



ADVANCING
PUBLIC
TRANSPORT



► VREF, UITP AND BRT+ COE REPORT

TRANSFORMING CITIES WITH BUS RAPID TRANSIT (BRT) SYSTEMS

HOW TO INTEGRATE BRT?

MAY | 2019



Note for Acknowledgement and Editorial Committee

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References

- Klopp J., Harber J., Quarshie M., (2019) A Review of BRT as Public Transport Reform in African Cities, Unpublished Working Paper.
- Sinha S., (2019) BRT Governance and Challenges – A case of Indian Cities, Unpublished Working Paper.
- Flores O., and Díaz R., (2018) Transportation Governance in Latin America: BRT as a tool for structural change or as a tweak over existing conditions? Unpublished Working Paper.
- Munoz JC., Paget-Seekins L., (2015) Restructuring Public Transport through Bus Rapid Transit: An international and interdisciplinary perspective. Policy Press.

International Association of Public Transport (UITP)
Rue Sainte-Marie, 6 | B-1080 Brussels | Belgium

Tel: +32 2 673 61 00
info@uitp.org
www.uitp.org

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VREF

The Volvo Research and Educational Foundations (VREF) inspire, initiate and support research and educational activities promoting sustainable transport for fair access in urban areas. Through the “Future Urban Transport - How to deal with complexity (FUT)” program, VREF invests in research, education and communication for the purpose of contributing new ideas and solutions for the design of sustainable transportation systems in cities. The challenge is to find urban transport solutions that will provide accessibility for the masses while at the same time radically reducing transportation's negative local and global environmental impacts. Since 2001 the FUT program has created ten Centres of Excellence (CoE) and a number of projects and events worldwide. VREF has supported CoE BRT+ since 2010. VREF engages in communication activities such as meeting places and publications through partnerships with universities, institutes, international organisations, foundations and other non-profit organisations.



Bus Rapid Transit (BRT+ CoE) is a Centre of Excellence for Bus Rapid Transit Studies implemented in Santiago, Chile, and financed by the Volvo Research and Educational Foundations (VREF).

This CoE was established in May of 2010 and is working as a consortium of five institutions that include Pontificia Universidad Católica de Chile (PUC), Massachusetts Institute of Technology (MIT), University of Pretoria (UP), The University of Sydney (USyd) and World Resources Institute Ross Center for Sustainable Cities – WRI, including its network of centers of sustainable transport.

The main goal of this Centre of Excellence is to develop a new framework for planning, design, financing, implementation and operation of BRT in different urban areas, giving clear guidelines to decision makers on when and how BRT projects can effectively enhance mobility and meet accessibility needs. These guidelines will be a major milestone to change the way decision makers address investment and design plans for configuring urban mobility systems. An essential goal of the BRT+ CoE is to identify elements which are transferable between existing and prospective BRT systems and elements that are project site specific.

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INTRODUCTION

Bus Rapid Transit (BRT) systems emerged in Latin America as an innovation that could transform cities and the way people move. While they constitute a first step towards integrated public transport networks (IPTN) and could be a catalyst for urban development they should not be treated in isolation as a mere substitute for rail infrastructure where public funds are scarce.

This report argues that a systemic approach, acknowledging that BRT impacts and performance depend on local conditions. It draws on the global knowledge of the VREF BRT + CoE to pay particular attention to Africa through the cases of Cape Town and Dakar.

TOWARDS A STANDPOINT HOW TO VIEW A BRT SYSTEM?

Urban Mobility Systems have become dysfunctional to the point that they now threaten cities in the sense of lowering life expectancy, setting the scene for various Non-Communicable Disease (NCD) such as diabetes, obesity and cancer (<https://www.uitp.org/policy-brief-integrating-mobility-health-impact-decision-making>). This could be seen as the result of many years of decision-making that systematically favoured road infrastructures and cars. Many cities, pushed by climate change concerns, have decided to have restrictions towards the use of the car. In this scenario, it is now important to reconsider the way we provide transport in the cities.

Yet cities are not all equal. They are more or less car dependent and sustainable according to past development and characteristics such as metropolitan structure, density, land use, public policies and income.



► Representation of heavily motorised cities



In Western Europe, cities like London, Paris, Copenhagen, Stockholm, Munich, Zurich, Hamburg, Berlin and Vienna implemented complementary measures that aimed to reduce the use of cars over time. This is why between 1993 and 2014 Vienna managed to decrease the amount of trips by car by a third. Such a result is to be associated with a successful implementation of a coordinated package of transport and land-use policies that simultaneously improve conditions for public transport and active travel while making the car slower, less convenient and more costly. In Vienna, this was achieved mainly through the expansion of the U-Bahn (i.e.: the metro system), and parking management policies.

WHAT A BRT PROJECT WOULD INVOLVE IN CONTEXT LIKE VIENNA?

The delivery of BRT systems are less problematic in cities like Vienna because they can be implemented under the same rationale than previous initiatives that promote public transport and restrict car use without significant change. This same reasoning could be applied to other cities, like Gothenburg, Sweden or Manchester, UK.

Gothenburg is part of the Västra Götaland region which has the “good life” vision, which means that the region should be attractive and competitive but at the same time sustainable. However, Gothenburg’s labour market is still growing which means that more people will need to commute. At the institutional level there is a consensus that this should be achieved via public transport. Subsequently, the region, the city, and Västtrafik, the Public Transport Authority (PTA), engaged in doubling public transport ridership and collaborate with each other to make this happen. The city regulates the use of the car with an urban toll and Västtrafik works with public transport operators to deliver high quality public transport, especially bus services to encourage people to rely on public transport but also to walk and bike. In both cas-

es, Vienna and Gothenburg, there is no BRT systems available at this point but we can assume that introducing them would not entail major challenges. In Vienna, it might imply that the city has to change the public transport policy based on U-Bahn towards the enhancement of surface transport. A change that should be easier in Gothenburg where buses and tramways are already relied upon. For Gothenburg the BRT challenge is to find and provide additional space for buses and then explaining to car drivers that even less capacity will be allocated to them forcing some of them to leave their car and do the same as the majority of the population – walk or bike to the station and rely on the BRT system to arrive on time to their destination. This means that BRT systems can be implemented in environments where there is already a commitment to public transport in general even if it always leads to political discussions regarding space reductions for cars. Nevertheless, cities like Manchester engaged in this path.

Manchester is implementing a bus priority package consisting of over 25 miles of key bus routes being either created or expanded, making the scheme one of the largest investments in Greater Manchester’s bus network in decades. The scheme comes with an integrated public transport network that comprises the first guided busway, new buses, cycle paths and pavement improvements. The benefits of the bus priority package are shorter journey times, more punctual and reliable bus services, improved passenger travel experience, increased access to workplaces, improved connectivity to health care and residential appeal for local communities served by the scheme.

In cities like Vienna, Gothenburg or Manchester, the BRT system would represent an additional tool to support public transport policies. But what would mean the delivery of BRT systems in other environments like Seoul, South Korea?



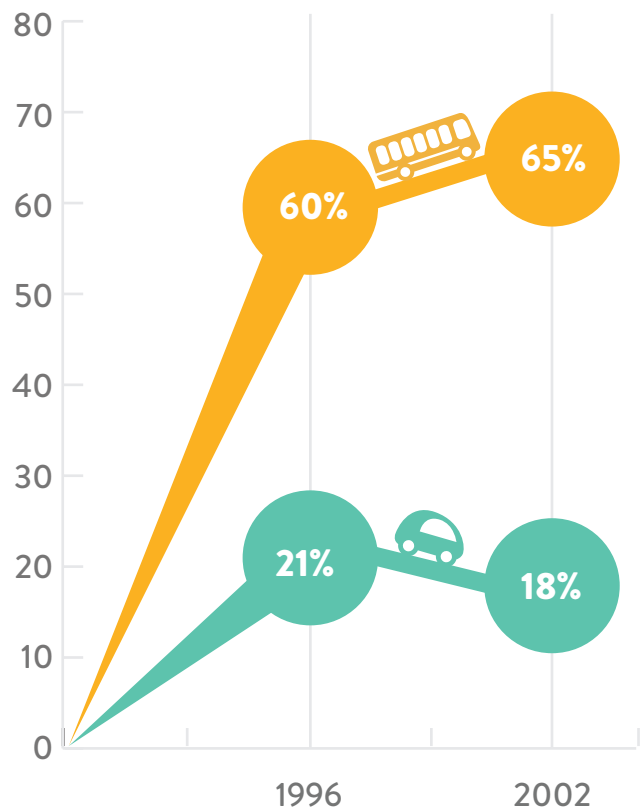
SEOUL'S BRT SYSTEM DELIVERY – A STORY OF POLITICAL LEADERSHIP

With a population of 10.29 million, the core city of Seoul is one of the world's largest cities and with 17,000 people per km², also one of the world's most densely populated cities; 1.3 times denser than Tokyo and twice as dense as New York. With over 25 million residents, the Greater Seoul metropolitan area depends heavily on public transport for its growing travel needs. Rail and bus services carry 65% of all trips in Seoul, one of the world's highest market shares of public transport.

Seoul relied on a dual transport system based on highway and mass transit infrastructures. Despite one of the largest metro/subway systems in the world, private motorization grew rapidly during the 80's. Therefore, the large increase in car ownership and use in 1980s and early 1990s diminished public transport's share of total travel in Seoul. The combined modal share of bus and metro fell from 75% in 1980 to 60% in 1996. Over the same period, the trips taken by private cars rose from just 4% to 21%.

As congestion intensified, Seoul had to build more metro lines and to widen road, limiting opportunities for pedestrians above-ground. Concur-

rently, the average bus speed decreased by 50% between 1980 and 1990 reducing the economic viability and appeal of bus transport. However, in the mid-1990s car-restrictive policies reinforced the introduction of the BRT system which culminated with the political decision to transform an elevated highway corridor into a popular world-famous public park and reinvigorate its ailing bus system. The redevelopment of the central business district came with bus priority lanes, the integration of bus fares with the subway system, the replacement of aging bus fleet and mechanisms for allocating fare revenues. Thanks to the policy measures public transport's share of trips rose from 60% in 1996 to 65% in 2002 while the proportion of car trips dropped from 21% to 18%. Further, the average number of daily bus and subway passengers increased by 13% between 2003 and 2010.



► Reducing Car Dependency in Seoul

As cities depart from different conditions, the delivery of BRT Systems is likely to “mean” differently across the globe.

In general, introducing BRT systems requires to break away from the “predict and provide” model that originated from the 50s and put cars at the centre of transport planning policies which, to a great extent, were reduced to matching road capacities with the demand. And such a shift demands a certain level of political leadership like in Seoul. In contrast, it seems that BRT Systems can be more easily implemented in cities where there is an institutional framework that promotes public transport and active modes with a set of consistent measures. But for car-dependant cities the delivery of a BRT constitutes a significant change that could lead them to a virtuous/sustainable path. A potential which is even greater in Emerging Economies and Low Income Countries (LIC) which follow a distinct development pattern.

THE POTENTIAL OF BRT SYSTEMS IN EMERGING ECONOMIES AND LOW INCOME COUNTRIES (LIC)

Cities from these countries experienced the motorisation era differently than Western Europe and US. Due to economic circumstances and the lack of resources, governments did not invest in rail and mass transit infrastructure. At the same time these cities were attracting a rural population in search for jobs and opportunities. People started to concentrate in cities, often settling at the fringe of the urban territory. A phenomenon that encouraged sprawl and gave rise to informal neighbourhood, often coined as slum. Planning capacities and public utilities could not follow the growth to provide basic services such as water, sanitation and transport. As people could not afford cars, communities organised to respond to the mobility needs, hence the emergence of paratransit. This phenomenon was exacerbated by a series of “wrong” choices in the traditional bus sector, especially regarding fares. Many cities adopted a flat fare structure which has apparent social benefits making the service more affordable for the poor. However, the level of fare was not set sufficiently high to allow bus companies to cross-subsidize longer routes. In places where public budgets were low, this loss of revenue was not subject to public compensation putting pressure on the operation and maintenance of traditional buses. Many public bus companies went bankrupt and paratransit flourished to fill the gap. In this sense the development and resilience of paratransit cannot be understood without taking into consideration what happened and constrained traditional public services in respect of funding, operation, regulation and institutional capacities.



PARATRANSIT DEFINITION

Paratransit refers to unscheduled, on demand services delivered along non-fixed routes. It often consists of minibuses that operate under for-profit entrepreneurial schemes. Paratransit systems are present in all regions: Africa, Asia, Middle East and Latin America. But they are not homogeneous. They are more or less regulated by cities. Some are informal and illegal, others rely on sophisticated business models. In the 80s they were seen as proof that the market could deliver transport services without public compensation. Nowadays, they tend to be badly perceived due to the low quality of service and the issues they pose in terms of safety, congestion and pollution.

The specific development pattern of Emerging Economies and LIC explains why in these cities car use is still relatively low compared to Western Economies. But the perceived need to own one remains very high since many people tend to either walk and/or rely on paratransit or do not move because they have no access to services. In this landscape, BRT systems might constitute a credible alternative to the car-dominated future. This is well illustrated with the case of Amman, Jordan.



► Jakarta, Indonesia



AMMAN APPROACH TO BRT

Amman is the capital of Jordan and a center for commerce and culture with strong international and regional links. It counts 4 million people whose 60% are under 25 years old. This demographic attribute reflects the modal split with 26% of walk and 13% school bus. The share of traditional public transport is relatively limited, 13% while cars, either individual or shared, represent already 34%. Some sort of paratransit amount for the rest of the trips with about 16%. By 2025, the number of cars is expected to reach 2,000,000 compared to 800,000 in 2010. For the Greater Amman Municipality (GAM) the delivery of BRT Systems consists in a policy shift that gives priority to public transport and aims at restoring a balance in the Urban Mobility System. The BRT System comprises three routes (32km), dedicated bus lanes, new terminals with park-and-ride, stations with off-board payment, pedestrian facilities, traveler information system and an electronic payment system. With BRT, GAM's strategy is to deliver a premium, yet affordable service that would provide an alternative to cars. For this purpose it relies on intersection improvements that will give priority to buses over cars.

The potential of BRT Systems in cities like Amman is less about replacing paratransit and more about preventing future generations to rely exclusively on cars. This is all the more relevant since this population is willing to walk. Therefore, to achieve this potential, BRT Systems, must effectively provide not only a high standard service, but also focus in addressing the first and last mile problem through proper integration. Despite its high level of services, like rail, BRT systems are not a door-to-door solution. Consequently, it is likely that BRT will always look less attractive than cars except if the use of cars becomes too complicated – congestion, lack of parking space, urban tolls etc. hence the importance of a feeder system when people cannot walk or bike. Therefore, from an integrational perspective, the paratransit sector should be reformed; paratransit might still have a role to play in the urban mobility system.

WHERE DO WE STAND ON BRT SYSTEMS?

BRT Systems consist of large buses that run on dedicated lanes and stop at well-defined stations, and include a technology that enables passengers to pay before boarding.

They offer mass transport services at lower costs than rail reaching high levels of capacity comfort and safety while retaining the flexibility of a bus with fairly short implementation times. They provide multi-corridor services that surpass and adapt to the demand quite effectively. Also, BRT systems are about equipping cities with surface public transport, so that people can enjoy the city while travelling. An effective BRT becomes a credible alternative to car. Yet their introduction is raising distinct challenges in cities where they emerge. In this regard, we can categorise cities in three geographical types – see table below.

US CITIES	WESTERN EUROPE & SOME ASIAN CITIES & SOME EMERGING ECONOMIES	CITIES FROM EMERGING ECONOMIES & LOW INCOME COUNTRIES (LIC)
ALL CAR	CAR + PUBLIC TRANSPORT + ACTIVE MODES	CAR + PARATRANSIT + ACTIVE MODES

Some cities are better prepared than others to deliver BRT systems. Decision-makers should be able to assess to what extent the conditions of the public transport industry will support or constrain its development and when possible to change it.

In cities where there is already a public transport market, BRT systems might be perceived as a natural continuity or improvement, as these cities can deliver the BRT system with the same structures and processes used to provide the existing services. However, where the public transport networks are underdeveloped, in car-dependant cities or in Emerging Economies and Low Income Countries (LIC), it needs industry to be built and organise it accordingly, a process that involves the reform of the traditional bus and paratransit sector as well as advancing public institutions and the way they work. The delivery of BRT systems and the subsequent change start from the demand – *Do we have a market for BRT services? Will one emerge in the future? How can such a market be created?* In this respect, BRT Systems are access providers: they enable people to reach a wide range of opportunities, such as jobs, education and leisure, and ultimately the possibility to interact with each other. The relevance of BRT systems will therefore depend on the extent to which public transport, and the BRT system, constitute a solution to fulfil population access needs. Again, this would vary depending on the city.

SO HOW TO VIEW BRT SYSTEMS?

BRT systems should be viewed as an innovation which is led by the market that is people. People need to choose and use the BRT systems. This is an important point as many BRTs tend to be conceived top-down and neglect the demand side. For cities which mainly rely on public transport increasing capabilities exist to improve the delivery of existing services. In “all cars” and “paratransit” cities BRT opens-up new markets. In the beginning, it might concern a relatively small share of people, along limited corridors, but as the system expands the market increases. This could be further eased with pro-active public transport policies that support the development of the network and might lead to a process where the provision of a public transport network is fundamentally reviewed. In this sense, BRT systems have a disruptive character, it is not so much about the change they involve at the institutional and organisational level; it is about the people they serve that require to adapt and reconsider how we deliver transport. It means that all the reforms that BRT systems involve must be carried out in relation to providing access to people via public transport. This endeavour could be seen as an integration process that should be managed in context – the next part therefore explores what it takes to integrate a BRT system.





► Barranquilla, Colombia

BRT SYSTEM AS AN INTEGRATION PROCESS

For many cities the delivery of BRT systems is the first step towards Integrated Public Transport Network (IPTN). This first step comes with a commitment to sustainability and the determination to provide good accessibility through public transport and not just by car. Despite their potential, most BRT projects struggle to gain acceptance and face barriers of diverse nature. In order to further understand the nature of these barriers, there is a need to focus on a crucial component of BRT System; namely the bus lane. All BRT systems in the world start from a segregated busway and imply to negotiate additional space for buses on roads that are often overpopulated by cars and paratransit vehicles. In most cases this poses a problem where there is conflict over the use of public space. BRT systems emerge in a built environment which might not allow the insertion of bus corridors and stations due to the size of the roads and how con-

gested they are. This is a contradiction. While this can be seen in heavily congested areas where BRT systems are needed the most, many authorities are not willing to allocate a dedicated lane to BRT. Instead they look for opportunities to enlarge the fraction of the streets devoted to motorised transport hurting pedestrian areas or expropriating private properties. In this context, the success shown in Seoul of transforming a highway into a park to then insert the BRT and the stations is inspirational. Such decision was also made acceptable because Seoul had a dense metro/subway system that could offer a credible alternative to car in first instance. The effort to develop the BRT was then sustained by the reform of the bus sector and fare integration measures that made the use of public transport relatively seamless for customers. This explains why the decision to deliver the BRT was well received in Seoul. However, in many cities such a decision would involve a high political risk. This applies to Cairo's BRT project in Egypt.

CAIRO'S BRT PROJECT

In 2015, the Greater Cairo Metropolitan Area (GCMA) comprised a population of about 20 million inhabitants which is expected to reach 24 million in 2027. The availability of urban transport infrastructure and services has not kept pace with the growing population and the resulting demand leading to serious traffic congestion, a decline in urban mobility during the past 20 years and an inefficient functioning of the city. Subsequently, the Greater Cairo Metropolitan Area faced two crucial urban planning issues. The first was how to redevelop or restructure the inner city areas with an extremely high population density (about 21,700 persons/sq. km on the average) to alleviate the important economic losses due to traffic congestion. The second issue was how to provide effective accessibility to growing new communities physically spreading over more than 50km distant from the metropolitan center.

The public transport system in Cairo consists of a metro system and a network of bus, minibus, and microbus routes. The Cairo Metro network operated by the National Authority for Tunnels spans 78 km with three lines. The system carries around 4.1 million passengers per day and is reported to have the highest number of boarding per km of any metro system in the world. The Greater Cairo bus network is made up of approximately 450 official numbered bus and minibus routes along with numerous informal micro-

bus services. Change in the bus sector is being resisted by a highly unionised workforce. This situation has led the government to consider the creation of a new parallel (and additional) public bus operator who would own about 2000 new buses to be procured by the government but which would lease the buses to private operators who would operate certain routes based on performance contracts. Yet the final decision on the creation of this new operator and on operational details had not been taken. Efforts by different institutions to improve urban transport in Cairo are continuing slowly. Almost all of those efforts are focusing on investments with insufficient attention to the necessary “soft” actions (reforms, regulation, traffic management, etc.)

In this context, the BRT project could consist of an additional solution. A pre-feasibility study identified two attractive corridors based on their passenger demand and available right way. The BRT project was promoted in light of the short implementation time it requires – about 3 years – and the lower costs they imply compared to Light Rail Transit (LRT) System. Despite these arguments, the BRT system did not emerge in Cairo. The reason identified are related to the acceptability to allocate additional space to bus services in a heavily congested area but also to the weak reputation of the traditional bus sector and the lack of consistent transport measures to encourage public transport in general. To put that into context, we can contrast Cairo with Istanbul where the delivery of the first BRT project was relatively “easy”.



THE ISTANBUL CASE

With over 15 million inhabitants on an area of 5,461 km² divided by the Bosphorus Strait into two continents Istanbul is the largest city in Turkey. With 2,786km² it has a smaller population density compared to Seoul. Urban transportation is one of the key problems of Istanbul and the challenge continues to grow with the rise of population. Between 2000 and 2012 Istanbul's population increased by 38.3% while at the same time private car ownership rose significantly. There are 4.17 million registered private motorised vehicles in Istanbul and every day, 400 new vehicles add to the city's traffic congestion. Urban transportation is a hot topic on the agenda of decision makers and several projects have been introduced to help increase the supply-level of public transport services.

Despite significant rail projects which carry about 2.7 million passengers per day, traditional bus transportation remains an important public transport mode. There are over 6,300 traditional buses operated by İETT, the public bus company, which carry 1.4 million passengers per day. Currently, paratransit plays a significant role in land transport with almost 6,500 mini-buses, 572 jitneys, 17,395 taxis and around 66,000 shuttles. In response to the rapid population increase, the city of Istanbul also developed BRT solutions.

Istanbul BRT systems (2007-2012, 4 phases) is now

52 km long and carries around 950,000 passengers per day which expands along the European side of Istanbul and crosses the Bosphorus. Istanbul's BRT was implemented on the main highway of the city where two lanes were taken away from private cars and dedicated to public transport. With 1x1 lanes, Istanbul's BRT system offers a capacity of more than 30,000 passengers per hour per day during peak hours where they operate double articulated high-capacity buses with headways of 20 seconds. The first BRT route with a total length of 18.5 km began operation in September 2007. The first phase of the project was delivered in 2007 between Avcılar and Topkapi (15 stations for 18.2 km) with the very short implementation time of 77 days. Also, it displays the remarkable feature of not receiving any public compensation for operation.

To make sense of Istanbul success there is a need to recollect the context in which the BRT project emerged. At that time, the Metropolitan Municipality of Istanbul had made its priority to solve Istanbul's congestion problem and engaged in a heavy investment program that included a large network of LRT and metro infrastructures as well as the modernisation of the bus company, İETT, and series of coordination measures dedicated to reorganise the paratransit sector and integrate fares. Still, LRT and metro projects were systematically delayed often due to funding availability. Subsequently, the BRT came as a "quick fix". Instead of waiting for rail projects the Municipality relied on the capacities of its bus company and delivered the BRT project.





LESSONS FROM CAIRO AND ISTANBUL

Both cities are comparable in terms of development patterns, culture and demographic trends. Yet, BRT systems emerged and developed very quickly in Istanbul while they encountered a very long gestation period in Cairo. This relates to the following reasons: in Istanbul the BRT could be seen as the result of a long process of reforms, investments and measures to improve public transport regardless of the mode that acted as an enabler for the project. This attention to the context breaks away from more traditional approaches which see BRTs as an “assembling” effort that consists to put together the various components at system level. Beyond the technical aspect, BRT projects need to be integrated in a wider set of policies, raising strategic issues: where to start from? Shall decision makers start with the reform of the bus industry and the paratransit sector, the integration of tariff and fares, the regulation of car use etc.?

To put it differently, BRT projects do not stand alone and should not be seen in isolation. This means that the identification of high demand corridors and the suitability of the road do not suffice to their successful implementation. To emerge they need to gain acceptance from a wide range of stakeholders who can be impacted by the projects. Failure to do so will lead to resistance that can effectively stop the implementation process. In many cities BRT systems can be considered as a first step towards an Integrated Public Transport Network that could be difficult to undertake where it is not acceptable yet to divert space from cars. This means that, sometimes, BRT systems require radical change. The success of BRT projects is not only about the length of the corridor or the characteristics of the system (i.e. full BRT or BRT lite), it is about their capacities to expand and gradually bring more people/passengers to public transport: people need to consider the BRT as attractive to become a valid piece of the urban transport system. From this perspective, branding and marketing campaigns can help communicate the benefits and relative competitiveness of the whole system to the citizens. Given the requirements of BRT projects, we can question what type of structures and processes are requested to integrate them bringing governance issues to the fore with the establishment of a Metropolitan Public Transport Authority (PTA).

THE ESTABLISHMENT OF A PUBLIC TRANSPORT AUTHORITY (PTA) AS A PREREQUISITE?

The establishment of a PTA integrates all transport functions and modes into one structure at a local sphere of government.

The successful implementation of BRT systems depend on their integration at street level but also on a high degree of coordination with other public transport modes including fares and tariffs as well as pro-active urban transport policies. This integration is difficult to achieve in the context of a dispersed institutional framework and where transport competencies and authority are spread over different jurisdictions.

To this end, we observe that there is a correlation between the emergence of the BRT system and some form of consolidation at the institutional level because BRT systems require consistent decisions at the strategic, tactic and operational level.

Istanbul can be seen as an example since the delivery of BRT systems, among other projects and measures, is related to the establishment of a metropolitan level of government. With the settlement of this governance entity comes funding capacities and an investment logic. To be more precise, prior to the Istanbul Metropolitan Municipality, central government bodies used to intervene directly through large-scale projects that were often imposed top-down without much consideration for local context. The situation changed with Istanbul Metropolitan Municipality's capacity to receive and manage state dotation to raise revenues and control the different public transport companies. The cost for the city to implement the BRT system in Istanbul considered not just the financial needs of the corridor but also compensation for the traditional bus company which operates less profitable routes which are essential to supply the BRT and rail corridors.

Despite the benefits, in practice, the rise of such governance structures is subject to complex political forces. PTAs from all over the world vary in size and competencies. In Western Economies, they emerged in the 80s as part of public sector reforms at a time of shrinking budgets. One emblematic case is Transport for London (TfL). The establishment of TfL shows a commitment to reduce the car dependency delivering high quality public transport combined with restricted parking space and

congestion charge as well as policies that promote active modes. Another example is the Land Transport Authorities (LTA) in Singapore or Îles de France Mobilité in Paris. They still face barriers in emerging economies and low income countries. Governments have been hesitant to

place institutional power in a PTA due to fears that PTAs would use government revenue to create parallel structures for work that could otherwise be carried out internally. Lagos, Nigeria and Dakar, Senegal with LAMATA and CETUD are exceptions, among others.



LAMATA IN LAGOS

Lagos is the commercial capital of Nigeria and one of the largest cities on the African continent with a metropolitan population reaching almost 23 million and growing at a rate of nearly 3.2% per year. It has a total area of 3,577.28 square kilometers of which 779.56 square kilometers representing about 22% is wetland and a population density of 6,515 persons per square kilometer. The transport network in the state is predominantly based on roads with 90% of total passengers and goods moved through that mode. The demand for trips in the Lagos megacity region by all modes (including walking) was estimated at 22 million per day with walk trips accounting for 40% of total trips in metropolitan Lagos.

The primary motivation for establishing LAMATA was the multiplicity of agencies estimated as exceeding 100 which were involved in urban transport and had led to inertia stand still. The organisation was created under the impetus of the World Bank and its initial focus was on maintenance and rehabilitation

of the “core” road network. After that, it undertook a bus-franchising pilot and ultimately delivered its BRT-lite. The BRT-lite was part of a broader program that also included water transport, rail, and cable car, which are modes with the aim of reducing congestion and air pollution. LAMATA overcame the resistance of the bus sector and moved forward delivering the first BRT system in 2008 which offers high capacity rapid transit services running on designated traffic free lanes on the main corridor in Lagos. The negotiations with the bus sector influenced the design and operations of the system which “omitted” several features found in a full-specification BRT, or “gold standard” BRT such as level boarding, continuous exclusive rights-of-way, and enclosed stations. These omissions led to the designation of the corridor as a “BRT-lite”. It is important to note that incumbent bus services remained intact; they were only excluded from using the BRT-Lite lanes. Forecasts at the time suggested that at least 300 buses would be needed. As such, BRT-Lite provided the bus service industry with a new income stream without requiring anything substantial in return. This of course wiped out much of the political challenge that the project had initially faced.

CETUD IN DAKAR

Dakar is the capital and largest city of Senegal. It is located on the Cap-Vert peninsula of 550 km² on the Atlantic coast and is the westernmost city of African mainland. With 3.5 million inhabitants, it covers 23% of the country's population on 0.3% of the national territory. The city has 100,000 new inhabitants per year that is the population is expected to grow to 5 million in 2030. Dakar experiences around 7.2 million daily trips with an estimate of 2.1 million motorised daily trips. Public transport accounts for about 80% of all motorized trips (1.7 million). It is expected that motorised trips will at least double over the next 20 years rising to about 5.6 million daily trips.

The CETUD, accounting for up to 45 percent of daily trips, was one of the first PTA in Africa and was requested to determine the bus routes to be operated and quotas; to authorise corresponding public transport vehicles and their technical operating procedures, to draft the terms of reference and tender documents, to sign an agreement with approved operators, and control of contract performance and to prepare fare policies and elaborate the criteria for access to the profession of public passenger transport operators. At the same time, CETUD coordinates the different modes of transport and share the revenues, elaborates and supports the implementation of action plans and investments to improve traffic, road safety and the conditions and quality of the public transport fleet in order to contribute to the fight against noise and atmospheric pollution caused by motorised transport. Before launching the BRT system and suburban train project, CETUD engaged in the renewal of the paratransit fleet offering loans to entrepreneurs.



LESSONS FROM LAGOS AND DAKAR

As LAMATA did with the bus sector, CETUD's work with paratransit is important because the delivery of BRT systems often implies that the transport provision model has to be changed. Dakar engaged in a transition that consists of overcoming an extreme form of deregulation which leaves the initiative to the market to a public-led franchising/contracting scheme where planning and operational functions are separated. To a certain extent this represents the (re)-implication of the public sector in the delivery of urban transport and access. And this is not a linear process because to be able to (re)introduce planning, there is a need to change and reorganise the whole sector at the same time. To understand the magnitude of the challenge, in Senegal, 97% of business activities are informal and generate 16% of the country's revenue. This includes the mobility sector as well. This means that most of the entrepreneurs that work in the paratransit sector are under precarious conditions, insofar as the BRT system is also a threat as it occurs on the most profitable routes – where the demand and number of customers are the highest. As a result, to include them in the reform it is important to support them financially either with loans or public compensation. To this extent, CETUD's BRT project success relies on having managed to renew 1607 vehicles from the minibus fleet. Even if BRT is not in operation yet, we can assume that some pre-conditions are about to be met. Again, the BRT system is a transition process that goes far beyond the bus corridors and their performance.

In Lagos and Dakar, establishing a PTA was a starting point for the development of the BRT project, questioning whether PTAs should be considered as a prerequisite for BRT implementation. Not necessarily. Many BRT projects are designed and delivered through a Special Purpose Vehicle (SPV) that consists of representatives of different public agencies involved in the project. A SPV constitutes a flexible mode of project governance

which vanishes once the BRT projects are delivered. This constitutes a weakness because it is not recommendable to provide the policy framework for consistent transport policy. Looking at the Latin American BRT situation, we realise that TransMilenio in Bogota, Colombia, the largest BRT system of the world, has been developed without a PTA.



TRANSMILENIO INSTITUTIONAL FRAMEWORK

Bogota is the capital and largest city of Colombia with a population over 8 million on an area of 1,775 km² which corresponds to a population density of 5,155 km². The daily journey modal split in Bogota is 13% private car, 36% public transport, 46% walking, 4% bicycle and 1% other. Bogota experiences over 6 million trips per day in which Empresa de Transporte del Tercer Milenio (TransMilenio S.A.) carries around 1.7 million passengers.

TransMilenio is a public agency responsible of the Integrated Public Transport System which includes the city's BRT. The agency was formed as a shareholder company by a series of city institutions in which the Mayor's Office is the main partner. The other partners are the Secretary of Mobility (through education and road safety fund) the Urban Development Institute —

IDU— (in charge of road building and maintenance), the District Institute of Culture and Tourism —IDCT— and the Company of Urban Development and Urban Renewal of Bogota (formerly known as Metrovivienda). TransMilenio's role is to plan, manage and control the network of public urban passenger transportation services in the city of Bogota. This includes coordination with different public and private stakeholders involved in building infrastructure, operation of transportation services, and provision of operational control services, fare collection and fiduciary management of the systems' funds. Even though the operation relies on private bus companies, TransMilenio defines all dispatch times in every route and controls their operation along the route for the BRT services. It oversees the operation of the feeder and conventional bus routes. The agency also manages cable car operation, also performed by a private contractor. Regarding infrastructure construction, TransMilenio S.A. provides input to the engineering and architecture designs, constructed by the Urban Development Institute (IDU) through private contractors.

TransMilenio was created to manage the BRT and feeder services of Bogotá's transit system. Now the city, with the support of the national government, is putting forward the bidding process for the construction of the first metro line. This process is handled by a newly created agency (Metro de Bogotá), which also under the administration of the city. The local transportation authority is the Secretary of Mobility (SDM) which oversees and coordinates the activities of Metro de Bogotá, TransMilenio, and IDU among other roles.

Still the establishment of a PTA in Bogotá and its region could be seen as good practice to ensure continuity of services and strong planning capacities at metropolitan level. Beyond the structure this is the coordination processes that drives the entity that matters. It is true however, that the settlement and constitution of PTAs are often incremental. They are not static and their competencies evolve over time. In this respect, the most advanced form of governance for BRT systems are entities that are able to consider the development of transport and land together towards Transit Oriented Development (TOD).



► Bogotá, Colombia



GOVERNING FOR TRANSIT ORIENTED DEVELOPMENT (TOD)

The delivery of transport infrastructures and services is often conceived without any form of coordination with urban development, land-use and housing in particular which is a very important opportunity that is wasted. This is all the more relevant in emerging economies and Low Income Countries (LIC) where public capacities and regulations are weak. This situation raises cities' operating costs and makes the provision of transport very expensive. To a large extent, the integration of the BRT systems project into a TOD logic constitutes a change that is characterised by the combination of planning transport and land use. The idea is to catalyse mixed-use development around BRT stations. In the TOD logic, land users, owners and developers become important stakeholders of BRT projects. It is therefore paramount that the governance structure in place promotes that. This is why, TransMilenio SA is more than a transport company and the company interacts with urban development agencies. The problem with the disconnection between land and transport is that the BRT systems are built to support current travel patterns and tendencies which may be detrimental to the city operations. For example, travel patterns might pose equity concerns when the most disadvantaged population must travel longer and further (although fast in a BRT) to reach job opportunities.

The examples of Istanbul, Lagos, Dakar, and Bogota show that the delivery of BRT project requires some organisational capacities in order to create the conditions for their successful implementation. It is now clear that BRT systems are more than a substitute for rail where public funds are scarce, they entail their own imperatives and complexity. Subsequently, based on the Latin American experience in particular, the next part offers guiding principles to help decision-makers maximise their benefits.

TOWARDS PRINCIPLES: WHAT CAN WE LEARN FROM THE LATIN AMERICAN EXPERIENCE?

Latin America is the cradle of BRT systems. It accounts for 1,790 kilometers of BRT, serving 20.5 million daily passengers in 55 cities in 13 countries. It includes the first and the largest BRT systems in the world; namely Curitiba, Brazil and TransMilenio Bogota, Colombia. There is a need



TRANSMILENIO IN BOGOTA

TransMilenio was planned as an extensive network of trunk and feeder bus services, integrated into a mass transit network to replace existing semi-regulated bus services. Bogotá's public transportation system is divided into two large physical, operational and fare-integrated sub-systems: the BRT TransMilenio network and its feeder services, and the Integrated Public Transportation System (SITP), which aggregates bus services operating in the main avenues of the city in mostly mixed traffic. TransMilenio's Phase I began operations in December 2000, which comprised 3 trunk corridors and 42 kilometers in length. As of May 2019, this system has 12 corridors in service and 114.4 kilometres of trunk routes. The buses, which transport an average of 2.4 million passengers on working days, are divided into articulated (49.9% of the fleet), bi-articulated (10.8%), feeders (30.3%) and dual service (9.1%). The original plan stipulated TransMilenio would cover 85% of the city with a total of 388 kilometres by 2016. However, expansion proceeded much more slowly than initially planned. In December 2018, the city launched a 3.2 km cable car in a low income and hilly community in the southern part of the city which is also managed by TransMilenio.

to adopt an evaluative perspective on the Latin American experience assessing whether these cities achieved their transition towards Integrated Public Transport Network (IPTN). To this purpose we can contrast TransMilenio in Bogotá and Santiago in Chile which are quite similar cities in culture and demographics but have followed opposite paths in terms of their transportation infrastructure decisions.



TRANSANTIAGO IN CHILE

TranSantiago is the public transportation system that integrates both physically and fare-wise all the urban bus routes that operate in the capital of Chile, the Metro network, and a suburban rail service. This system, introduced in February 2007 serves a population of around 6.48 million inhabitants in a 680-km² area. Currently, an average of 5.2 million journeys are made in all modes of the system on working days, which represent 45.8% of motorised journeys in the city. The backbone of TranSantiago is the Metro network which as of April 2019 has 7 lines, 140 kilometers in length and 136 stations. The urban rail network also has 23 kilometers of the MetroTren suburban rail, which since 2017 is part of the integrated system. Regarding the bus subsystem, it is structured into seven zonal business units in which trunk and feeder services operate. According to data from the Metropolitan Public Transportation Board (DTPM in Spanish), the total fleet of the system adds up to 6,646 buses, which operate in 378 services covering 2,821 kilometres of roads. The BRT-lite system has 72 km of segregated roads or corridors, 31 km of exclusive roads (streets where only public transport buses and taxis circulate in all its tracks at certain times), and 119 km of Only

Bus lanes (located on the right side of the road, without physical separation of the others, intended for the exclusive use of buses 24 hours a day). Segregated lanes function as open BRT corridors in which many services circulate throughout the entire corridors or in specific parts of them. The fare payment in all modes of the system is made with a contactless smart card.



DIFFERENCES BETWEEN TRANSMILENIO AND TRANSANTIAGO

Bogotá contrasts with Santiago in which transport modes have received an infrastructure boost over the last few decades. While Bogota has invested in BRTs and bikes, Santiago has pushed Metro and highways. The performance of Santiago's Metro and Bogota's BRT are quite similar in length, capacity and ridership but Santiago's Metro offers a higher speed than TransMilenio with its new rail lines. Passenger satisfaction with the system is much higher in Santiago, Metro is a pride symbol for Santiaguinos, while TransMilenio has become a complaint token for Bogotanos. Still, if we compare the modal share of public transport, Bogota has kept it around 80% for the last two decades while Santiago has seen it fall from 83% in 1977, to 47% in 2012. An apparent attribute of BRTs is that the contrast between a fast public transport service and an in-congestion car is visible for everyone.

Another difference between Bogota and Santiago is how their bus industry transformations were performed. Bogota provided the full BRT infrastructure for TransMilenio buses to operate while TranSantiago has been quite slow to build a few BRT-lite corridors. Also, the route taken to integrate modes of transport has been very varied.

When TranSantiago was introduced, Santiago already had an organised transportation network and a rationalised transit fleet. The system relied on fragmented bus owners that provided the service where most of the usual problems that such an industry scheme has to deal with are the following: buses fighting for passengers, very high accident rates, discrimination to low-fare passengers (e.g. students), assaults on drivers, very high pollution, etc. The new system consisted of a significant transformation of the industry and the way public transport's users travel in Santiago. The transformation involved firms, fare integration across buses and Metro, touchless

smartcards, etc. It also involved a new bus authority and the need for important subsidies to finance the system. This unintended subsidy has been very controversial in Chile, since the high evasion rate was also observed in the bus system. In contrast to TransMilenio which has implemented new infrastructure little by little and in which fare integration has been slow, TranSantiago decided to reorganise the routes and implement fare integration at once.



LESSONS FROM BOGOTA AND SANTIAGO

Contrasting both examples is interesting because these cities adopted different strategies. Santiago completed its large integration projects in very short time over the entire metropolitan area but at very high costs for the users in the form of low quality services and inconvenience and for the government as it involved unexpected subsidies and affected the prestige of the administration. Bogota followed a more gradual path but faced a lack of continuity at political level and the resistance of incumbents which in turn affected the confidence of the public. While TransMilenio was conceived to deliver high quality bus services to Bogota and to gradually replace paratransit, TranSantiago benefited from the on-going reforms of the bus sector that accelerated the deployment of the BRT system.

In fact, only a small subset of Latin American cities have completed the reform cycle evolving into fully integrated transportation systems. Others only gradually increase their reach, such as the cases of Mexico City and Quito, Ecuador where BRT systems remain constrained to a few trunk lines without achieving physical, operational and fare integration to traditional bus services or to metro.

In Brazil, the first BRT emerged in 1974 in Curitiba. The strength of the system relies on the planning tradition of the city and the idea that public transport is key to urban development.

Sufficient space was allocated to buses but the BRT still came with significant challenges: the lack of integration into the metropolitan area, lack of public funds and ultimately the technology that was not applied in a correct way. In Belo Horizonte the BRT was part of a broader urban mobility plan and received excellent technical support from the city as well as the financial support of the bus operators which invested in the system over the years. However, the BRT is confined to a small area, lack public compensations and is not integrated in line with the rest of the network. The city is currently thinking about restricting car use, the possibility to integrate the system as well as making public funds available. In Rio de Janeiro, the Olympic Games 2016 and World Cup 2014 created a unique opportunity to reach resources for urban mobility, the BRT system was implemented in terms of physical and fare integration but the investments were selective and not part of a planning process. Contracts for operation are not fulfilled and the infrastructure deteriorates. While the deployment of BRT systems should be seen as the development of public transport networks and an effort to enhance the urban environment of Latin American cities, it also comes with shortcomings as it is not uncommon to see them delivered without key components such as priority at the intersection or headway control mechanisms. This is in contrast to rail projects which are conceived as robust systems at the very front-end. The question is now to step back and reflect on how to treat such an experience.

HOW TO TREAT THE LATIN AMERICAN EXPERIENCE?

Again, the delivery of BRT systems is a process that depends on pre-existing conditions and evolves over time. Projects are often not delivered according to plan that is on time and within budget. They encounter delays and excessive costs. Yet, we can argue that this does not necessarily mean that they fail because we know that their deployment is subject to complex contextual forces that mark the difficulties to introduce public transport in environments where car and paratransit dominate. The Latin American experience remains relevant to other cities that would like to develop public transport networks. However, professional training and advice often communicate the experience as “assembling” components at the system level: the bus lane, stations, vehicles, technology on board etc. This is misleading because it downplays the financial and organisational effort to create a market for high quality public transport and provide access with the system, bringing cities on a sustainable trajectory. These organisational aspects are all the more relevant since the Latin American experience tends to be replicated in other continents such as India and Africa.



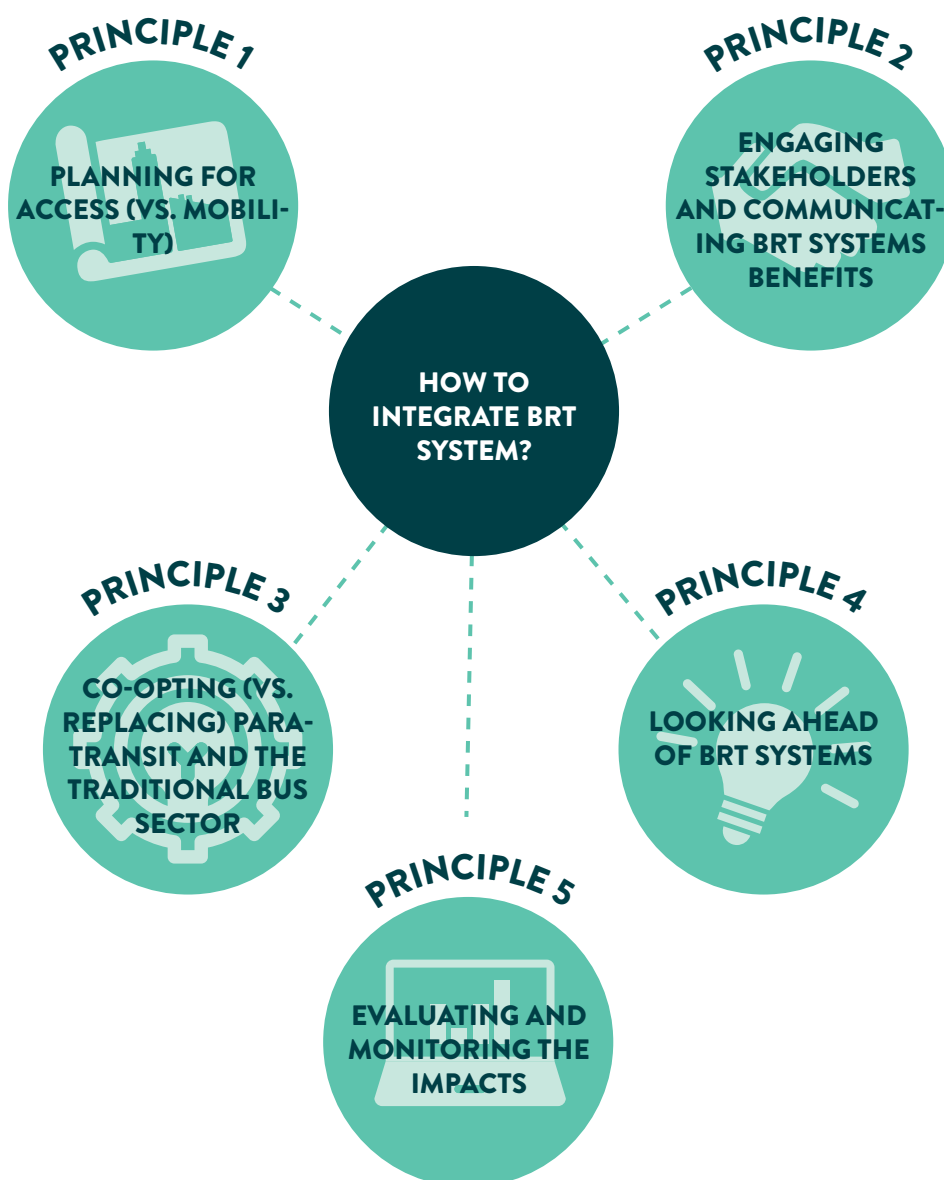
India has twice the population of Latin America but only few BRT systems. This pertains to the lack of public transport in general. Even with several million inhabitants, cities have only skeletal regular bus services. Subsequently, in 2006 the Government of India announced the first National Urban Transport Policy (NUTP) which focused on land use transport integration and prioritised sustainable modes. This policy included BRT systems. Despite investments at national level, India counts only nine BRTs in operation four at project stage and one which has been dismantled. The Indian experience is only partially encouraging because many BRTs failed to cover their operating costs with fares and to coordinate with the traditional bus industry. When central funding ceased, it was decided to not continue to expand BRT systems.

Africa urbanises rapidly and car ownership increases. African cities are facing massive congestion, air pollution and road accidents. 14 BRTs are implemented or under plan representing an opportunity to introduce clean bus fleet but also to mitigate traffic injuries on the main cities arteries through busway design. Yet they raise important equity issues as they cannot extend to the fringe of the cities where the less affluent live, a population that keeps relying on walking and paratransit.



There is a pressing need to turn the Latin American experience into overarching/generic principles that could help decision-makers to design and make the most of their BRT systems. This implies to maximise their benefits at different time horizons and for the widest range of stakeholders. Here, time matters because impacts arise over a time span that is not limited to the first corridor project. This is the overall strategic approach that drives the creation of value that should be considered in the form of financial revenues that would sustain further extensions or positive externalities such as air quality improvement, safety, enhanced urban environment and ultimately the consolidation of institutions and the way they work.

Subsequently, in light of the Latin American experience, mainly, we singled out five organisational principles that could apply to Africa or other cities in the world; namely 1) *Planning for Access* (vs. *mobility*), 2) *Engaging with people and customers*, 3) *Co-opting* (vs. *Replacing*) *paratransit and the traditional bus sector*, 4) *Monitoring and Evaluating the Impacts*, 5) *Looking ahead of BRT Systems*.



► Principles for integrating BRT Systems



PRINCIPLE 1: PLANNING FOR ACCESS (VS. MOBILITY)

Access refers to the range of opportunities that are presented to people through transport, such as jobs, education, leisure as well as the possibility to attend social gatherings and events. Still urban planning policies are often focused on time saving, which relates to the “ease of moving” and consists in delivering transport infrastructures, especially road to match the predicted travel de-

mand. This attitude gives relevance to speed and cars and neglect the access benefits of more sustainable modes such as walking, cycling and public transport which are relatively slower than cars. Adopting an accessibility approach consists in taking into consideration how access is unequally spread in space and among the population, a rationale that would jointly deal with transport and land-use. In many cities both, land and transport are treated separately, this increases cities’ operating costs making the delivery of transport expensive. To illustrate this point, the case of Cape Town, South Africa is insightful.



CAPE TOWN, SOUTH AFRICA

Cape Town, South Africa: Cape Town is a fragmented city with a radial and inequitable transport network. Historical apartheid spatial planning and socio-economic engineering has resulted in the majority of the urban poor residing in remote areas, dispersed communities with no economic base and with little development between them as well as the separation of land uses and long distances between places of work and residence. The average direct transport cost for the low-income public transport user group is 43% of monthly household income against the internationally accepted norm of between 5 and 10%. This poses serious constraints on economic growth and development, increase negative environmental impacts, CO2 emissions and energy consumption. In this context, MyCiti, Cape Town's BRT system constitutes an opportunity to provide access with public transport, which in certain area could attract a significant number of private motorists, contributing to reduce car dependency. The BRT system comprises 40 routes, 42 stations and more than 700 bus stops as well as 558 drivers and a fleet of 255 buses. And It transports about 67 000 passengers on a typical weekday. However, it cannot replace minibus and taxis at full city coverage. This conclusion emerged as the result of the evaluation of the first phase of implementation leading to a new business model that integrates minibus and taxi solutions in the network as well as Transit Oriented Development (TOD).

This emphasises the need to integrate BRT systems in wider transport policies and urban development. Again, BRT corridors do not stand-alone and depend on people ability to use another mode to reach

the station. The first step is to couple the delivery of BRT systems with multi-modal stations and park-and-ride as well as walking and cycling facilities. A second step is to consider how land is used and possibly coordinate with housing to densify areas near the station increasing access along the corridors and at the same time reducing the delivery and operating costs of the system. Regarding this second step, Cape Town engaged in a TOD policy that is outlined as follows.

TOD is a long-term development strategy to address spatial inequality, improve public transport affordability, and arrest sprawl. The strategy is driven by the integration of sustainable public transport and strategic land use intervention and built on the principles of affordability, accessibility, efficiency, intensification and densification. The core TOD principles are interpreted as:

- Affordability – reduce the cost of public transport to commuters and the cost of providing public transport to the City.
- Accessibility – facilitate equal access to social and economic activity through strategic urban development and the provision of safe public transport.
- Efficiency – provide an environment and level of service that reduces trip lengths and dependence on private vehicles.
- Densification – manage the desired form, composition of land uses and location of urban development conducive to affordable, accessible and efficient public transport. The following table shows how transport objectives are linked to land use interventions

Some of the key mechanisms include:

Institutional Alignment: All existing corporate strategic policy and development frameworks must incorporate TOD principles and objectives (to the extent that they have not already been embedded) in order to institutionalise TOD within all directorates of the City and ensure that TOD principles and objectives are key considerations in the assessment of all private sector development approvals and public sector led development across Cape Town.

Working towards an Integrated Business Model: It is widely agreed that TOD can lower infrastructure costs in the long run but the initial TOD infrastructure needs can be considerable and can require extensive public investment. Key financial tools to consider include:

- Improve Parking Management and Tariff structures
- Investigate parking related income
- Promote commercialisation of strategic public transport stations and precincts

Private Sector Collaboration: This program centres on levers to influence a change in behaviour of businesses and developers to move progressively towards TOD. Key tools to consider include:

- Investigate and adopt incentives to stimulate development consistent with TOD development guidelines
- Develop an appropriate TOD land acquisition and release program
- Streamline land use planning approvals

Civil Society Participation: Unsustainable user behaviour to be challenged through Travel Demand Management (TDM), effective communication and the formation of a public sustainable-rewards program.

The TOD initiative of Cape Town comes at the second phase of BRT development. However, we could argue that such attitude could have been adopted at the very beginning of the BRT delivery. Newly planned projects could integrate a TOD component at the outset. Yet, this might raise institutional constraints in context of inadequate organisational frameworks and where there is a lack of coordination between different public agencies, recollecting the need for a Public Transport Authority

(PTAs) that would ensure that decisions are consistent. Planning BRT systems and land jointly presents several advantages. First, it permits to optimise the BRT operation, decreasing costs and generating a ridership that is not limited to peak hours when people go to work. Secondly, it could legitimise value capture mechanisms as we can imagine that people might be willing to pay to have an access connection with public transport and the BRT. An example of value capture is the *versement transport* in France.



THE VERSEMENT TRANSPORT

The versement transport is a tax that concerns employers with more than 11 employees and is dedicated to finance transport. The tax base is the wage share and range from 2.7 % in Paris to 0.9 % with localities fewer than 100,000 inhabitants. The rationale is that employers benefit from public transport related access and should pay for it. This means that it constitutes an additional channel of funding for public transport in general. In Paris the versement transport represents about 40 % of public transport funding. Such a mechanism could further sustain the expansion of BRT systems in cities where public funds are scarce.

Similar to the versement transport rationale there is a multiplicity of Land Value Capture (LVC) mechanisms where land users, owners or developers accept to pay a tax or a fee to have access to public transport subsequent to the increased land value it involves (see UITP forthcoming Policy Brief, The Value of Public Transport, How to Implement Land Value Capture). However, in order for this to be implemented LVC requires coordinating decisions between transport and land development to ensure the characteristics and attributes of the BRT system serve land users' needs. To illustrate this point we can refer to rail system. LVC is generally applied to rail because the infrastructure is "fixed" – it cannot be removed over time. In contrast, the BRT is flexible and the system can be easily dismantled. Therefore, it is important to have consistent public transport policies that transcend political cycles.

Planning for access (vs. Mobility) is an opportunity to address the whole range of BRT stakeholders which are not limited to passengers and system users. This leads us to the next principle, namely engaging stakeholders and communicating BRT systems' benefits.



PRINCIPLE 2: ENGAGING STAKEHOLDERS AND COMMUNICATING BRT SYSTEMS BENEFITS

As exemplified in Cape Town, TOD policies come with a participative approach that aims at raising stakeholder's awareness and engaging them in the BRT delivery process. The delivery of BRT projects relies on people acceptance to change their travel behaviour and eventually to pay for access via public transport. It is therefore paramount to communicate the BRTs benefits. Stakeholders are viewed as key information holders that could help shaping the system and ultimately legitimise car use regulation. In the context of this, the branding of the system becomes relevant.



BRANDING BRT SYSTEMS

Brands constitute the basis of recognition to an inanimate entity, commodity or object. As BRT service performs best when working altogether as a system, the success of a BRT system is dependent on the creation of an effective identity program that conveys the positive image to its current or potential users to capture public attention and acceptance. At the same time, creating a relevant and compelling brand for a BRT system and a credible and effective identity can contribute to advocating the BRT concept. Since successful branding strategies begin with traditional marketing analysis to different aspects of BRT operation, almost equally important is to clearly identify and characterise the target market, it is therefore significant to consider the demographic profile of different areas which vitally affect bus demand (e.g. population density, age, gender, income and whether they have access to cars or not) and target audience's current perceptions of the quality of the service provided and expectation about transit and potential barriers to its use.

It's important to understand that each BRT journey that people take has several different components, each of which can influence decisions that customers make about whether to use the BRT systems. For this reason, a consistent and compelling brand plays an important role with the capacity to convey the following benefits of the bus product to the customer: (1) emphasising BRT as a premium, higher-quality feel for a BRT service, clearly distinguishing it from standard or more conventional services (e.g. its environmental benefits, its speed, frequency and span of service, its passenger capacity, reliability

of service, customer comforts, safety; (2) providing easy identification and hence use of services; (3) creating pride and sense of contribution for employees that reinforces satisfaction and retention impacting increased customer loyalty and potential for attracting third parties.

Almost equally important, though, is competition from other modes like car and taxi, staying at home, walk and cycle and rail and tram.



HOW TO COMMUNICATE THE BRAND WITH THE TARGET AUDIENCE?

Comprehensive brand strategy tactics and building corporate identity to successfully engage with target audiences can be carried out by converting the BRT system into a brand by strong service name and logo and line names that are relevant to the operating environment: (1) appealing vehicles by attractive design, colours, graphics and signage; (2) remarkable stops, stations, terminals, depots through good design, colours, graphics, signage and materials; (3) recognizable additions and surroundings such as barriers, pavement, markings, materials, colors, signage and landscaping; (4) a successful communication campaign by information, press-releases, website, social media, brochures; (5) making employees proud of the BRT system and increasing their engagement by uniforms; (6) notable payment system through tickets, cards and ticketing machines.



IMPORTANCE OF KEEPING THE BRAND FRESH

As will be introduced later, the forward looking technologies (e.g. clean propulsion, automation, connectivity) have a transformative effect on BRT operations. This constitutes an invaluable opportunity for PT companies to engage with its customer by recreating the brand strategy and implementation to communicate the improved operational conditions (e.g. environmental benefits through the replacement of conventional buses with battery or fuel cell electric buses at the same bus line) within the same BRT line. In the same way, this would also maximise the good image of PT companies' vis-à-vis users thanks to the improvement of the service contributing to increase the ridership.



A WORD ON EQUITY

As mentioned earlier access is unequally spread in space and the delivery of BRT system could widen the access differential among the population, leaving the less affluent not being able to use the system. However, it is important to remember that BRT systems remain relatively expensive in terms of investment and it might be difficult to extend the system to the whole city in one-go. BRT systems indeed constitute premium public transport services in environments where people do not have access to public transport or rather rely on low quality paratransit services. This is a first attempt to deliver an alternative to car where people can afford it. Pricing and fare structure can play a role in the societal goal of reducing access inequalities among communities but it should not endanger the financial sustainability of the system and its capacity to expand. Instead, we could advise positive housing policies aiming at avoiding gentrification around the stations. This means that the delivery of BRT systems should be part of a broader policy package that deals with the integration of transport in urban development strategy in general.

Engaging the broad range of BRT stakeholders and communicating the value of the systems are crucial components of their sustainability. The next principle deals with incumbents; namely paratransit and the traditional bus sector.



PRINCIPLE 3: CO-OPTING (VS. REPLACING) PARATRANSIT AND THE TRADITIONAL BUS SECTOR

As mentioned earlier, BRT systems do not stand alone, they need to be fed and integrated within a broader system above ground than the corridors. However, many BRT projects tend to be conceived to modernise the existing system, especially replacing paratransit. Such an approach is not only with resistance of incumbents but might also lead to costs related to compensations. An alternative strategy would be to co-opt the sector, upgrading it to complement the BRT corridors. This strategy was applied in Mexico City to a certain extent as Mayors convinced jitney owners to give up individual buses in return for stock in the new company that would own and operate new BRT buses. However, in many cases, paratransit will remain an important component of the network and we can argue that a hybrid approach which consists of planning the BRT and enhancing the sector simultaneously is the way forward. Such an approach would be further sustained by the emergence of new technology and services, offering an opportunity to transform the whole sector from “within”, making it more efficient.



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THE HYBRID MODEL OF CAPE TOWN

One key BRT challenge in Cape Town is the fact that operational costs have significantly exceeded projections due to higher costs and lower revenues than what was anticipated. The original approach has not proven feasible in which this was forecasted in regards to the Phase 1 area, minibus-taxis would be fully replaced with the MyCiTi system. Greater level of enforcement is required than expected to ensure that illegal vehicles do not move into the space vacated by the minibus-taxis. As existing licences were taken away from new operators who had rights to the same area emerged in ways that were not anticipated – requiring an amended sector transition / compensation approach. In addition, many current users are reluctant to make the shift from a mode that they are familiar with to a new, unfamiliar mode – resulting in the need for a new hybrid service delivery model to be developed. Removal of all the minibus-taxis in the peak would lead to expensive additional peak bus requirements to meet the need in a number of areas which again leads to the conclusion that a hybrid solution is desirable.

The success of the sector transformation process is directly linked to the ability of the city to ensure that the process is inclusive, broad-based, empowering and does not create false expectations or create an unsuitable example. Similarly, integration and coordination between departments within the Public Transport Authority are of crucial strategic importance to ensure successful integration of the minibus-taxi industry and an efficient and effective transformation

process. The city supports technology development to offer a wide range of support services to help with transforming the sector including business support, training and skills development for the adoption of new technologies and understanding of roles in revised business structures. Compensation remains a part of the integrated public transport network, although highly reduced. Where operators forfeit their operating licenses due to services being replaced by contracted BRT or quality bus services, a compensation approach will be appropriate. This would allow both buy-in and buy-out, and calculate compensation based on the net present value of the business. It will also be an objective to pay compensation to an entity rather than an individual to keep the value in the system as share capital. Given the hybrid approach and the critical role that minibus-taxis will fill in the integrated public transport network, many operators may not lose their licences. These operators will not receive compensation but could still be integrated as unsubsidised services providing direct services and transfers to the integrated public transport network services. The hybrid approach requires that operators do not only understand the operational role that minibus-taxis will fill in the new system, but also the role of technologies, infrastructure requirements and the industry transition model.

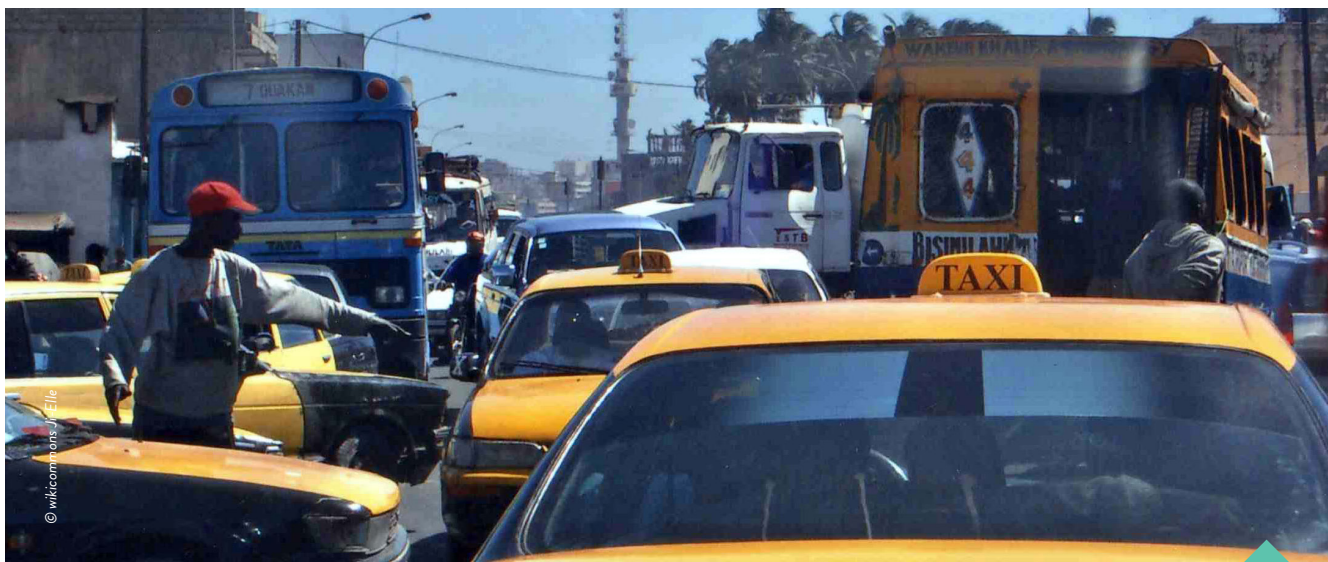
The integrated public transport network looks to leverage the strengths of the minibus-taxi industry and services. Rather than replacing these services, minibus-taxis will be recognised as being of the new system. Minibus-taxis will provide both feeder and longer distance travel in the metropolitan area build-

ing on their attributes of flexibility and efficiency, and emphasising the provision of on demand and demand- responsive services. These services will not be subsidised and therefore retain the need for financial viability as dictated by demand. The services themselves will look different than the services above-ground today. Improvements on safety, customer service, and standards for vehicle quality and vehicle operation, among other characteristics, will need to be carried out in order for these services to provide the quality new generation services need in the integrated public transport network. Technology advances will be a central part of landscape the public transport landscape in the future. The presence of smartphones presents a wide range of technology opportunities already available to the minibus-taxi owner and driver. The use of technology by the minibus-taxi will be critical, particularly for the new generation services envisaged providing on-demand and demand-responsive services, since minibus-taxis are flexible and particularly well-placed to take advantage of smartphone-enabled technologies to improve and expand their services. Where appropriate, the use of technology will also include the smart and integrated ticketing solution to make transfer and fare collection easier. This use of technology may not only be linked to formal, scheduled services provided by current minibus-taxi operators but may be an attractive instrument for transforming individual operators and uncontracted Taxi Operating Companies with significant benefits to the passenger, operator and the city of such an arrangement. There may also be significant potential for the use of technologies that are compatible with MyCiTi services and city systems, which, however, which come at lower cost. Mechanisms that provide more effective access to the public transport user through centralised platforms such as e-hailing, will be important when it comes to providing additional value-added services to existing and new markets.

At this point, the above-mentioned principle, namely engaging the whole range of BRT stakeholders, including incumbents and paratransit, provide a framework to evaluate the strengths of BRT projects, this could be carried out similar to Dakar, Senegal case for example.



► Lagos, Nigeria



THE DAKAR'S BRT PROJECT

The urban area of Dakar is situated on a Peninsula of 550 km² and includes 23% of the country's population. It has seen a rapid urban growth and further growth is forecasted from 3.5 million in 2017 to 5 million by 2030. There is a serious imbalance in the distribution of urban functions and in terms of mobility, 70% of all trips are walked by people and 80% of the motorised trips are made by public transport. With 25 cars per 1000 inhabitants the motorisation ratio is still low today but the congestion is growing fast.

The Republic of Senegal and the Executive Council of Urban Transport of Dakar (CETUD) have started the construction of a transport network on reserved lanes in the urban area of Dakar as early as back in 2010. In the search for financial partners to make this new transport project viable, the country has received support from the World Bank (WB). The project is a Private Public Partnership in urban transport and counts as the most important financing source of the WB in Senegal with a new funding mechanism (SUF). It's also a Green Project and was identified in respect of contributions from Senegal for the reduction of greenhouse gases and it is the first of its kind receiving GCF funding for a transportation project. As part of the BRT to improve travel conditions in Dakar, global restructuring of the public transport network (feeder bus lines: 60% on the BRT and 90% on the TER) and urban requalification ("de façade à façade") along the corridor.

The project objective entails 5 major goals. 1) to respond adequately to the demand for transport under the best possible performance conditions; 2) to create a structural impact on the urban network: renewal of the city centre, urban development; 3) to reduce road congestion through modal shift from cars to BRT; 4) to pursue the policy of development of the public transport network; 5) to promote optimum connection and an inter-modality with the new line of Regional Express Train (TER). The viability and sustainability of the investments on these two transport systems - BRT and TER - are highly dependent on the existence of effective feeder lines.

As mentioned earlier, the strength of Dakar's BRT plan relies on its institutional framework and the establishment of CETUD as a PTA and the work it is doing to renew the paratransit fleet as well as measures to improve the urban environment and the modal share of public transport in general. The players CETUD and WB have subsequently launched a tender with the objective to create a pilot project in Dakar ranging from the planning of core network to the design of the first priority bus lane. The design approach of the BRT project from the CETUD was based on the integration of transport services from the beginning and infrastructure from the design phase of the BRT: articulation between city planning and transport of the service of sustainable development. The priority project for the BRT line holds a distance of 18,3 km from Gare routière Petersen in Dakar South to the Préfecture de Guédiawaye Northeast. The route serves altogether 23 closed

stations at central middle location (middle of the road, this is the standard solution) 3 of which are multimodal interchange hubs for high-floor buses (dock height 95 cm) and crosses 14 different municipalities. The projected performances are for the time saved on travel, 45 minutes of running time instead of 90. Travel time is often the most important determinant for choice of transport mode. The average commercial speed is calculated at 25 km/h instead of 14 today. Rolling stock of 144 articulated high-floor buses (Euro V and 50 ppm fuel). The service plan foresees operation of 4 types of bus services, with passing lanes for the express services at the level of the stations. The total investment is 306 billion FCFA (490 million €). With a return on investment estimated at 15% to 18%, this is (superior to the minimum required profitability of 12% by WB). The profitability threshold is set to 110 000 PAX/day, far inferior compared to the strong forecasted demand of more than 200 000 to 300 000 PAX/day. The operational scheme that is foreseen consists of putting in place a Public Service Delegation type of contract (Délégation de service public, DSP) with the traffic risk taken by the operator.

CETUD will be the Transport Authority responsible to tender and manage this operation contract with a single operator on the track (the BRT line) and 2 other operators for the feeder lines. In terms of investment: all fixed elements of the project are owned by the State (infrastructure, bus depots, systems, ticketing systems, stations, etc.). The operator buys 'only' buses on the BRT line and the equipment on board the bus. The operator must pay operations fees to the government of Senegal.

As a project Dakar's BRT relates to the whole urban mobility system: buses but also rail, and paratransit reforms with the objective to deliver an integrated public transport network and provide access via public transport. The project includes external funding and integrates into a strong planning rationale. Stakeholder's engagement is paramount, as is the bus and paratransit sector, customers, land users and funders' involvement. The industry should determine the technology to be used in the future, hence the next principle: Looking ahead of BRT Systems.



PRINCIPLE 4: LOOKING AHEAD OF BRT SYSTEMS

Looking backwards it is clear BRT is considered as the biggest innovation in the bus domain ever since the gradual introduction and mainstreaming of classic bus-based public transport services which has become the standard everywhere around the world. BRT systems in the broader context of public transport and understood as transformation process have the potential to constitute an agent of change because they are one of the key contributors to help cities break away from car-dependencies and contribute to the solution of congestion in cities. Therefore, advocacy issues should not go unnoticed and policy makers should understand that the cities need to find alternative ways of moving people.

Based on the development of BRT knowledge and looking ahead, it should be noticed that the sector aspires to further evolve the operational part of BRT systems which can be applicable to different BRT operations around the world. It will evolve the BRT concept with key research and key innovation enablers that are emerging today e.g. clean propulsion (electrification, hydrogen), automation and connectivity that will offer new opportunities for advanced generation of BRT systems. For this reason, UITP intends to create BRTv2.0 project to contribute to develop scenarios to further develop the operational part of BRT systems and to evolve in advocating the BRT systems and make them more relevant in terms of sustainable urban mobility globally (UITP, forthcoming).



Autonomous Bus



BRT ELECTRIFICATION (CLEAN PROPULSION: ELECTRIFICATION AND HYDROGEN)

The move to and interest in electric buses has gained significant momentum over the last couple of years in many parts of the world. This is largely due to four key drivers: climate change and CO₂ emissions reduction; urban migration causing an increased demand for public transportation; air quality in cities and reduced dependency on fossil fuels. There has been a real shift towards clean transportation in many countries at national and local level. Large cities, in increasing numbers, are pursuing policies to operate zero emission urban transportation systems within the next decade and this is driving demand for full electric (battery bus, fuel cell hydrogen bus and trolleybus) and plug-in hybrid electric buses. Most of the buses used in BRT lines are articulated or double articulated with capacities of up to 220 people. Double-decker buses, and standard buses, are also used on some BRT lines. New innovative battery trolleybus lines are also being installed for BRT lines. Trolleybus technology is well proven; the BRT system in Quito has been in operation since 1995 and Malatya, Turkey opened a new TRT (Trolleybus Rapid Transit) in 2015 but certainly not widespread.

It is true that many cities are already introducing electric buses that charge the passengers when it stops but especially in the scaling up phase only on the least demanding routes. The biggest benefits for climate and air quality come from switching the longest, fastest and busiest routes to electricity which is a particular tough challenge as these buses are the biggest, heaviest and busiest. Electric bus driveline technology also benefits from improvements in battery chemistry and energy storage management, as well as advances in fast charging infrastructure. As the mass automobile industry pushes ahead with its move to electric cars this is not only increasing demand for battery supply, it is improving battery density and reducing cost; again much to the benefit of the bus building industry. The investment on clean propulsion technologies can be optimised through BRT systems as operations can be planned, mileage is known and energy requirements can be predicted on board because the lane and distance are familiar.



TOWARDS E-BUSWAY IN NANTES, FRANCE

Nantes Metropole launched in 2006 its BHLS Busway line. Busway (line 4) was set up to complete the core backbone of Nantes Metropole public transport network made of 3 tramway lines with the goal of having at least a similar high level of service at lower cost. Operations started in November 2006 after 18 months works. Since then it has been an overwhelming success with a ridership that has tripled within 10 years to more than 42 000 passengers per day. 25 % of customers usually travelled with their cars to do the same journey 3 months before the new service is launched. Operated with 23 specific CNG articulated buses, its infrastructure is 100% dedicated to performance with their own right-of-way lane and priority at all crossroads.

To overcome line saturation, 2019 is a major step forward for the busway with the upgrade of the line with double articulated buses fully electric with opportunity charging. Addressing 2 issues:

- Urgent extra capacity requirement
- Proposal of a project representing a big step forward for climate change management

The e-Busway will have double-articulated 24.5 m long, fully electrical buses with charging infrastructure opportunity charging at 2 end stations + 2 major stops (among 13). In operation at the end of 2019, Hess vehicles (130 kWh batteries) equipped with ABB TOSA charging system (600 kW charging) were chosen.



AUTOMATED BRT PUBLIC TRANSPORT – FROM TODAY AND INTO THE FUTURE!

Autonomous vehicles (AVs) can help to build affordable, sustainable and convenient mobility options to all citizens including less mobile persons, the elderly, children and people living in suburban or rural areas (<https://www.uitp.org/news/autonomous-vehicles-urban-mobility>). Similarly, with the developed BRT concept in mind, there is a need to explore how next generation BRT operations can take advantage of new technology enablers like automation. Autonomous vehicles and system optimisation will greatly change the BRT transportation in future several years. Industries are already moving and, within UITP we study this evolution in a project like SPACE and make UITP becoming the reference for the “next generation” bus (UITP, forthcoming). It’s true that today the autonomous bus is a small vehicle (10 seater) but already the first full size buses (12 meter) projects are coming to be demonstrated. In level 4: the automated bus drives in mixed traffic on designated roads and in restricted areas. For the next generation, BRT systems are a natural application field for automation because they use an infrastructure (designated bus-lanes and dedicated their own right-of-way infrastructure), which can be exclusive for the BRT buses, and constitutes the typical operational environment suitable for automated bus.

Automated BRT buses can use various types of automated functionality like; guidance, automatic docking, driver assistance, collaborative automation, bus stop automation, bus platooning (urban bus-trains/BRT-evolution), queue assist, bus depot automation, charging station automation and automated accessibility solutions for impaired and elderly users. This may be combined with automated functions for enhanced safety, traffic flow and network utilisation. Additional functionality such as adaptive urban traffic control system that controls the traffic lights and gives speed advices and priority can be introduced when these systems reach the market. Also, functionality for enhanced reliability with advanced headway management can be introduced.

For the implementation in general terms it is important to underline the layered and scalable implementation of automation. They always will have a driver allowing the vehicles to use open roads. As said, autonomous vehicle and system optimisation will greatly change the BRT transportation in the next few years. Whenever we ad-

dress the transition to automation, let’s not forget the pitfalls. Human skills and power of judgement must be retained. Automation in the BRT domain should not be about replacing but augmenting the human capability.



CONNECTIVITY (BIG DATA, CLOUD COMPUTING, ARTIFICIAL IN- TELLIGENCE...)

With the developed BRT concept in mind there is a need to explore how next generation BRT operations can take advantage by new technology enablers such as connectivity. Public Transport has always been full of data. Customer travel pattern data is captured through fare transactions. Vehicle operation data is collected through scheduling and dispatch systems, vehicle health data is captured through telematics devices, and engineering data is captured through asset management systems. The BRT industry is also a complex industry with a large number of variables. It’s a perfect industry for applications of artificial intelligence. No one would deny that artificial intelligence is shaping the world.

There should be a good synchronisation of BRT systems with other transport modes and services (etc. ferry, metro; but especially first mile last mile solutions: feeder, taxi etc.). The reach of the impacts of above-mentioned technology enablers will naturally need to be extended and explored in relation to the BRT feeder bus and taxi system at the interface with BRT. A research by MIT shows that it is possible to reduce 14,000 taxis to 2,000 minibuses given that real taxi data are processed by autonomous vehicle with advanced dynamic routing algorithms. In the advent of the future, the use of Internet + bus will create a new mode of public service.

Data is the new oil. Artificial intelligence is the new electricity. And every company of the future - also the BRT operators - will need to be a software company. Data ownership is going to be a new battlefield in the growth of disruptive businesses and the next generation BRT is going to be entirely part of that.

Besides technology, BRT systems performance needs to be systematically evaluated and monitored, introducing the last principle: Evaluating and Monitoring the Impacts.



PRINCIPLE 5: EVALUATING AND MONITORING THE IMPACTS

Implementing a BRT project should not be seen as the end of a process. To do so would see a repetition of the cycle that led to a decline and the need for introducing a new BRT in the first place. Instead, the BRT process, having established optimised operation, needs to ensure an appropriate institutional structure and effective regulation to develop a new relationship between public and private sector actors and ensure that standards and business practices are enforced to provide a secure business environment for continued investment and good quality public transport services. BRT projects should be transparent and follow accountability principles. The key to understanding the success of a transformation is creating key performance indicators. Each objective of the BRT project should be aligned to appropriate indicators (refer to the case studies Dakar, Cape Town and if relevant others.)

As with any other transportation schemes, the successful implementation of a BRT project has multiple effects. Ideally, the effects of a well-implemented BRT scheme will achieve all of the project objectives, while avoiding undesirable or unintended impacts. This can be in a positive way when the transportation system is well designed and implemented; or in a negative way when the transportation system is below requirements and hinders other aspects of society or the urban area. To capture such aspects, the need for key performance indicator (KPIs) to evaluate how the BRT system affects the urban transport system and overarching societal and urban goals.

URBAN TRANSPORTATION SYSTEM

Evidence of urban transportation factor impacts is quite limited. Changes to mode share arising from BRT are sometimes recorded for the corridor but are not evaluated across the entire network. Evidence of BRT scheme effects on energy consumption and emissions is very limited.

SOCIETAL AND URBAN GOALS

There is little or no evidence that BRT schemes have effects on either Societal or Urban factors. This does not mean that BRT schemes have no such effects – the facts are not known. The BRT enquiries indicate that in practice these factors are not measured for BRT schemes, although it is standard to measure them for rail-based projects. BRT schemes are invariably below mandatory threshold, thus requiring only a light post-implementation

appraisal. What is not mandatory is neither budgeted for nor performed leading to an extreme shortage of any evidence. Experience with BRT schemes worldwide indicates a similar extreme lack of data. A few evaluations of societal and urban factors have started to emerge, e.g. showing positive impacts on land values and investments linked to BRT, and of user acceptance, but these remain quite limited.

Despite the many BRT schemes implemented in Europe, and the many BRT and BRT-lite schemes implemented worldwide, policy-makers and decision-takers still do not have any substantive knowledge of what effects (if any) bus-based transit schemes have on societal or urban factors. For example, they do not have evidence-based guidance on whether a bus-based scheme can leverage property development, help to intensify land-use, attract new businesses, or stimulate the local economy. They do not have evidence-based guidance on whether bus-based transit schemes make a meaningful contribution to better employment prospects, to combating social exclusion, or to improved quality of life.

This knowledge-deficit must be overcome through structured evaluation of impacts beyond the direct performance factors of BRT. Ideally, it should be mandatory for all BRT projects, even those below financing thresholds, at least for a few years until sufficient evidence has been gathered.

PERFORMANCE CRITERIA

Performance shall in principle be managed through the establishment and monitoring of key performance indicators (KPIs). These will enable a regular check on operations to ensure that they continue to perform to the standards required. KPIs might relate to 1) the level of service received by the user, 2) the performance of the operator against contract requirements, 3) the contribution of the bus network to wider city objectives and vision.

THE LEVEL OF SERVICE RECEIVED BY THE USER

The CEN standard EN 13816 “Public transportation of passengers – service quality” defines the concept of service quality applied to passenger transportation. It defines a management and quality measurement method with reference to the quality cycle concept. The fundamental principle is that all calculation methods are “client” oriented. They must take into account the number of passengers involved at a required quality level. This standard defines the obligatory and optional quality criteria, as a reference tool for measuring the quality of the service with respect to a reference situation. A large set of quality indicators is described and arranged into 8 groups as follows (where only the main items are highlighted):

- Availability of services operating hours, Frequency, Vehicle load factor
- Accessibility of services external interface, internal interface, ticketing availability
- Information general information, travel information (with abnormal conditions)
- Time: trip planning, average excess journey time
- Adherence to schedule: punctuality / regularity
- Customer care availability of staff, assistance
- Comfort seating and personal space, ride comfort
- Safety and security level & amount of accidents
- Environmental impact emission norms of vehicles

THE PERFORMANCE OF THE OPERATOR AGAINST CONTRACT REQUIREMENTS

Such as :

- Mileage operated (excluding traffic and other non-deductible losses)
- Reliability
- Driver and vehicle quality monitoring
- Customer satisfaction
- Public correspondence data
- Safety

THE CONTRIBUTION OF THE BUS NETWORK TO WIDER CITY OBJECTIVES AND VISION

Regarding evaluation of benefits and impacts of BRT, beyond technical and ridership performance, this includes:

- Transportation system impacts: modal share, total network effectiveness, transport sector energy consumption and emissions
- Impact on society: access to jobs, social equity, social exclusion
- Urban impacts and importance for public transport: land use patterns and urban
- Spatial/economic structure, land values, development, urban economy
- Economic value impacts: post-implementation socio-economic Cost Benefit Analysis (CBA), structured impacts analysis

Initially KPIs might focus on securing financial sustainability and passenger satisfaction but once this becomes an expected norm, they may be developed to optimise performance further. For example, KPIs at Transport for London now focus on dwell times at stops, late arrivals and quality of rides, since the more common performance measurements (regularity, punctuality and so on) are now more consistently achieved by operators.

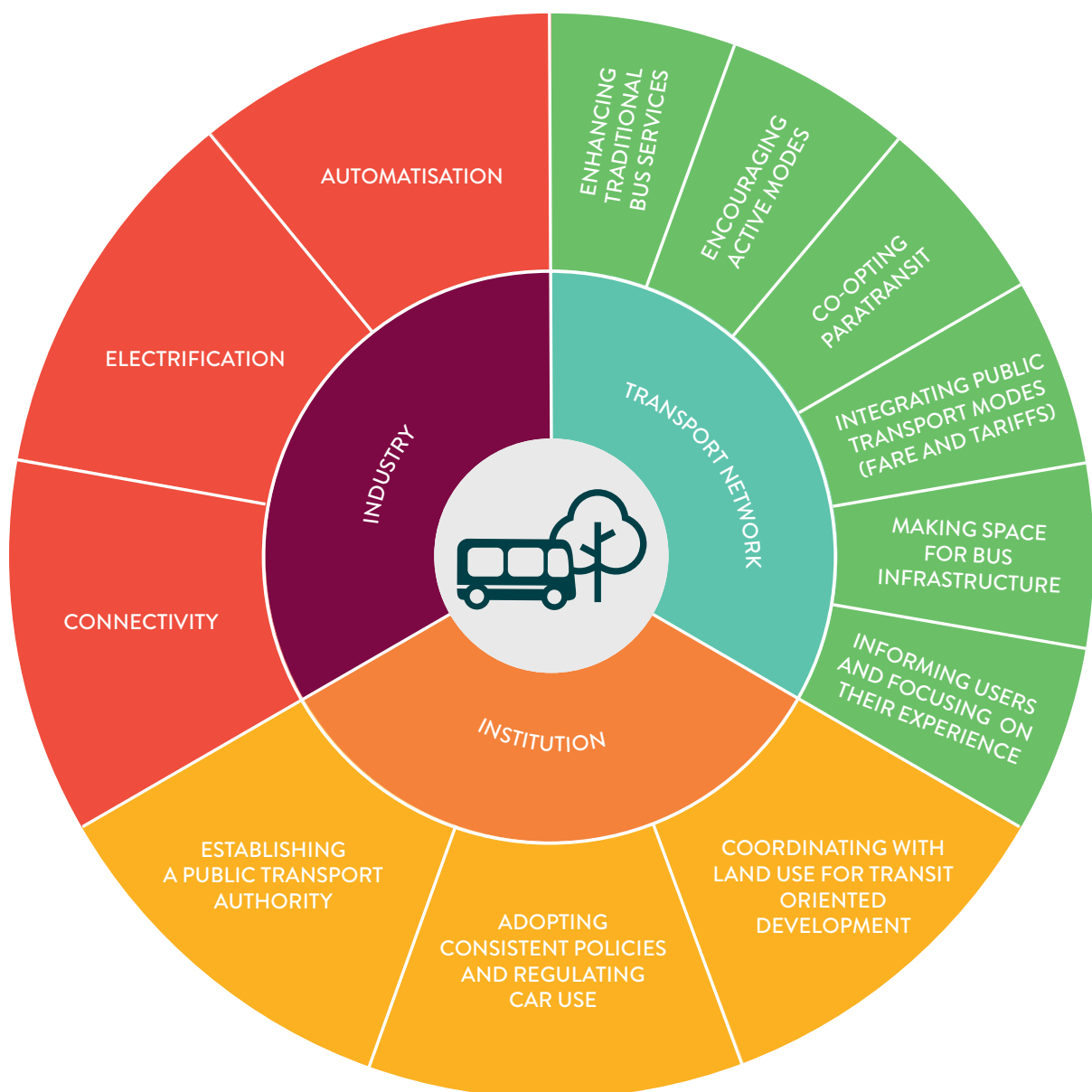
COLLECTING DATA

Data will drive performance monitoring. This will be qualitative where relating to user satisfaction and quantitative relating to financial and operational performance. Base data collection can form part of the contractual requirement of operators and can also in part be automated through electronic ticketing and fleet monitoring. Other data will need to be collected by the planning entity. Data should be monitored on a regular basis, linked to the contract profitability (bonus/penalty) and analysed at least monthly.

CONCLUSION

The paper argues for the integrated character of BRT system. BRT systems do not stand alone and rely on series of preconditions that could ease or impede their successful implementation. Among others, a commitment to sustainability, a conducive policy framework that promotes public transport in general as well as adequate institutional and organisational processes are essen-

tial elements of their delivery. Subsequently the paper proposed 5 principles that would help integrating BRT systems, accounting for the most stakeholders, customers but also land users and incumbents, namely the traditional bus sector and paratransit. It demonstrates that BRT system delivery is a process, a first step towards Integrated Public Transport Network that could be more or less achieved according to the cities where they emerge.





RECOMMENDATIONS SUMMARY

PRINCIPLE 1: PLANNING FOR ACCESS (VS. MOBILITY)

- Accounting for access
- Providing access via public transport, BRT systems and active modes
- Regulating car use
- Developing transport and land jointly
- Developing alternative funding channels based on the access value of Public Transport

PRINCIPLE 2: ENGAGING STAKEHOLDERS AND COMMUNICATING BRT SYSTEMS BENEFITS

- Adopting a participative approach where stakeholders are seen as holding key information
- Adopting a branding strategy that supports customer engagement
- Accounting for equity concerns with
 - Supportive land and housing policies.
 - Fare structures

PRINCIPLE 3: CO-OPTING (VS. REPLACING) PARATRANSIT AND THE TRADITIONAL BUS SECTOR

- Enhancing the bus and paratransit sector while delivering the BRT systems
- Planning for hybrid systems where BRT, traditional buses and paratransit

- complement each other
- form an integrated public transport network
- Accounting for the emergence of new technology and mobility services that could enhance the efficiency of the sector.

PRINCIPLE 4: LOOKING AHEAD OF BRT SYSTEMS

- Accounting for the technology that could transform the bus industry
 - Electrification
 - Automatisations
 - Connectivity
- And change the way BRT systems are operated.

PRINCIPLE 5: EVALUATING AND MONITORING THE IMPACTS

- Creating Key Performance Indicators (KPI) that reflect on:
 - Performance: service reliability, quality, and ridership
 - Urban transportation system: modal share, total network effectiveness, transport sector energy consumption and emissions
 - Societal goals: access to jobs, social equity, and social exclusion
 - Urban goals: land use patterns, land and housing values, development, and urban economy
 - Economic value: post-implementation socio-economic CBA, structured impacts analysis

This is an official Report of UITP, the International Association of Public Transport. UITP has more than 1,600 member companies in 99 countries throughout the world and represents the interests of key players in this sector. Its membership includes transport authorities, operators, both private and public, in all modes of collective passenger transport, and the industry. UITP addresses the economic, technical, organisation and management aspects of passenger transport, as well as the development of policy for mobility and public transport worldwide.

This Report was prepared by UITP, Knowledge and Innovation Department, VREF and BRT + CoE

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