SUSTAINABLE PUBLIC TRANSPORT: BRT DEVELOPMENT IN THE PHILIPPINES

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Abstract: Bus Rapid Transit (BRT) is now considered as an important urban mass transit option for different cities all over the world. It offers capacities and service levels that are comparable to those of urban rail systems but at a fraction of the cost. This paper presents the concept of BRT as a public transport system and compares it with other mass transit options for urban areas. It also discusses the factors that warrant the implementation of BRT in the Philippines, culling lessons from international best practices in Asia and Africa. These lessons underscore the importance of "soft" aspects of BRT planning and implementation which include political, governance and planning context, public transport system integration, operating arrangements, finance, branding, and communications. These factors significantly shape the viability and sustainability of a BRT system aside from its physical infrastructure components. The paper also presents the salient points of the Cebu BRT study completed in October 2012, focusing on its mains features and prospects for sustainability. The paper is capped by a discussion of the conditions and opportunities which are auspicious for the planning and implementation of BRT systems in cities of the country, in response to cities' needs for sustainable mobility or its people.

Key words: Bus Rapid Transit (BRT), Mass Transit, Urban Public Transportation, Modal Comparison, Institutional components of BRT

1 INTRODUCTION

Complex urban transport problems warrant a continuous search for solutions. People's need for mobility is a given in today's cities where commute trips tend to become longer as a result of urban sprawl and the growing mismatch between residential and employment locations. Consequently, more trips are made in terms of volume and distance. With a growing middle class whose tendency is to acquire and use private cars as the main mode of travel, traffic congestion worsens with its attendant economic and environmental externalities. As a result, dignity of travel, which the authors define as the ability of all people to travel using safe, reliable, convenient, and affordable means is lacking in many urban areas. Public transportation is ideally an alternative, but tends to cater to just its captive market or those who do not have access to the private car. But with worsening traffic congestion that results from uncontrolled growth in the number of private vehicles as well as the number of inefficient public transport vehicles, the viability and attractiveness of conventional road-based public transport is compromised thereby making it less and less attractive for choice travelers. This blackhole theory of public transport continues to compromise its prospects for functioning as an effective and sustainable travel alternative in the city.

Bus Rapid Transit (BRT) is fast becoming an important public transport option for developed and developing cities. Its cost effectiveness, rail-competitive passenger capacity, shorter construction time, possibility to absorb some of the existing public transport workers, and its potential to effect public transport reform are among the BRT's strengths. Others are its complementarities with existing public transport systems, environmental benefits, and inherent versatility and flexibility render it as a significant and viable mass transit option for today's cities.

The objectives of this paper are:
1. To present the concept of the BRT as a mass transit system;
2. To compare BRT with other mass transit options;
3. To draw lessons from international experience;
4. To present the factors that warrant the implementation of BRT systems in the Philippines;
5. To present the salient points of the Cebu BRT study; and
6. To discuss the prospects of BRT in the country.

Chapter 2 of this paper presents a definition of BRT, its components, features, and history. Chapter 3 discusses a comparison of BRT with other mass transit options. Chapter 4 discusses international experience and lessons learned in BRT planning and

implementation, highlighting the importance of not only the hard infrastructure aspect of BRT but also its "soft" aspects. Chapter 5 discusses the warrants of BRT in the Philippines. Chapter 6 presents the salient points of the Cebu BRT study. Chapter 6 presents the prospects of BRT in the Philippines and Chapter 7 summarizes the paper.

2 WHAT BRT IS

2.1 Definition

The BRT Planning Guide (Sourcebook for Policy Makers in Developing Cities) defines BRT or Bus Rapid Transit as a bus-based mass transit system that delivers fast, comfortable, and cost-effective urban mobility. Through the provision of exclusive right-of-way lanes and excellence in customer service, BRT essentially emulates the performance and amenity characteristics of a modern rail-based system but at a fraction of the cost of rail.

2.2 Features and Components

BRT's philosophy subscribes to the essential attributes that are found in quality rapid transit systems. These attributes are speed, reliability, and image. These are attributes that are achieved by the BRT through the following system features that are found in most BRT systems in different parts of the world. These features are:

- Exclusive right-of-way lanes
- Rapid boarding and alighting
- Free transfers between lines
- Pre-board fare collection and fare verification
- Enclosed stations that are safe and comfortable
- Clear route maps, signage, and real-time information displays
- Automatic vehicle location technology to manage vehicle movements
- Modal integration and stations and terminals
- Competitively-bid concessions for operations
- Effective reform of the existing institutional structures for public transport
- Clean vehicle technologies
- Excellence in marketing and customer service

2.3 History of BRT

The continuous evolution of BRT as a mass transit system can be traced to these milestones:

- 1937: Chicago City outlined plans to convert 3 inner city rail lines to express bus corridors
- 1950s: BRT plans were developed for United States cities including Washington D.C. and St. Louis
- 1960s: High-occupancy lanes and exclusive bus lanes in the United States
- 1963: Express buses using counter-flow in New York City
- 1970: BRT plans were developed for Milwaukee
- 1972: Construction of a dedicated busway (7.5 kms) known as "Via Expresa" in Lima, Peru
- 1973: Busways were constructed in Runcorn, U.K. (22 kms) and Los Angeles, U.S.A. (11 kms, called the El Monte Busway)
- 1974: "Surface Subway" in the form of a BRT in Curitiba, Brazil, with 57 kms of exclusive busways and 340 kms of feeder services
- 1975: Sao Paulo, Brazil (now with 250 kms of exclusive busways), and Arlington, U.S.A
- 1976: Boiania, Brazil
- 1977: Porto Alegre, Brazil and Pittsburg, U.S.A.
- 1996: Quito, Equador opened its BRT system using electric trolley technology and now combined with clean diesel technology
- late 1990s: The BRT became more widely known with visits of technical and political groups from Bogota, Columbia and Los Angeles, U.S.A. to Curritiba, Brazil. This Bogota initiative resulted in its BRT system called the TransMilenio. The fruit of the Los Angeles inititive is a national BRT program that includes 17 cities in the U.S. The former mayor of Bogota, Enrique Penalosa, became an internationally prominent champion of the BRT concept.
- 2004: An initial 12.9 kms of exclusive busways opened in Jakarta. The system is called "TransJakarta". It has since expanded to 172 kms.
- 2008: Opening of BRT Lite in Lagos, Nigeria with 22 kms of majority-segregated lanes, only 18 months after inception. The system is currently constructing additional 22 kms of busways with more corridors in planning stage.
- 2010: Opening of the BRT in Guangzhou, China, known as GBRT, with more than 30,000 passengers per hour per direction. It currently has a network length of 22.5 kms.
- 2012: Opening of Janmarg BRTS in Ahmeddabad, India with 45 kms of busways and additional 41 kms in planning stage.

There are other BRT systems that are in the planning or implementation stage or already operational in different parts of the world.

3 MODAL COMPARISON

BRT is one of the urban transit systems that offer high line capacities, line capacity being defined as the product of passenger capacity of the vehicle or transit unit and the speed of the transit unit. High line capacities in urban areas can be achieved through the provision of exclusive rights-of-way. This may be in the form of tracks (elevated, at-grade, or subterranean) for rail-based systems, and exclusive road lanes for bus systems. The different mass transit options vary in cost, capacity, attributes, and others. A comparative analysis of different modes is presented here based on the following criteria: cost, construction time, capacity.

3.1 Cost

A review of various mass transit systems shows variation in capital or infrastructure cost on a per kilometer basis. BRT systems are the least expensive with Metros or subways being the most expensive. The most expensive BRT systems are just equivalent to the least expensive LRT system.

Table 1 Per Kilometer Costs of Mass Transit Systems

Mass Transit System	Investment Cost (in Million US$ per km.)
BRT	0.5M – 15M
Tram	10M – 25M
Light Rail	15M – 40M
Urban Rail	25M – 60M
Elevated Rail	50M – 100M
Metro	50M – 320M

The following table shows some mass transit systems and their unit infrastructure costs per kilometer.

Table 2 Units Costs of Urban Mass Transit Systems

City	Type of System	Kms of segregated lines	Cost per km (Million US$ per km)
Taipei	Bus rapid transit	57	0.5
Quito (Eco Via)	Bus rapid transit	10	1.2
Curritiba (1994 ext)	Bus rapid transit	57	1.5
Sao Paolo	Bus rapid transit	114	3.0
Bogota	Bus rapid transit	40	5.3
Tunis	Light rail transit	30	13.3
Lyon	Light rail transit	18	18.9
Bordeaux	Light rail transit	23	20.5
Los Angeles (Gold)	Light rail transit	23	37.8
Zurich (2005 ext)	Light rail transit	20	42.0
Bangkok (BTS)	Elevated rail	23	73.9
Madrid (1999 ext)	Metro rail	38	42.8
Hongkong	Metro rail	82	220.0
London (Jubilee)	Metro rail	16	350.0

Source: www.uncrd.or.jp/env/est/.../BRT.../1-2_Introduction_to_BRT.pdf

3.2 Construction Time

The required construction time of the transit system depends on its level of infrastructure requirements. BRT systems usually utilize existing road lanes which are improved and fitted with curbs or markings to achieve exclusivity. They are also usually at-grade. Rail-based systems, on the other hand, require the construction of tracks that are either elevated, at-grade, or underground. Construction time therefore for rail-based systems is generally longer than that for BRT.

Some BRT systems in various parts of the world have been constructed within 18 months as in the case of Lagos, Nigeria, while metros require 5 years or more to construct.

3.3 Capacity

Capacity refers to not just static capacity or the number of passengers that can be accommodated in a transit unit but line capacity which incorporates the speed of the transit vehicle. Line capacities are expressed in number of passengers per hour per direction (pphpd). Shown below are comparative statistics.

Table 3 Passenger Flows

Line	Type	Actual Capacity (pphpd)
Sao Paolo East Line	Subway	60,000
Santiago La Moneda	Subway	36,000
London Victoria Line	Subway	25,000
Guangzhou Metro	Subway	14,000
Bogota TransMilenio	BRT	45,000
Guangzhou BRT	BRT	40,000
Porto Alegre Assis Brasil	BRT	26,000
Curritiba Eixo Sul	BRT	15,100
Bangkok BTS	Elevated rail	42,000
Tunis	Light rail	13,400
Kuala Lumpur Putra	Elevated rail	7,000
Strasbourg	Light rail	6,000

Source: www.uncrd.or.jp/env/est/.../BRT.../1-2_Introduction_to_BRT.pdf

A US General Accounting Office (US GAO, 2003) study says that buses running on exclusive busways can achieve the same commercial speeds as urban rail systems. Full BRT systems achieve commercial speeds of 22-29 kph.

3.4 Other Criteria

Other comparison criteria include the transit system's performance and impacts. Performance of the system is indicated by travel time or speed, frequency, reliability, comfort, safety, convenience, image and perception. Impacts include environmental, economic, social impacts.

4 INTERNATIONAL BEST PRACTICE AND LESSONS LEARNED

To develop a sustainable public transport system requires not only the planning and development of its physical infrastructure aspects such as segregated lanes, stations, vehicles and the like but also the so-called "soft" aspects of the system. These are political, governance and planning context, public transport system integration, operating arrangements, finance, branding, and communications (Kumar et. al, 2012). This looks at international experience in planning and implementing 5 BRT systems in Asia and Africa, specifically in Lagos, Johannesburg, New Delhi, Ahmedabad, and Jakarta.

Below are the salient points of the 5 cases studied presented in the World Bank report:

Table 4 Five Case Study BRT Systems

	Lagos, BRT-Lite	Johannasburg, Rea Vaya	Jakarta, TransJakarta	Delhi HCBS Busway	Ahmedabad JanMarg
Total System Length	22 Km, 20+ km under construction	25.5 Km, 300+ Km planned	135.11 Km, expanding	5.8 km, median transitway 8.7 km, curb lanes without enforcement	45Km 41 Km additional planned
Construction cost $US per Km	$1.2m+/Km	$14.2m+/Km	$1.3m/Km+	$5m/Km	$3m/Km
Percent segregated	60%	100%	90-95%	NA (<40%)	100%
No. existing stations	26	30	142	29	67

Vehicles	High Floor 11.7m	Medium Floor: 18m (trunk) 12m (feeder/ Complemntary.)	High Floor: 11.5m, Some 18 m	DTC: Primarily low floor, 12m; Some A/C Others: Variety of types and sizes	High floor 12m; testing 18 m
Average daily ridership on system (Approx.)	200,000	45,000	280,000	85,000	135,000
Max. Ld. Pt., Pk. Direction, Pk. Hr. Vol. (Approx.)	10,000/Hr.	3,500/Hr.	10,000/Hr.	10,000/Hr.	2,000//Hr.
Former mode of BRT passengers	Car (6%), PT (90%)	Not known	Car (14%) Motorcycle (6%) Public Transport (69%)	Not known	Bus (40%) Auto Rickshaw (35%) Taxi, Auto (13%)
Av. Rev. Spd. (Km/Hr)	20 for local service			18 on median transitway	25
Travel time savings from previous	29% over length of corridor		40-50% over length of each corridor	30% over length of median transitway	20-30% over length of each corridor

4.1 Political, governance, and planning context

Among the important but non-infrastructure factor which can have a significant impact on the success of BRT planning and implementation is institutional in nature, pertaining to the political, governance, and planning context in which the BRT as an intervention is pursued. The issue of weak institutions is a major stumbling block for BRT since BRT is not just an infrastructure intervention but an attempt at public transport reform. There may be no government entity with a public transport policy, planning, and oversight capability or authority. Or the existing public transport entity may not have the ability to plan, implement, and operate a BRT.

There may be a need to strengthen the institutions during BRT planning and project preparation. It is also possible to change the structure of institutions or establish new, multi-modal authority or one that has the authority to cooperate with other authorities in the planning, implementation, and operation of BRT.

An almost constant and expected response of incumbent PT operators particularly the informal sector is one of opposition because of the perceived threat to their livelihood. BRT planning and preparation should be mindful of this issue.

Another challenge is the absence of a well-prepared and valid master plan which identifies mass transit corridors. The potential of achieving synergy between land use and transport planning is sometimes overlooked. BRT can provide a high level of accessibility to destinations along a corridor and if coupled with clear and focused land use planning can not only push property values but also enable the city to achieve the kind of development it wants to pursue.

Lastly, the need for champions who will advocate BRT as a sustainable public transport solution in the government, private sector, academe, and various circles cannot be overemphasized. Ahmedabad, Jakarta, and Lagos all had strong and determined political leaders supported by academic and technical experts who collectively were the agents of change that broke through conventional and traditional thinking.

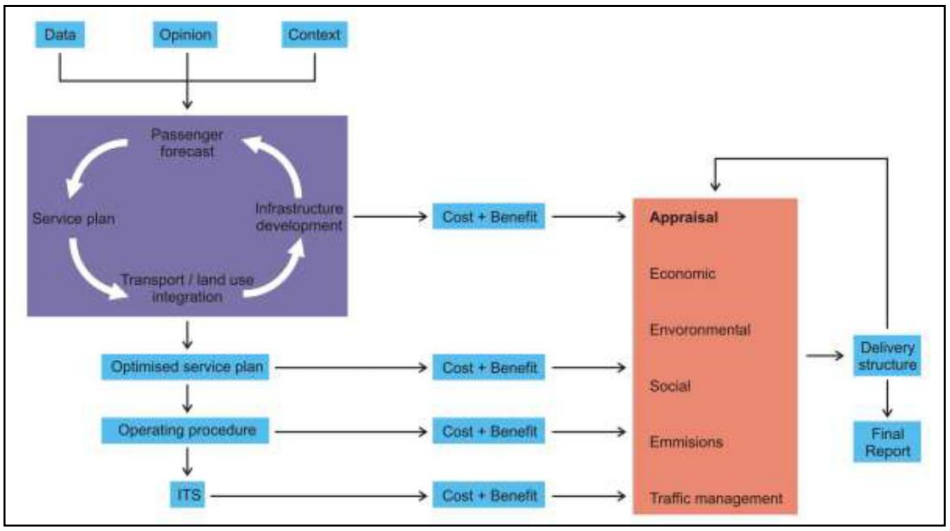
4.2 Public transport system integration

Because a BRT system uses at-grade physical space, its interaction with the rest of the road users is inevitable. Public transport integration has always been an issue in the cities where BRT is introduced. There were problems when the rest of the public transport network is not integrated with BRT in terms of fare and service. Such integration could be achieved in doses and not without political challenges. In the case of Ahmedabad, it was easier to integrate the BRT with the rest of the public transport system in terms of connections, fares, etc.

The potential for NMT (non-motorized transport) could be harnessed in BRT implementation through the treatment of walking and the use of bicycles as important access modes. As such, the improvement of sidewalks and the provision of bicycle storage

facilities at BRT stations are important.

Another lesson learned is the importance of having a full understanding of the local needs and travel demand first, followed by a service plan, and then the hard infrastructure. If not done in this sequence, it is possible that the design of BRT elements could be inconsistent with the demand. There can be missing passing lanes at critical points, or lack of level, no-gap boarding, or limited vehicle capacity, less than ideal interior layout, door width and placement. What is needed is a clear identification of local user needs and travel demand prior to the planning and design of the physical infrastructure elements.



Source: C. Brader

Figure 1 BRT Planning Process

4.3 Operating arrangements

The prevalent success among cities that adopted BRT is having an independent public special purpose vehicle (SPV) or authority that implements and manages competitively procured operation contractors and service providers as in the case of BRTs in Latin America. There are multiple operators that are contractually engaged by the BRT SPV and paid on a gross-cost contract, either on per bus-km or bus-hr basis, with proper performance incentives and penalties. Some of these operators are companies formed from incumbent minibus operators as in the case of Lagos, Jakarta, and in later phases, Johannesburg.

4.4 Finance

BRT infrastructure is mostly financed by the government, with buses purchased and operated by private companies on a gross cost contract, either per km or per hour of service provided. Revenue accrue to the SPV or BRT management entity. The table below shows the nature and scope of financing made for the BRT of the different cities.

Table 5 Financing of BRT Components

City	Financing of Infrastructure	Financing of Vehicles	Infra operating & maintenance costs
Ahmedabad	Municipality, State of Gudjarat, National Government of India	Private sector	Farebox and other revenues
Johannesburg	National Government of South Africa	City Government of Johannesburg	With government subsidies
Jakarta	Province of Jakarta	Government for some lines, Private sector for the others	With government subsidies
Delhi	Municipality financed the busway	Private sector	Advertising revenues
Lagos		Private sector	Farebox and other revenues

The variation in nature of financing across cities depends on the scale of the public transport market, institutional structures, nature of contracts with operators, fare levels, and competition from informal public transport operators.

4.5 Communications and Branding

BRT as an intervention needs to be understood, made acceptable, and supported by the different transport stakeholders both from the government and private sectors. Communicating to various audiences the concept, benefits, as well as challenges faced by BRT is therefore crucial in the success of BRT. Lack of information, as in the case of Delhi, can hurt the BRT advocacy.

Communication is important in making people understand the concept of BRT. People will only be supportive of anything new if they understand its benefits and if their mindsets are changed. Traditional thinking is that it is only rail-based systems that can solve urban transport problems. Openness of mind is needed for people to consider other options, better options in terms of responsiveness to needs, costs, implementation times, etc.

Part of communications is the crafting of clear and focused messages meant for different audiences. There is no one-message-fits-all in communications. A specific message will be suitable for a particular stakeholder group. The message on travel time and convenience of the BRT will matter to the commuters. The opportunities for BRT operations will interest the existing public transport operators. The environmental benefits of BRT will be valued by environmental groups. The land development potential associated with a high-quality mass transit system like the BRT will excite businessmen and property developers.

Branding plays the role of a symbol that represents what the BRT system promises to deliver. Effective and catchy brands are important for people to associate the BRT with reliable and safe service. Brands also become part of the image that the city wants to project. Branding is meant to evoke in people's mind their aspirations and needs and how these can be met by a particular product or service. Branding also helps in communicating the benefits that BRT stands for.

5 WARRANTS OF BRT IN THE PHILIPPINES

Cities in developing countries such as the Philippines face the consequent challenges of urban transport that go along with development. These challenges or externalities are traffic congestion, air pollution, rising transport costs, road safety, rising national government subsidies, and other issues. These are discussed below.

5.1 Traffic Congestion

The high number of both private and public vehicles on the road leads to traffic congestion with its attendant economic and environmental consequences. Vehicle ownership in the country is growing rapidly. In 1990, the total number of registered vehicles was 1.6 million; in 2007 this was 5.5 million. Since 2005, motorcycles/tricycles (MCs/TCs) have grown the fastest with an average annual increase of (10.77%), followed by SUVs (10.55%) and trucks (2.75%).

For the National Capital Region (NCR), vehicle registration between 1997 and 2007 shows an average annual increase of 2.70%. For Cebu City, the number of vehicle registration has shown an annual growth rate of 7% for the period 1994 to 2000 and 4% for the period 2000 to 2006. The share of trips using the private modes increased from 9.7% in 1979 to 20.6% in 1992 while the share of trips using public transport decreased from 90.3% in 1979 to 79.4% in 1992. It is anticipated that the Metro Cebu will experience an increasing rate of person-trips due to rapid population growth and urbanization.

It has been estimated that the annual cost of traffic congestion for Metro Manila is 140 Billion Pesos. More recent estimates put this at 2.4 Billion Pesos per day (JICA 2013). This is attributable to lost man-hours, additional fuel consumption health costs, and opportunity costs of lost investments.

5.2 Environment

Transportation or mobile sources have been identified as the major contributor of many air pollutants. The following table shows a national inventory of various pollutants and the contribution share of the three (3) sources: stationary, mobile, and area sources.

Table 7 2007 National Emission Inventory According to Air Pollutants (DENR)

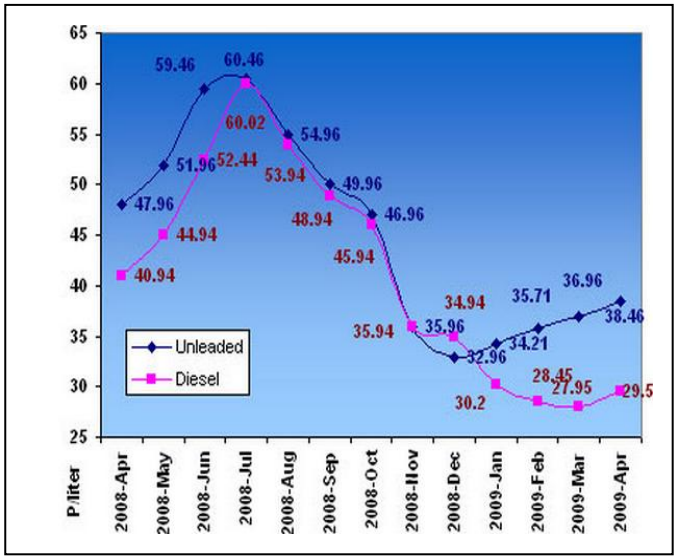
	PM (%)	CO (%)	NOX (%)	SOX (%)	VOC (%)	Total Share (%)
Stationary	14.13	10.26	30.82	97.35	6.48	20.87
Mobile	31.44	85.03	38.26	2.33	87.42	65.13
Area	54.42	4.71	30.92	0.32	6.10	14.01

According to the Cebu City CLUP (2000), air pollution is now an increasing problem in the city. In the absence of heavy industries or thermal and coal fired plants in the city, the deterioration of air quality is mainly attributed to emissions from motor vehicles as with the national figures. Severe air pollution is now observed in many areas of the city particularly in

major roads.

5.3 Fuel Price

Fuel prices have been unpredictable in the past two years as a result of complex confluence of factors such as growing demand in emerging economic powers, uncertainties in production, foreign exchange fluctuations, and others. The chart below shows the oil price trend for unleaded and diesel fuel between April 2008 and April 2009. The erratic behavior of fuel prices result in uncertainties and pressure in public transport provision, furthermore underscoring the importance of quality and reliable public transport systems in the midst of oil price ambiguities.



Source: (http://www.alternat1ve.com/biofuel/2008/05/15/average-philippine-gasoline-prices-2007-2008)

Figure 2 Philippine Oil Prices of Unleaded and Diesel, 2008-2009

5.4 Road Safety

Road safety has been an important issue that cities face today. The national cost of traffic accidents has been estimated to be 105 Billion Pesos equivalent to 2.6% of the country's GDP. The occurrence of traffic accidents is correlated to volume of vehicles, and a number of vehicles involved are public transport vehicles and motorcycles. Metro Manila's Commonwealth Avenue has been notoriously dubbed as "killer highway" as a result of frequent accidents, both fatal and non-fatal. This arterial road also serves in Metro Manila as an important bus corridor.

The number of accidents in Cebu City in 2000-2006 ranged from a level of 14,000 in 2000 to around 10,000 in 2006. The number of accidents is quite high considering that Metro Manila recorded a maximum of 11,185 accidents in 2005 in its 2002-2005 data.

5.5 Rising government subsidies for rail transit systems

Due to the high investment costs of rail-based systems and the need to keep fares at socially-acceptable levels, the required national government subsidies for rail systems have been growing rapidly. For example, the national government subsidizes the EDSA MRT passengers at close to 48 Pesos each, based on the proposed 2011 General Appropriations Act. This amounts to an MRT subsidy of P7.3 billion in 2011, which is P2.2 billion or 43 percent more than the P5.1 billion subsidy to train riders in 2010 (Manila Standard Today, Sept 6, 2010).

Issues of affordability and equity are raised here. The national government which is already faced with financial difficulties have to provide huge subsidies to an expensive system. Furthermore, there are equity and fairness issues because the rail subsidies come from taxpayers' money from all over the country and are earmarked solely for Metro Manila commuters.

5.6 Others

Road-based public transport in the Philippines is in the hands of private operators who are guided by their own compartmentalized perspective of market demand and supply and fundamentally driven by their profit motive as investors in the industry. Consequently, public transport provision is highly fragmented and there is practically no semblance of full systems operation and management, "systems' referring to the whole public transport system. As a result, there is erratic, inefficient, even unsafe provision of public transport, rendering captive passengers no choice but to take the low-quality services and the choice passengers the propensity to use their private cars. A high-quality and systematically organized, managed, and provided public transport system is therefore warranted.

6 BRT STUDIES IN THE PHILIPPINES, WITH FOCUS ON THE CEBU CITY BRT

BRT studies have been and are being conducted in various cities in the Philippines including Metro Manila, Cebu City, and Davao City. These are studies conducted by international development organizations including the USAid, ADB, and the World Bank as well as private companies like the Ayala Corporation.

The following sub-sections present and discuss the salient points of a BRT study that has been conducted in Cebu City, Philippines. This is the World Bank's feasibility study of a BRT system for Cebu City conducted completed in October 2012 and as of this writing awaiting national government approval. A study is currently being conducted for Metro Manila, and is in its final stages. Presented here are the highlights of the study including the environmental and social benefits of BRT.

6.1 Overview of the proposed BRT system for Cebu City

6.1.1 Project Definition

The Cebu BRT project includes:

- A segregated busway between Bulacao and Ayala Mall
- Stations and terminals along the segregated busway route
- A depot for the garaging of buses designated to operate as BRT services
- An Area Traffic Control (ATC) System to facilitate priority run times within the corridor and give city wide benefits of improved traffic flow
- An open service plan that ensures that while infrastructure is limited to that between Bulacao and Ayala, BRT services operate beyond this. Specifically in the case of Ayala Mall to Talamban where bus passage will be facilitated by bus priority measures where required and where achievable within the confines of the roadway.
- Traffic management measures to improve traffic flow outside of the corridor that are seen to complement the BRT and maximize its impact
- Parking management measures that will similarly complement BRT and improve traffic flow
- Interchange improvements to offer enhancement to the level of service received by all public transport passengers irrespective of whether they use BRT or not
- Urban planning improvements consisting of public realm enhancements and enhanced integration of transport and land use.

6.1.2 BRT Route

The diagram shows the proposed BRT route which consists of segregated operation between Bulacao and Ayala, as well as within SRP, and buses running with some priority between Ayala and Talamban. In segregated sections BRT will run in its own lanes in the center of the road. There will be gaps where it crosses signalized intersections. At signalized junctions BRT will receive priority by interaction with the central computer housing the Area Traffic Control System.

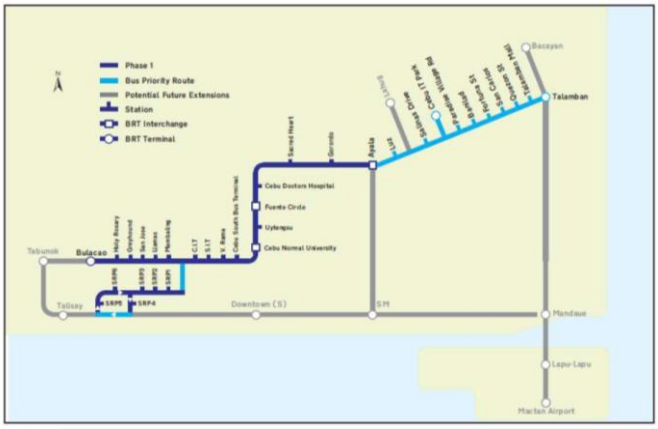


Figure 3 Proposed BRT Network for Cebu City and Environs

6.1.3 User-oriented design

The scheme has been developed through a deep understanding of the needs of travellers within and through Cebu City. As part of the Feasibility Study over 5000 people have been engaged with more reached through newspapers, TV, radio and the project's Facebook and web site. In addition meetings and presentations have been given to interest groups and stakeholders.

The understanding of need and context has been supported by large scale data collection to understand the scale of movement in and around the city. Data has been used to create a sophisticated forecasting model that enables the development team to

understand in some detail the potential patronage and revenue to be achieved by the scheme, the revenue it will bring and its impact upon existing transport providers. Forecast future years of 2020, 2025, 2035 and 2040 have been considered in addition to a 2015 opening year. Applying projected growth to the transport network shows that travel conditions in Cebu will deteriorate significantly in the future. The implementation of BRT between Bulacao and Talamban together with an improved ATC system will offset that deterioration to a certain extent but will not protect the City entirely from the negative effects of growth. Further transport interventions will be required

6.1.3 Branding

A BRT brand was developed by discussing colours, images and feelings associated with proposed BRT travel within the Barangays fronting the BRT route. The output from these focus groups was interpreted by a graphic designer to produce a whole series of names with different means of portrayal and brand colours. These options were tested through quantitative assessment of the general public in SM, Ayala and City Hall. The output of this process was a clear preference for the name, TransCebu, with a dominance of the colour green and use of a sunshine motif.

Figure 4 Cebu City BRT Branding

6.1.4 Passenger Forecasts and Service Plan

A summary of the passenger ridership forecast for target opening year 2015 is shown below:

Table 8 Forecast Passenger Ridership

AM peak passengers	26,100
Daily passengers	330,000
AM peak link loading (pphpd)	5,300
AM peak boardings	
Bulacao – Ayala service	5,800
Bulacao – IT Park service	3,500
Bulacao – Talamban service	8,500
Bulacao – SRP service	500
Talamaban – SRP service	3,600
Talamaban – Ayala service	1,800
Ayala – SRP service	2,000
Talamban – IT Park – Ayala service	800

These passenger forecasts are used as basis for developing the service plan shown below.

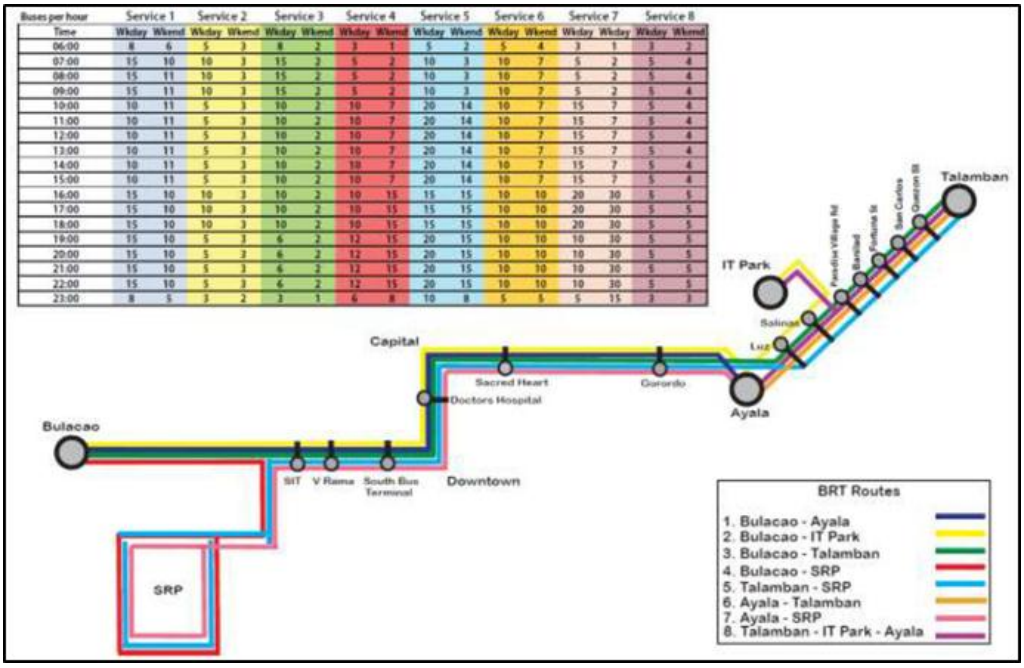


Figure 5 Cebu BRT Service Plan for 2015

6.1.5 BRT Vehicle

Alternative vehicle types were investigated and a 13.7m twin door rigid vehicle powered by an ultra-clean diesel engine is proposed. This vehicle could be bought as a chassis from a number of international suppliers to be assembled in the Philippines.

6.1.6 Infrastructure

In general terms, the BRT running way can be built without ROW acquisition except at its stations, terminals and depots. At stations, widening is required to accommodate a median station. To support BRT, sidewalks will be improved to provide access and ground level pedestrian signals will be provided. Spaces for jeepneys to drop off passengers will be provided at interchange stations. Jeepneys will only be allowed to stop at these designated areas and will not travel along the corridor for more than one stop. A general station layout is shown below.

Figure 6 Typical Station Layout

Passengers will pay by smartcard to enter the station to ensure that boarding the vehicle will be swiftly executed. Stations will have a ticket kiosk and turnstiles. Station personnel will be present to ensure a secure environment. Outline station designs have been developed with respect to forecast passenger capacity, to meet the needs of the number of buses that will serve them, offer a pleasant waiting environment and have a low environmental footprint.

6.1.7 Area Traffic Control and Traffic Management

The existing Area Traffic Control (SCATS) system is old, not maintained and largely dysfunctional. BRT requires control along

its corridor to offer preferential journey times to its passengers and minimise its impacts upon other travellers. As such a new city wide traffic control system has been investigated and proposed that will bring significant benefits across the whole City.

To complement BRT and make it more effective, ATC, parking management and jeepney organisation/routeing has been examined in the Downtown area, together with accessibility improvements between BRT and Downtown.

6.1.8 Managing PUJ Sector Impacts

Along the route of the BRT, Jeepneys will be affected. They will however continue to play an important role within the future public transport network. The diagram below shows how some Jeepney services will act as 'feeders' to the BRT. This will significantly enhance people's travel opportunities and travel experiences.

Some will be replaced. It is estimated that approximately 1,300 jeepneys will be affected. A companion study to the Feasibility Study has been undertaken that held extensive discussions with the jeepney industry to understand how individuals and groups might be motivated to be involved in the delivery of BRT. A BRT operator, or operators, will be required that are trained and capable of offering the required service levels. There is much international experience in the engagement of existing, informal, operators becoming active in BRT operation.

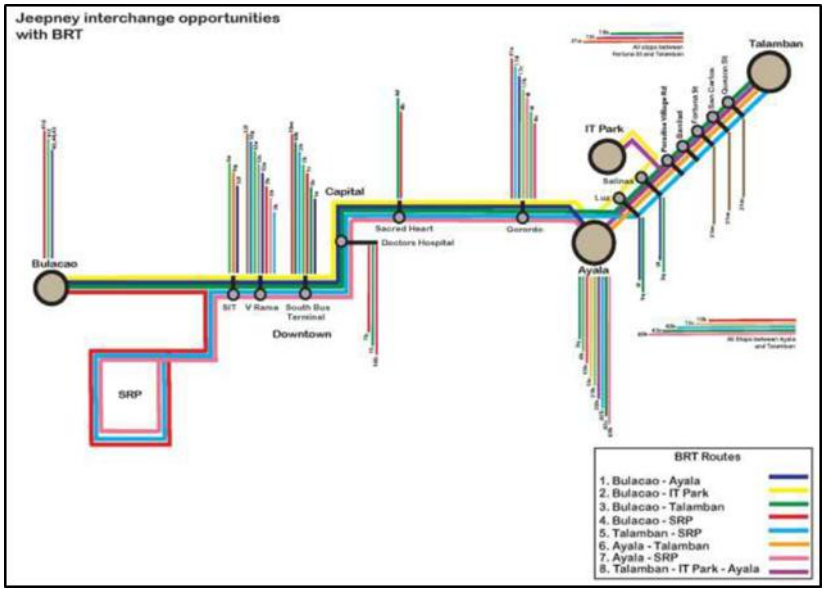


Figure 7 Jeepney Interchange Opportunities with BRT

6.1.9 Environmental and Social Benefits

The operation of the BRT should have beneficial effects on the surrounding environment overall. The introduction of the BRT will allow faster more efficient mass public travel and improved traffic flow on the adjacent traffic lanes and smoother asphalt pavement and improved road side gutters and drainage can be expected to reduce the accumulation of road side dust and therefore air pollution from disturbed dust should also be controlled. The improvement of the road will be within the existing corridor and will use existing flyovers where necessary keeping BRT vehicles away from roadside sensitive receivers such as places of worship and schools. The residential areas are generally set back from the roadway. Gaseous and particulate emissions from the expected traffic flows will be well dispersed from the road and under the new arrangements there will be insufficient additional traffic to increase noise above the acceptable standards. Overall the Project may result in increasing vehicle speeds but additional future traffic should be better organized and there will be additional signage and pedestrian controls so that community safety issues are unlikely to arise. The overall conditions for efficient BRT travel by the public, the segregation of traffic and the enhanced road facilities will mean driving conditions improve. Routine safety measures, signage and road markings will be introduced to reduce pedestrian and driving risk further.

GHG Emission Benefits

At present, around 474,000 tonnes of CO_2e are currently being produced by some 893 million vehicle-km of travel across the Cebu City road network. For the proposed BRT corridor, 120,000 tonnes of CO_2e are being produced by 205 million vehicle-km. In terms of GHG emissions per person-km, 135.6 grams CO_2e are being produced per person-km across Cebu City by passenger transport and 131.1 grams CO_2e per personkm in the BRT corridor. Current urban transport greenhouse gas emissions across Cebu City per GDP per capita are 323.1 tonnes of CO_2e per US dollar4 GDP per capita.

For the future, implementing the BRT-ATC scenario in Cebu City would give significant greenhouse gas emission benefits over the baseline scenario against the three main performance indicators. In particular, it would:

- Yield annual savings across Cebu City by comparison with the baseline scenario of 115,000 tonnes of CO2e by the year 2020 and 192,000 tonnes by 2025 (equivalent to 24% and 41% of the current total annual GHG emissions from urban transport in Cebu respectively).
- Save a total of 3,867,000 tonnes of CO2e over a 20 year period from 2015 by comparison with the baseline scenario - the equivalent of saving over eight times the current total annual GHG emissions from urban transport in Cebu.
- Reduce GHG emissions per person-km below current levels and in the BRT corridor keep them below those levels for the 20 year period from 2015. Across the city, GHG emissions per person-km would be kept below current levels for around 9 years from 2015. Under the baseline scenario by contrast, emissions per person-km would exceed current levels within 3 to 4 years from 2015 and then continue to rise throughout the 20 year period.

6.1.10 Economic and Financial Appraisal

The economic appraisal defines the project's viability from a social perspective. The financial appraisal defines the project's viability from a business and commercial perspective. The table below presents opening year (2015) revenue against opening year recurring costs. Total opening year financial benefits are estimated at approximately 880 million Pesos. This covers all recurring costs including direct operating costs including vehicles, operational control, systems management, infrastructure maintenance and technical support consultancy and leaves a net surplus of approximately 25 million Pesos. Overall, opening revenues cover approximately 103% of all recurring costs assuming a fare of 9 Pesos. It is estimated that increasing BRT fares to 10 Pesos would allow opening year revenues to cover 114% of all recurring costs.

Over an appraisal period of 2015-2042 economic viability is proven using both World Bank and NEDA discount factors.

Table 8 Cebu BRT Economic Appraisal

Economic Benefit Cost Ratio (EBCR)	8.0
Economic Net Present Value (ENPV) (millions of Pesos)	81,439
Economic Internal Rate of Return (EIRR)	39%

7 PROSPECTS FOR BRT IN THE PHILIPPINES

Conditions are ripe for the planning and implementation of BRT in the Philippines. For one, BRT has officially been recognized as belonging to the menu of Environmentally Sustainable Transport (EST) strategies of the country. Hence, it is officially recognized as a potentially viable option. Second, climate change funds are available to finance studies and implementation of BRT systems in Metro Manila and Cebu. Thirdly, the Cebu BRT has been identified as one of the top PPP undertakings of the current national government.

7.1 EST Framework

Efforts to implement BRT in the Philippines have been officially included in the Environmentally Sustainable Transport (EST) Framework for the Philippines. The Presidential Administrative Order No. 254 issued in January 2009 mandated the DOTC to develop the EST Framework for the country. The National EST Strategies, Indicators, and Action Plans were submitted by the DOTC to the Office of the President and the NEDA in November 2009. The EST strategies include the BRT as a environmentally sustainable mass transit option, officially recognizing it as an option for cities in the Philippines.

7.2 Climate Change Funds

There are funds that are being made available for BRT studies and implementation courtesy of Climate Change funds. At present, 350 Million US$ consisting of 250 Million US$ from the International Bank for Reconstruction and Development, 50 Million US$ concessional loans from the Clean Technology Fund, and 50 Million US$ Philippine government counterpart funds for 50 kms of BRT in the Philippines (PPIAF Update).

7.3 Public Private Partnership

BRT implementation is an opportunity for private-public partnership with official development assistance, ensuring the barest Philippine government exposure. As a PPP undertaking, the BRT infrastructure (busways, stations, terminal and depot, ITS) may be paid for by the government through Official Development Assistance while rolling stock or buses and their operations and maintenance may be invested in by the private sector. The Cebu BRT project has been identified as one of the 16 top PPP projects of the current administration (The Freeman, 2010).

8 SUMMARY

This paper presents the concept of BRT as a public transport system and compares it with other mass transit options. The paper also discusses the factors that warrant the implementation of BRT in the Philippines. It also presents the highlights of the Ceby BRT study. The paper is capped by a discussion of the conditions and opportunities which are auspicious for further BRT planning and implementation in the country.

APPENDIX

[1]Lloyd Wright quoting Levinson et al. Bus Rapid Transit, Volume 1: Case Studies in Bus Rapid Transit, TCRP Report 90. Washington, DC, USA. Transit Cooperative Research Program

[2]Clean Air in the Philippies, Summary of Progress in Improving Air Quality, CAI – Asia & Partnership for Clean Air, November 2008

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