they are good starting points.

**Develop an eco-system of alternate sustainable means of finance for public transport authorities**: In order to survive and compete with others, mostly private modes of transport, for patronage, public transport authorities need access to funds for expanding networks, adding capacity to existing networks, replacing aging assets, implementing service improvements, meeting operation costs, and investing in long-term productivity improvement and research programmes. Since such funds cannot be available from fare income alone, a plethora of other options based on the 'beneficiary pays' and 'polluter pays' principles, within the framework recommended, will need to be actively promoted, nurtured and institutionalized with the help of supporting policy and regulatory frameworks.

**Commit to multi-year subsidy support to public transport linked to the authority's productivity improvements**: Supply-side subsidies to public transport authorities are often criticized, particularly for having substantial leakages. Very often, subsidies end up getting used to pay large labour costs of legacy systems like AMTS or DTC and little is passed on to the commuters in terms of improved services. Such subsidies, while unavoidable due to inherent viability gaps in public transport systems, can be justified only if accompanied by sustained efforts at reforms and productivity improvements in public transport. However, calls for productivity improvements are translated into cost reductions exercises through curtailments on 'loss making' routes with scant attention being paid to its effects on overall transport coverage.

Any subsidies under any programmes must, therefore, be linked to long-term and sustained efforts at ridership and productivity improvement measures such as manpower rationalization, fuel efficiency, asset durability, vehicle efficiency in terms of load factors, rationalizing schedules to match demand patterns, integration with other modes, fare collection efficiency, coverage, vehicle maintenance, and service quality standards. A method of score carding public transport authorities and linking performance with subsidy must be developed at the policy level. On their part, governments must commit to long-term budget availability to support sustained capacity creation, network expansion and service quality improvement programmes.

**Adopt scientific fare adjustment mechanisms:** The objective of transport pricing policy is not just revenue generation and ensuring sustainability. The market for public transport as a service exhibits characteristics both of what economists call 'public goods' (available to all without exclusion and whose quantity does not diminish with use, e,g. sunlight) and 'private goods' (available in limited quantity to only those who pay for it, e.g., all market goods). Thus, public transport usage should not be limited to only those who can afford its full cost, given the huge positive externalities associated with it such as decongestion and emission reduction. It follows that pricing policy should have multiple objectives, such as affordability, sustainability, influencing land use, combating natural monopoly inherent in certain public transport systems, exploiting network scale, and most importantly, discouraging private vehicle use while providing a comparable alternative to the mode switching commuter.

This calls for a debate on the exact fare adjustment mechanism that could be evolved nationally. Section 67 of the Central Motor Vehicle Act, 1988, confers power to the transport departments of state governments to fix fares for contract, stage and goods carriages, based on which fares for public transport are revised periodically. MOHUA or Ministry of Road Transport and Highways (MORTH) could, therefore, formulate a recommendary policy on a fare adjustment mechanism in terms of broad principles to be followed by all states while fixing city public transport fares under this existing system, which could be followed with minor changes to suit local needs.

**Contain private vehicle proliferation through mode integration**: Indian public transport systems function as an unconnected system of independently functioning collection of rail, bus, para-transit and non-motorized transit options. As a result, the integrated cost of journeys primarily due to inter-changes is much higher than the marginal cost of private vehicle use, leading to declining public transport patronage and increased private vehicle use. This problem can be resolved only through fare and physical integration. While any long-term policy prescription must include unification of the institutional systems, a moment towards integration of fare systems using ITS must be attempted by forming a Working Group led by MOHUA comprising representatives of all stakeholders.

**Use integrated demand aggregation to solve the last mile problem**: The proliferating use of two-wheelers is now a phenomenon that is threatening the patronage of public transport systems worldwide. The marginal cost of a two-wheeler is cheaper than public transport upto a fair distance in Delhi. For cities with average trio distances, two-wheelers become the mode of choice for a large majority. However, two-wheeler use is undesirable in terms of transport sector efficiencies beyond very short distances. The power of a two-wheeler can be limited only under circumstances where para-transit becomes easily and affordably available for last mile and short journeys. This is possible only through integrated pricing of para-transit modes with main systems, or intelligently deploying demand for identifying and catering to short trips. Use of e-autos on earmarked short routes to cater to short and last mile journeys using aggregators could be an answer to this problem and must be explored.

**Introduce congestion charges along with a rationalized parking policy:**
Implementing congestion pricing has also been known to have positive results in terms of rationalizing road use in many cities and could yield large amounts of money which could be funnelled to Urban Transit Fund along with parking charges. With improvements in electronic road pricing technology, the challenge of large queues at tolling points could be avoided. For introducing congestion charges, the following need to be considered
(i) Pricing entry to entire zones need to be considered rather than tolling only specific stretches
(ii) Chosen zones must have alternative system of access through public transport
(iii) Congestion pricing would need to be integrated with a parking policy

**Use technology to improve fare collection efficiencies:** Fare collection exercises in our bus systems are mostly carried out manually using conductors. This is known to lead to substantial leakages both in terms of uncollected fares due to crowding and also tickets not being issued against the fare collected. Increase of efficiency in this regard could add one-tenth to one-fifth of revenue.

**Introduce demand-side disincentives and taxation:** Based on the polluter pays principle, car ownership could be made to pay higher to extract the cost of negative externalities they create. This higher costs could be in the form of higher registration charges, a cess on insurance, etc. as discussed earlier. Additional funds generated could be funnelled to the Urban Transport Fund.

**Rationalize taxes:** Large amount of taxation is levied on public transport, shared by Central and state governments. These flow to consolidated funds and are not earmarked or ring fenced for public transport purposes. Thus, despite large taxation, the sector is fund starved. Further, the bus sector is taxed more heavily than the Metro sector. Taxes create a large burden on public transport authorities and reduce their viability. Thus, there is a strong case for tax rationalization by providing tax relief to public transport authorities and ensuring parity between Metros and buses, and between cars and buses.

**Outsource services for which there is service provider market:** Outsourcing operations and maintenance of many of the public transport sub-systems could lead to substantial cost savings, as witnessed in case of bus services run on gross cost contract (GCC) by many cities. Metros regularly outsource maintenance of a large number of sub-systems such as power systems, signalling, etc. ITS is almost always outsourced. This practice allows leaner staff, higher productivities and, sometimes, though not always, improved maintenance. Public transport authorities must be actively encouraged to outsource functions for which there is an active service provider market. In partnership with the government, they must encourage development of such vendor markets.

**Link public transport to viable models in order to create its access to market funding:** Collectively, taxi aggregators—Transportation Network Entities (TNCs) or ride-sharing apps—have raised more than US $17 billion in 2017, a lion's share of which was raised by Uber, Didi, Grab and Ola. On-demand transport market is growing rapidly in cities in India as the demand for mobility expands. The question, therefore, is if aggregators can attract risk capital of large proportions, why traditional public transport authorities with public ownership, legal cover and larger role cannot access funds from financial markets? The transport sector is already recognized as an infrastructure sector since 2012 and is eligible for many funding benefits. Public transport authorities are rarely able to exploit these benefits. Models whereby public transport authorities access funds from open market sources like banks, debt markets and venture funds will need to be configured and created. This can be done only when public transport authorities are backed by sustainable, predictable and dedicated stream of funds from internal and external sources.

**Upgrading to clean fuel technology should be accompanied by efforts to help financial health of public transport authorities**: India has recently seen attempts at promoting electric mobility through schemes such as FAME to reduce emissions. This has been supplemented with subsidizing purchase of electric buses under the same scheme. Further, Niti Ayog is promoting procurement of electric buses through various measures, including publication of a standard bankable concession agreement under GCC. Promoting use of electric buses by subsidizing them to make their integrated capital and operating costs comparable to conventional fuel buses is unlikely to solve the problem of the public transport authorities not having the funds to pay the bus operator.

The so called bankable concession agreements that prioritize payments to the operator over other public transport authorities payments through escrow agreements are likely to result in loss of financial flexibility of public transport authorities akin to what happened to state electricity boards in the power sector when multiple power purchase agreements were signed. The underlying basic problem of financial health of public transport authorities must be addressed rather than leaning on such sporadic policy interventions that primarily benefit electric bus manufacturers. Furthermore, such policies are encouraging public transport authorities to adopt electric buses without fully understanding the limitations and implications of such technologies.

An alternative could be to link subsidies to intelligent electric bus adoption in a manner that demonstrates that such efforts have led to net emission reduction and have contributed to adoption of new technology in a replicable manner.

**Move towards demand side subsidies in the long-run**: The experience of Latin American countries and recent experience worldwide shows that demand-based subsidies such as beneficiary discount card can deliver assistance to the poor more efficiently than supply-side subsidies provided to public transport authorities.[24] India has made substantial progress in direct transfer subsidies such as in case of LPG and other social service schemes despite challenges in terms of errors of inclusion and exclusion. Student, handicapped and senior citizen cards are an example of existing demand-side subsidies used for decades. However, public transport authorities are mostly not compensated by the government for these discounts, which they ought to be. The difficulty in implementing this in public transport is controlling identification at the gate. At present, there are no technologies available that can identify and link commuters with the stipulated beneficiary when he presents himself or herself in the public transport system with the beneficiary card—implying a risk of fraudulent use. Rapid changes in fast biometric testing technologies could solve this problem in the

future. When it does, there is a strong case for gradually transferring some subsidies from public transport systems directly to the intended beneficiary.

Policy must remain vigilant to this possibility and push in this direction in the future. However, given the other welfare objectives of pricing policy (in addition to affordability), such as promotion of transport sector efficiency, demand-side subsidies must be limited to pro-poor usage only.

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    - Lowest fare available for 10 km trip from tickets, concession travel cards, weekly or monthly passes have been considered.
    - To determine fare from weekly and monthly passes, six days and 26 days have been considered for weekly and monthly passes respectively. For each pass holder, three trips per day have been considered.
    - Purchasing power parity for all cities has been taken from IMF World Economic Outlook, April 2018.
    - For Beijing, Berlin, Delhi, Guangzhou, Istanbul, Moscow, Nanjing, Santiago, Seoul, Shanghai, Shenzhen, Sydney and Taipei, concessional fare (cards) for a single trip have been considered.
    - For Bangkok, Dubai, Hong Kong, Kuala Lumpur, Singapore and Washington D.C., a 10 km trip is calculated and a distance-based fare on the card has been taken into account.
    - For Mexico City, Rio de Janerio and Sao Paulo, a flat fare for a single trip has been taken into account.
    - For Brussels, Montreal, New York, Oslo, Paris, San Francisco and Toronto monthly passes have been considered.
    - For the London Underground and DLR, monthly cards for Zone 1–3 have been taken into account.
    - For Madrid, New Castle and Vancouver, card for Zone 1 has been taken into account.
    - For Barcelona, 10 trip journey tickets have been considered as 70 per cent of Barcelona residents and tourist use this medium.
    - In Buenos Aries, discounted fare depends on the number of trips taken in a month. To achieve a single trip value, three trips are considered per day for 26 days and a weighted average has been taken.
9. Notes: Inputs and assumptions:
    - Monthly expenditure is estimated considering 26 working days in a month and three trips per day (two work-related trips and one non-work-related trip) by dependent.
    - Minimum wages are different for different industries in Maharashtra. Municipal Corporations falls under Zone 1; hence the industry providing the highest minimum wages for Zone 1 is drawn into the analysis. Telangana's minimum wages are not available; hence Andhra Pradesh's wages for Zone 1 have been taken as proxy to calculate Hyderabad's minimum wages.

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12. Notes: Inputs and assumptions:
    - Extra 25 per cent cost has been added for last mile connectivity for Metro to calculate integrated cost.
    - Two-wheeler assumptions:- capital cost: Rs 60,000; petrol price: Rs 78.75 per litre; fuel efficiency: 40 km per litre; maintenance: Rs 1,000 per annum; and life span: seven years.
    - Car assumptions:- capital cost: Rs 5 lakh; fuel efficiency: 12 km per litre; maintenance: Rs 7,000 per annum; and life span: two lakh km
    - Marginal cost of car and two-wheeler has been considered by deducting depreciation.
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    - Two-wheeler assumptions:- Capital cost: Rs 60,000; petrol price: Rs 78.75 per litre; fuel efficiency: 40 km per litre; maintenance: Rs 1,000 pa; and life span: seven years.
    - Car assumptions:- capital cost: Rs 5 lakh; fuel efficiency: 12 km per litre; maintenance: Rs 7,000 per annum; and life span: two lakh km
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**Public transport remains central to air pollution and traffic congestion abatement, climate change mitigation and health risk management in urban areas. The success of public transport depends on reliability, convenience and accessibility, but it is affordability, social inclusion, and financial sustainability that can make it a game changer, aiding it in keeping up with the needs of expansion and modernization.**

**Today, this issue of affordability vs financial sustainability concerns all public transport systems in India—bus- and rail-based. Systemic responses have varied from shock fare hikes to choosing political exigencies over financial health. Attaining the right balance remains tricky business.**

**What, if at all, is the way out? This study by CSE diagnoses this problem by looking at a wide range of public transport agencies in India as well as across the world, and offers a possible direction for cities in India looking to modernize and scale up their public transport systems whilst ensuring affordability of the services.**

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