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Which BRT do we need?

A detailed study assesses two models. It also shows how to examine the success of a BRT project. Surprise, surprise!

Mobility is essential to modern life. Our physical environment, though, defines the boundaries of our mobility. In urban centres, these boundaries are within the physical limits of the city. As cities expand, we tend to expand our mobility boundaries. However, as our travel distance increases, we encounter another constraint: time. This creates a demand for faster mobility choices. Cities in the west met this demand in two ways: urban elevated roads and expressways (for those who can afford the luxury of motorised private transport) and urban rail systems (for those who cannot). These systems encouraged the growth of low density suburbs, leading to urban sprawl and long-distance commutes.

The story in the developing countries is very different. Walk, cycling and public transport meet more commuting needs than all private modes put together. There has been a high reliance on some form of bus-based public transport system. This means streets have been the mainstay of mobility for all commuters. Those who can afford cars and two-wheelers have jostled for space with pedestrians, cyclists, rickshaws and buses. Over time, cities in the developing world have grown into major urban centres of high population density, leading to congestion in streets. Hence the demand to decongest the roads.

For decision-makers the obvious choice has been politically lucrative, high-visibility, capital-intensive solutions adopted by western cities. For a majority public transport commuters stuck in traffic jams, this approach promises congestion-free urban rail systems. However, budget constraints often force a half-hearted approach, resulting in limited network, which is a fraction of the city road network,

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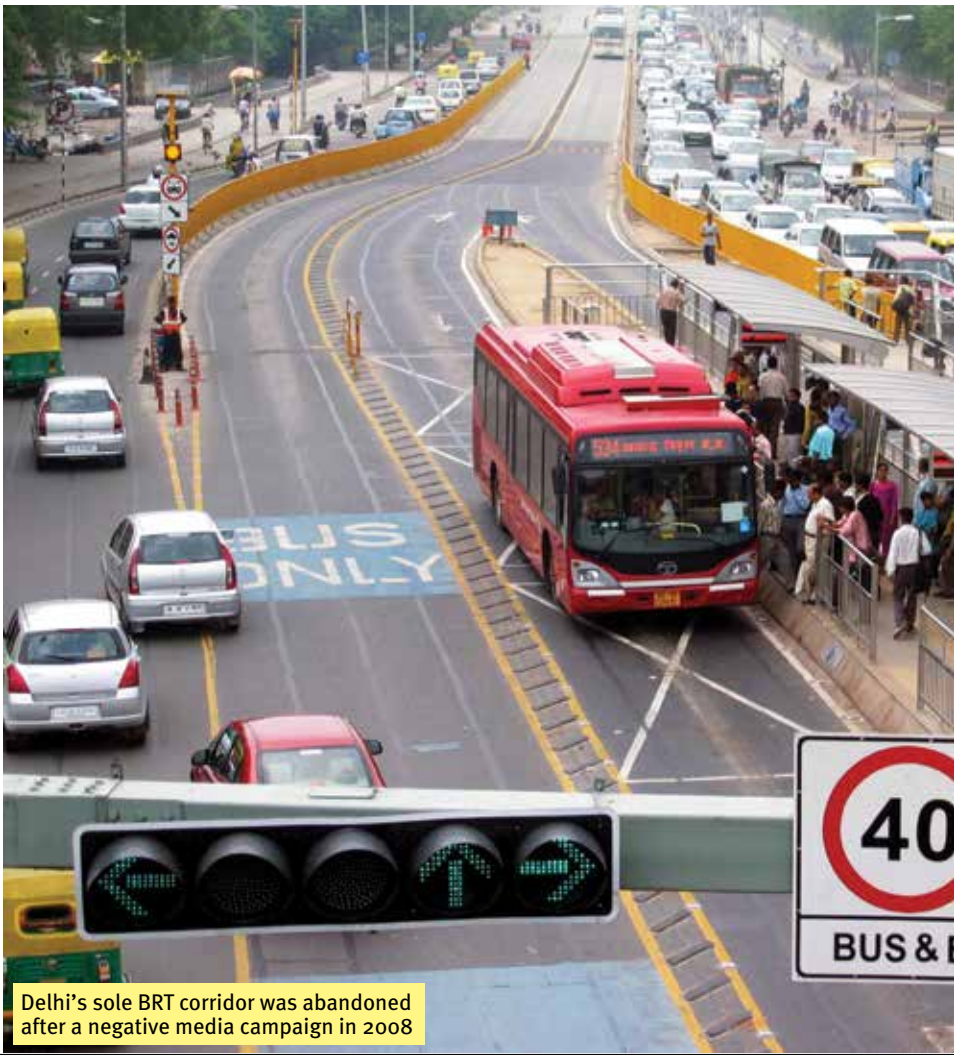

Delhi's sole BRT corridor was abandoned after a negative media campaign in 2008

missing the expectations of both the commuters and the politicians.

Birth and spread of BRT

To avoid this requires innovation. One model came from Curitiba, a mid-size town in southern Brazil. In the early 1970s, Jaime Lerner was the mayor of this town. He faced a decision to sanction a higher budget for a planned metro corridor. However, he faced pressing financial constraints. He needed a cheaper metro system. So he proposed getting rid of the most expensive component of a metro: the physical infrastructure for rails above or below ground. He ran his metro right in the middle of the street. The new system resembled a metro in all other aspects: operational, appearance, management and planning. It included buses modified to look like trains and bus stations as well as off-board ticketing, offering the experience of a metro. All this at a fraction of the estimated cost of the metro. It became operational in the mid-1970s and was christened 'bus rapid transit' or BRT.

Lerner's political career took an upturn. Soon, his success and innovation inspired mayors across cities of South America. Several BRT systems began to emerge. However, none was considered a success comparable to Curitiba's. Until early 2000, that is, when Enrique Penalosa, mayor of Colombia's capital Bogota, launched his own BRT system. Called TransMilenio, it is grounded in the same principles that created Curitiba's BRT; it brought a similar political boost to Penalosa.

The only difference was: TransMilenio happened at a time when the entire world was realising the importance of efficient public transport. Not just to address local congestion but also global concerns on vehicular emissions. It received global attention, setting BRT in the league of more established transit systems like metro, light rail and monorail. BRT was often called a cheaper metro (or metro on roads) with telltale features including reserved bus lanes, long-articulated (meaning bus segments with pivoted joints, like the ones between train coaches) or bi-articulated high-floor buses, large central stations, and on-station ticketing. BRT systems now work in 180 cities across the world, says an estimate. BRT's global emergence is also credited to a number of funded advocacy groups, with a vision for capacity building of cities to undertake transit development, as an attempt to counter climate change.

Two approaches

While a metro-like bus system evolved in Latin American cities, Asian and European cities witnessed a parallel development called 'improved bus systems'. Around 1985-86, Taipei City in Taiwan had an extensive bus system. The city decided to introduce central lanes as exclusive bus lanes to ensure congestion-free movement for buses and new designs of bus stops for easier boarding and alighting. The Taipei system was introduced in several cities of China and Japan. This retained the bus network and provided exclusive central lanes on main arterial roads.

Reserving exclusive lanes for buses, signal priority at intersections and bus platooning strategies were introduced in several European cities in the '80s and '90s. Around the same time, a group of researchers at IIT-Delhi were working on improving the flow of traffic on Indian roads, which have mixed traffic, and upgrade the current urban public bus system. Public transport was losing appeal because buses were stuck in congestion, bicyclists and pedestrians occupying the curbside lanes. These studies suggested reserved bicycle and bus lanes, among other things.

This shared several features with the Latin American model, but there was a critical difference. The Latin American model was a replication of the metro system, so it sought to replace existing bus systems along the corridor. Contrary to this, studies in Chinese as well Indian universities and institutes were focused on the improvement of existing bus systems. This has created a difference in opinion between researchers and advocacy groups. One lot is convinced that replicating the Latin American model would ensure similar 'success' levels.

When an existing system is replaced with a metro or a metro-like BRT, it constitutes a 'green field' project. Local conditions and context are of little relevance here. The priority is to implement and operate the system, changing the context with a custom-made settings. Hence, the commuter base and land use can be replaced with one that suits the 'selected model'. This change in context is often marketed as transit oriented development (TOD). This approach allows complete control over planning, including the context, which can lead to successful demonstration over small, corridor-specific stretches in a relatively short period of time. These controlled demonstrations in turn promise positive media attention with attendant political returns. This creates greater political ownership, a symbol of success for advocacy efforts.

When the objective is to upgrade an existing bus system, however, the effort cannot remain limited to a corridor. It must spread across the city, leading to reduced control with limited (or no) short-term returns. Improvements are undertaken in phases spread across years, gradually improving the appeal of public transport. This promises long-term benefits to a much larger commuter base. It assumes that long-term benefits have priority over short-term gains. So there exist two types of BRT systems worldwide; these vary not just in broad planning approach but also in infrastructure and system features.

Two sets of system features

Open bus operations allow multiple routes, with different origin destinations, to use one or more BRT corridor/s, entering and leaving either at the end or at any other intersection along its length.

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Closed bus operations, on the contrary, allow mostly single route operations, connecting origin destination points along or at the end points of the corridor; buses do not exit its confines at any location, nor are any other buses allowed entry. Both models require specifically planned infrastructure. This includes, a dedicated bus lane, bus stations located either near or away from the junctions, design of junctions, passenger access, high- or low-floor buses, among other things.

Bus lanes are usually physically segregated in the middle of the carriageway. In some cases, though, they are merely demarcated either on the curb side or as middle lanes. Bus stations can be planned to be dedicated for each direction of bus movement (known as staggered stations) or common, serving both directions from a single central station (known as island station). These stations may be located at intersections, or at a considerable distance from junctions, referred to as mid-block. Fare collection may be at the station, before boarding the bus (off-board fare collection), on the bus (on-board fare collection) or both. Intersections may have a roundabout or may be signalled, with or without built-in bus priority systems. Passenger access is usually through at-grade signalised pedestrian crossings, however, some systems integrate pedestrian over-bridges and under-passes. Buses can be acquired to suit different specifications and are available for different fuel types, floor height, number of doors and length.

The selection of features depends on the choice of BRT system. Let us first consider a system planned to replicate a metro: a closed system with dedicated lanes and a single route between origin and destination. If the operations are in a closed system, then special buses with doors for both directions (right-sided doors) can be introduced. This allows the use of island stations, which reduces the total number of stations required. Moreover, cheaper, high-floor buses built on standard truck chassis can be used along with platforms at matching height, to allow passengers to board without needing to climb. In closed systems, buses only move up and down between ends of the corridor, this means that all passenger demand is concentrated on this single route, which justifies articulation of buses to form higher capacity vehicles. Island stations are located away from the intersection because at junctions, the station would have one near side (before the intersection) docking and one far side (after the intersection) docking. Far side docking near the junction runs the risk of buses spilling over into the intersection, thus creating a case for mid-block stations. Since the bus remains within the corridor, investments in controlled stations with off-board ticketing appear attractive against the use of additional bus staff and random ticket checking in on-board systems.

A different set of features is required if an existing public bus system is to be upgraded. An open system allows multiple, existing bus routes. This requires left-sided stations to serve existing buses (with doors on the left side). This, in turn, necessitates staggered stations. In this setting – let us call it an open system, to differentiate from the metro-styled, closed system – smaller vehicles make more sense than the elongated, articulated buses. So low-floor urban buses are preferable. Near-side boarding is more efficient; it combines stoppage time at intersection with the time passengers take to board or alight from buses. Staggered stations serve only one direction per station. So it is possible to build one on either near side of the junction. In such a setting, off-board ticketing does not make sense, since the buses go out of the corridor; it is better to have staff inside the bus, dispensing tickets.

Public transport advocacy groups prefer the closed system. Their zealous support is rooted in the fact that this model is a proven 'success', hence, it defines the 'true BRT'. Nonetheless, more than half the BRTs around the world are based on an open system. Because most cities have a functioning public bus system, they look for ways to upgrade it. This list includes cities in Europe (Paris, Leone), China (Guanghzou, Kunming, etc.), Taiwan (Taipei City), South Korea (Seoul) and Australia (Brisbane).

The Indian experience

India woke up to BRT in 2002, when the then chief minister of Delhi, Sheila Dikshit, announced the creation of a 19-km corridor in south Delhi. Subsequently, when the union ministry of urban development released the national urban

Buses have to compete for space with vehicles that serve very few people. Hence, BRT.

transport policy in 2006, it included BRT as an important tool for cities to fight increasing car use, congestion and vehicular emissions. The central government offered funding support to cities under JnNURM for sustainable transport projects, including BRT. By 2014, 12 Indian cities had built or were building multiple BRT corridors at a total estimated cost of ₹5,300 crore. With the exception of Delhi, all other cities received nearly 50 percent of the BRT development cost as funding under JnNURM. Nearly half of these are based on the open system approach.

Delhi was the first city to start planning a BRT, while Pune was the first city to inaugurate an operational corridor in 2006. Both these cities have strong, functional public bus systems that account for nearly one-third of all commuting trips. This is why both the cities opted for an open system. In 2007, Ahmedabad began planning a BRT system. An international BRT advocacy group assisted Ahmedabad, so it planned a closed BRT system that became operational in 2009. It later expanded its network to a total length of over 80 km and received significant publicity as India's most successful BRT. There is little doubt that the city was successful in creating a positive public outreach about BRT. Meanwhile, Delhi's BRT, based on a rigorous research effort, got panned in the media. Only about one-third of its planned length was operationalised, before the remaining was abandoned in 2008. It subsequently earned the tag of the worst BRT in India. This contributed to the argument that closed systems are better than open systems.

Of the 12 cities developing BRT in India, nine have managed to generate a neutral or positive media buzz. Delhi, Indore and Pune drew adverse publicity. In Delhi, a strident anti-BRT campaign in the media in 2008 against a perceived reduction of space for private cars led the government to abandon the system.

Pune's case is peculiar. It began developing its first BRT as an open system. However, eager to replicate the success of Ahmedabad's BRT, Pune changed over to elements of a closed design in the second phase. A hawkish media in Pune has kept BRT expansion on the back foot. Of more than 100 km planned, only two corridors, totalling less than 30 km, have been built. The original corridor has already been replaced with an elevated road for motor vehicles, while the other is still waiting to be operationalised. Indore, too, opted for an open system and changed to a closed system mid-way, like Pune. The corridor, now a replica of the Ahmedabad BRT, has got negative media coverage, leading to a court intervention. The exclusive bus lanes were opened to all vehicles, thereby all but abandoning the system.

Comparative assessment

If the benchmark of a BRT system is the absence of a negative response from the media, then most systems in India are successful. The choice of an open or a closed system does not guarantee success. What is needed is public outreach, a positive media/communications campaign, a concerted effort from experienced professionals backed by leadership, both bureaucratic and political, in the government. This is where the true success of Ahmedabad BRT lies. The highest level of state political leadership backed it. A top bureaucrat crafted its careful public outreach. Such success is temporary if the commuters do not benefit from the promises. No BRT system in India is old enough yet for a long-term assessment.

A critical benchmark for BRT's long-term success is whether it improves the appeal of public transport. Though such promises are itemised and backed by numbers, in the detailed project reports (DPR), they are rarely verified to measure the project's success. Hence, a project's success continues to be measured by media perception. But all indicators are not measurable through observations. So proxy indicators are often applied to measure them.

A prominent international advocacy group has launched its own measure of these indicators. It suggests a feature-based scoring system. The aggregate of these scores leads to a ranking – gold, silver, bronze. In this, features of an open system would not aggregate to qualify even as a bronze standard, while those of a closed system can qualify a corridor as a silver or gold standard. The scoring system is justified on the basis of the perceived impact on indicators such as passenger speed, system capacity, comfort and image. Hence, it is suggested that off-board ticketing, the number of bus doors, the use of express buses and junction arrangement are important to reduce passenger delays. Here, the proxy for reduced passenger delay is an increase in frequency and commercial speed of buses.

This can be misleading. For example, commercial speed of buses can be increased by reducing the number of

bus stops. But that increases passenger walking distances and journey time.

For a BRT system to yield long-term benefits, it is important to better understand what indicates success. We conducted a detailed study in 2013 for this. It identified three categories of stakeholders. One, the passengers; two, the operator; and three, society at large. Indicators of success for each of the stakeholders were identified through a response to a questionnaire, by representatives from civil society organisations, prominent national and international advocacy groups, research institutes, bus operators and government planning departments.

For the users, the indicators included total passenger walking distance and delay in a one-way journey. To rate the operators, it included the commercial speed and capacity of the system. To assess the impact on society, it included the time saved against using a private vehicle or regular buses in mixed traffic. The study was specific to Indian cities. We generated a clearer understanding of what constitutes a BRT's success, and what features in which context contribute to it.

We found that, in general, an open system performs better when passengers are the priority, while a closed system performs better when the operators are the priority. Hence, an open system (when compared to a closed one) speeded up the passenger's journey, reducing delays as well as walking distance by 30 percent. A closed system, meanwhile, offered 30 percent higher commercial speed and higher capacity. On the whole, the study established that given Indian conditions, an open system is more likely to generate long-term benefits.

Our study created alternate design scenarios for Ahmedabad and Delhi BRTs for comparison. We modified different design components of BRT in these cities. So Ahmedabad's closed system was modelled as an open system, while Delhi's open system was modelled as a closed one. The results show that Ahmedabad BRT's performance for the users improves significantly, while there is a 10 percent deterioration on operator indicators. Similarly, Delhi BRT's performance significantly deteriorates on passenger indicators, with a corresponding increase in operator indicators.

So, no matter how good the current Ahmedabad system may be, it would have been better if it had used designs similar to Delhi BRT's design. It also shows that however poor the Delhi BRT may be, it would have been worse off with a closed system. Which also means the success or failure of BRT in Ahmedabad or Delhi cannot be ascribed to their planning or design. Besides, the evaluation of a BRT's success should include its impact on improving the city's overall public transport scenario, and not just its impact in an isolated corridor. A closed system concentrates resources along a limited corridor, serving only a fraction of the commuters. This cannot be an alternate to the current public bus system which serves along the wider street network.

A critical benchmark for BRT's long term success is whether it improves the appeal of public transport, improving urban mobility. This is the objective against which BRT projects are sanctioned.

Delhi's 5.8-km BRT corridor tries to maximise the benefits of limited investments. It offers relief to commuters from 40 bus routes across some of the most congested stretches of the city. The components of the Delhi BRT included bus specification and the inclusion of a new bus fleet for the whole city, and not just for the corridor. This resulted in 4,000 new low-floor buses being inducted in the city over a period of six years, replacing 70 percent of its fleet. In contrast, Ahmedabad brought in 80 new buses for its BRT corridors, a mere 10 percent of the total bus fleet serving the city. In Delhi, BRT's introduction brought in an electronic fare collection system for 80 bus routes throughout the city. Ahmedabad's closed system, meanwhile, has extended the same service to about 10 routes only. Unlike Ahmedabad, BRT interventions in Delhi are not limited to buses alone. They include dedicated paths for pedestrians and cyclists, parking facilities for auto rickshaws, and special lighting and paving features which make the entire length barrier free and safe for all.

An open and closed case

Given the conditions in Indian cities, open systems are more suitable. They are equipped to improve transit facilities on a city scale over a long term; they promise superior performance over closed systems. Because, for a majority of their trips, people in our cities commute over short distances, rarely more than 10 km. In addition, most Indian cities have an already evolved or evolving public bus system, which is currently serving the mobility requirements of a majority that cannot afford private vehicles. To increase mobility and decongest our cities, the bus system has to be improved overall. The open system agrees with that long-term objective. That said, an open system cannot be a general rule. The selection of a system and its features must be suited to the context of each city.

A formal, integrated public outreach strategy and the perception of stakeholders is critical, whatever system is selected. This becomes even more critical for an open system, where success is not immediate and the benefits are not apparent. Positive feedback is critical in generating ownership from political decision-makers, without which even the best projects and most thoughtful approaches face premature termination. ■

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