focus

November 2011

Bus Rapid Transit (BRT) systems: a bit more than just segregated lanes?

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a BRT project can be delivered in less than half the time of alternative solutions

BRT systems are once again making the headlines. In the UK the Cambridge – St Ives system, the longest BRT line in the world was launched in August 2011, while the city of Rio de Janeiro just announced a public concession to implement and operate an Olympic BRT.

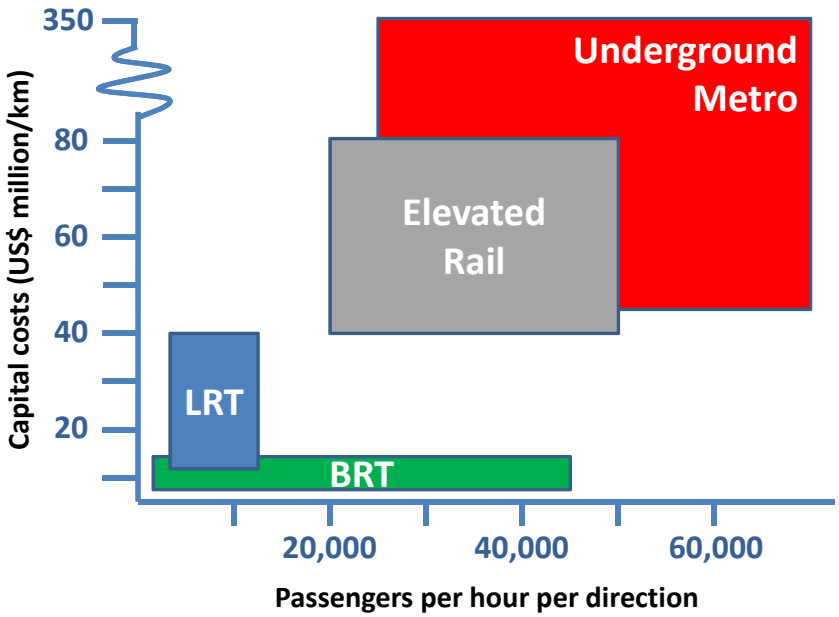
So what is BRT?

At first glance BRT is a public transport system based on buses running in segregated lanes. However, behind the day-to-day operations there is a complex interaction of bus services, Intelligent Transportation Systems (ITS), lane management policies, Public Private Partnerships (PPP) procurement and a strong political will to redesign public transport in a city.

It is the blend of these elements that makes a BRT system successful.

There are three main reasons behind the increased interest in BRT systems:

- Higher Performance Services: A combination of high-frequency, high-capacity bus services, overpass lanes and station designs can lead BRTs to have a capacity of more than 40k pax/hr/dir. This compares with Light Rail Transit (LRT) (15k pax/hr/dir) or metro (80k pax/hr/dir).
- Cheaper than alternative solutions: A BRT system entails a construction cost ranging from $1 to 12 million per km. This is up to five times cheaper than LRT and 10 times cheaper than metro. The cost varies with the specific characteristics of each system and, in particular, the level of segregation and integration with other modes.
- Shorter Implementation Times: As with construction cost, the implementation time is driven by the complexity of the system, but in general a BRT project can be delivered in less than half the time of any of the alternative solutions (metro or LRT).



Based on Bus Rapid Transit Planning Guide June 2007

the transport system moulded community development

Curitiba - setting the standard

Curitiba in Brazil was, without doubt, the city in Latin America that set the benchmark for transport planning within a development strategy. The local government directed all the public offices to work efficiently and in co-ordination towards the same general objective: a sustainable city.

In 1965, the new administration responded to fears of uncontrolled development spreading across the city with a new Master Plan.

This new Master Plan integrated transportation with land use planning. It limited central area growth while promoting high density industrial and residential developments along the main transportation corridors, designed to radiate from the city centre to the external zones. The city centre was partly closed to vehicle traffic and pedestrian streets were created as replacements.

Consequently, the traditional morning one-way peak congestion changed to a more balanced distribution of traffic in both directions. The transport system moulded community development as much as the community dictating its structure.

Other policies also contributed to the success. Land within two blocks of the public transport corridors was zoned for high density and, residential densities beyond were tapered in proportion to the distance from main corridors.

The backbone of the Master Plan was a hierarchical BRT system. Minibuses routing through residential areas fed passengers to conventional buses on orbital routes around the central area and on inter-district routes. Articulated and bi-articulated bus services ran along the five main radial corridors.

Buses running along dedicated lanes used cylindrical, clear-walled stations with ticket barriers, level access and wheelchair lifts. A single fare system allowed passengers to travel throughout the system with unlimited transfers between buses at interchanges.

Concessions were given to private companies to operate the system under agreement with the local authority. Operators were paid by distance travelled (veh-km.) rather than by number of passengers, allowing a balanced distribution of bus routes and eliminating congestion on main roads.

Curitiba's BRT was a success. It reduced travel times across the city, improved the level of service on public transport, reduced the usage of private vehicles and brought environmental benefits to the city.

Bogotá - taking BRT to the next level

The BRT system in Bogotá took the concepts developed and tested in Curitiba and applied them to a much bigger city.

In 1999 the newly elected mayor scrapped all plans for metro projects and directed all the effort into implementing, within only four years, Phase I of what it is now one of the most famous BRTs in the world: TransMilenio.

The project was progressed on two parallel fronts.

First, the technical aspects behind designing and planning a bus system capable of carrying more than 40k passengers / hour / direction. The results of the technical analysis was a detailed strategy to develop, over 16 years, 22 corridors (388km) of fully-segregated lanes across the city serving 5 million passengers per day.

The proposed system was based on articulated buses running along the central lanes of existing major highways, fully segregated from general traffic and with enclosed bus stations with ticket barriers, paid zones, platforms and travel information.

Most of the roads for the articulated services were dual carriageways with all stations having additional lanes to accommodate both local and express services without delays.

The system was complemented with feeder buses of lower capacity, running from the terminal stations onto the local roads. Interchange between articulated and feeder buses occurred at terminal stations at no extra cost and with negligible transfer times.

A major investment in infrastructure was an important element of the project. The administration spared no cost to build the BRT system as a multi-modal corridor. It invested not only in the BRT components but also in upgrading parallel highways, building cycle paths and on sidewalk maintenance, always having the BRT system as the axis for this integrated investment.

The second challenge was to design and sell the new business structure. A new public company was created to manage and plan the system, given the eponymous title Transmilenio S.A. (TMSA).

Managed by TMSA, the system was planned to operate under PPP concessions. Tenders were issued to select operators for the articulated and feeder buses. An operator for ticket and revenue handling was also selected through a similar open tender.

the system was designed to operate with smartcards

Tendering conditions for the bus operators encouraged the creation of consortia of traditional local companies associated with national and international investors.

Bus operators were responsible for buying and operating the buses while TMSA was responsible for managing the contracts, defining and supervising the service operation (routes, frequencies, etc) and monitoring the number of passengers.

The system infrastructure was financed by the government.

Different rules were set for the articulated and feeder bus operators, with the latter having lower requirements and hence easier access for more local consortia unable to support the higher investment required for the articulated bus tender.

The ticketing system was also privately operated. The system was designed to operate with smartcards from the outset.

Money collected from card sales was deposited in a fund, from which the operators were paid according to the rules set out in the concession contracts.

The system had a fixed fare allowing passengers to use any articulated or feeder service within the system, regardless of distance travelled or number of interchanges.

The fare was set by TMSA to cover all the operational costs, without subsidy from the government.

The articulated buses were paid on the basis of veh-km., feeder buses per passenger, the ticket operator by the number of tickets sold and TMSA received 3% of the total revenue.

Phase 1 of the system (40km) opened in 2001 and immediately changed the dynamics of the city. With bus services travelling at an average speed of 25km/hr, and some express services peaking at 40km/hr, travel times dropped dramatically.

Private vehicles also benefited from the upgrades in the highway infrastructure. Land use was reorganised around the BRT corridors and all the investment risks taken by the private companies paid off.

In 2004 Phase 2 (40km) started with similar conditions but removing some of the contractual differences between the articulated and feeder buses concessions. Phase 3 is currently under construction and is planned to start operations in 2012.

Santiago de Chile - re-learning lessons

The BRT project in the Chilean capital built upon the experiences from Bogotá and Curitiba. It had, in principle, the same idea of restructuring public transport to have a trunk-feeder system based on buses, but this time using the existing metro as the backbone of the project.

As in the other two cities, the new system was structured under concession contracts awarded to private companies, selected through a competitive bidding process, by the Ministry of Transportation and Telecommunications (MTT).

The planned system had some differences when compared with its precursors, but there were two key decisions that created challenges to the implementation of the system.

First, there were no plans for major infrastructure improvements. No fully segregated lanes were contemplated as part of the project.

Instead of bus lanes in the centre of the road, buses ran on the external right lanes with only some sections being fully segregated. Buses operated with lower platforms and right-hand doors to give access from the existing sidewalks.

Bus stations also received a low level of investment. The system was designed to have on-board payment (through the front door only) rather than enclosed stations with ticket barriers, such as the ones used in Bogotá and Curitiba. Simple bus shelters were built instead, with pedestrian signals to tell passengers where to wait and queue.

The second key decision was to implement the system in a single phase, without a transition period between old and new schemes. Unlike the progressive approach in Bogotá and Curitiba, the Santiago system was planned to be fully operational on day one.

The challenge of this approach was not only having the bus and metro system operating and integrated from the beginning, but also providing the correct information to passengers so that they could take full advantage of the system intuitively and without delays. It was an extremely aggressive approach with no room for errors.

Transantiago was launched in Feb 2007 and become a nightmare for commuters. The lack of dedicated infrastructure led to major problems. As bus lanes were not fully segregated general traffic affected the operating speed of the buses, making the fleet insufficient to cover the required frequencies.

Boarding and alighting times were also badly affected by passengers having to validate tickets when boarding, adding an additional source of delay.

only BRT can offer a large mass transit system to cope with spiraling demand and congestion

The system required more interchanges to complete typical journeys, exacerbated by long queues for buses and gross overcrowding of the metro.

Everything that could go wrong did and the choice of a full implementation from the beginning did not allow time for changes or quick improvements. The smartcards did not work well, travel information was poor and buses and metro were well over capacity. Chaos and frustrated passengers were the main symptoms of the system.

Transantiago ended up being a hard lesson in how not to plan and implement a mass transport system.

India - the next generation

BRT is now starting to play a key role in keeping Indian cities moving. Broad thoroughfares in the newer parts of cities, are enabling segregated laned BRTs to be built (e.g. Pune, Delhi, Ahmedabad and Jaipur), and in places where dedicating roadspace is difficult, BRT is being deployed in mixed traffic conditions (e.g. Mumbai and Indore) to improve the customer experience of public transport through high capacity vehicles.

Elsewhere in cities such as Rajkot and Surat BRTs are under construction. The combination of moderate capital cost combined with the lack of need to import technology is giving BRT an 'affordability' edge over metro systems.

Whilst Pune's system was the first notional BRT in India, it is in Ahmedabad (utilising semi low floor fleet) and Delhi (the second city in India to install BRT) that the BRT concept has been taken the furthest.

Ahmedabad claims to be the first 'true' BRT system, built in 2009. It consists of 12km of busways through the central/ median reservation, and offers split flyovers in congested areas as well as dedicated fleet with wide doors to facilitate rapid boarding and maintain an even service headway. The system also includes electronic fare collection, centralised control and user information systems. The plan is to eventually expand the system to cover 88km of BRT at an infrastructure cost of US$1.87m per km.

In Delhi the BRT forms part of a network of integrated modes including metro, monorail and light rail. BRT was introduced for the Commonwealth Games in 2010. Buses are not grade seperated but have dedicated lanes and stations.

A total of 26 BRT corridors are planned for Delhi, covering a total length of 310 km by the year 2020. The first corridor to be built was 14 km long from Ambedkar Nagar to Delhi Gate, and the patronage is extremely high due to it serving some of South Delhi's key economic hubs.

The BRT has improved the performance of other modes in Delhi in its corridors with bus and cycle journey times seeing sizeable improvement. Initial surveys indicate that around 60% of Delhi residents having access to the BRT use it for work trips with cleanliness and reliability being the key attributes admired most.

2011 and beyond

After being praised and imitated around the world for 10 years, TransMilenio seems to be moving backwards. The buses are overcrowded, attracting muggers and pickpockets. Perception of the system is falling and there is no imminent response from the government to solve the problems. The mobility agenda for the Colombian capital is now focused on new BRT lanes, a metro and full integration with other public buses.

In Transantiago the picture is completely the opposite. After four years of operations all flaws and glitches have been fixed. Sound investment in infrastructure has been made to facilitate the operation of the buses, the technology to control the fleet is now implemented and pre-boarding pay zones have been created. The system is far from perfect but at least is now moving in the right direction.

Elsewhere the experiences in Curitiba, Bogotá and Santiago have inspired similar solutions in other cities of the world: Metrobus (Mexico City), Metrobus (Istanbul) and Rea Vaya (Johannesburg). India is also now adopting BRT in many of its cities.

Finally, while the introduction of the Cambridge – St Ives BRT was two years late due to technical issues with the segregated track, early signs are encouraging and augur well for future projects such as Luton- Dunstable and BRT North (Sheffield – Meadowhall – Rotherham) in the UK.

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Some pictures in this Focus have been provided by Transmilenio S.A.