PART 2

Determining the best BRT for eThekwini

BRT systems are fast becoming part of the South African urban landscape. In the first part of this two-part article, the authors set about defining BRT systems, looking at their history and examining configurations, factors and options. This is the second and final part of the article – part one was published in the June 2014 edition of **IMIESA**.

By Emmanuel Adewumi and Dhiren Allopi, Durban University of Technology

Interpretations based on the checklist of the three operational BRT systems in South Africa

Running ways

BRT vehicles use a fast and easily recognisable dedicated bus lane or traffic lane or have exclusive rights of way. BRT running ways for Rea Vaya operate highway medians with distinctive pavement markings and studs that serve as a separator to other traffic to avoid vehicle manoeuvring and, in some areas of the feeder routes (outer suburbs) that join the trunk route at the main station, operate in mixed traffic. The Port Elizabeth BRT system, called Libhongolethu, makes use of a dedicated median lane along Lilian Diedricks station to Triangle (Nelson Mandela Bay Stadium) and Greenacres, and the other corridors from Lilian Diedrick station to the airport and Nelson Mandela Metropolitan University are operated in a mixed traffic setting. The My Citi BRT system in Cape Town makes use of mixed traffic, segregated, at-grade median and median busways. In mixed traffic, it operates on the kerbside of the road and a segregated busway is situated along the Civic Centre to Table View.

Branding

The ability to adopt branding in transport service is an important effort to encourage and maintain a reliable ridership. A perception survey was referenced in a 2004 report by the Federal Transport Authority (FTA) to measure public perception of BRT systems. The outcome of the survey indicated that most booming BRT systems were able to pull off a marked identity and position in their region amidst other transit services.

South African BRT systems are branded differently to establish uniqueness among other forms of public transport and as a form of public awareness and aesthetic view for the commuters. This particular system has a distinctive identity and image, which distinguishes it from other types of public transport.

Stations

These serve as a temporary shelter for passengers waiting to board to their various destinations, which is conveniently located and integrated along the route in which they serve. BRT stations possess specific paint schemes, logos, CCTV, security, real-time arrival information and streamlined passenger shelter design. The Libhongolethu BRT system has no covered station/shelter for either commuters or staff. It makes use of the existing CCTV on the road while the Rea Vaya and My Citi BRT systems have beautified stations and the latter has full weather protection. All the system stations are situated at the median of the highway.

Intelligent transportation system (ITS)

The Rea Vaya BRT system makes use of advanced digital technologies that improve passengers' convenience, speed, safety and reliability, both at the station and in the bus, by informing them of the name of each station in transit and also the time of arrival of the next bus at the station. Cape Town's My Citi makes use of a public announcement of the next station and a route map on the bus, which the commuters can study. Libhongolethu is a newly rolled-out BRT system still in the marketing stage; there are no information displays in the bus or station but an informative flyer is given to commuters who ask the staff questions. ITS can be referred to as the bus/intersection signal priority and CCTV monitoring of

BRT stations come in a wide variety of designs

operations that makes use of automatic vehicle location (AVL) with the aid of GPS. There is real-time display information and updated schedules both in the bus and station, which really help passengers who do not know at which station to alight or when the next bus may be arriving.

Fare collection

With Rea Vaya, the fare is collected in a fast and easy way before passengers board the bus, which is called off-vehicle fare payment, making use of multiple entrances for boarding and alighting, in order to reduce time. Some passengers make use of a smart card to pay for the fare, which is at a flat rate. My Citi fares are paid by smart card: the passenger swipes it at the entrance of the bus with money that has been loaded on it, and the fare is a flat rate like the Libhongolethu BRT system, which uses on-board payment.

COMPONENTS OF A BUS RAPID TRANSIT SYSTEM

A BRT system combines flexible service and new technologies to improve customer convenience and reduce delays. While specific BRT applications vary, the components may include:

A: Running Ways – exclusive guideways or dedicated lanes that allow BRT vehicles to be free of conflicting automobile traffic, parked or stopped vehicles, and other obstructions – maximising BRT operating speeds. In some situations, BRT vehicles also may operate in general traffic, trading speed and reliability for flexibility. "Queue jumper" is a term that refers to short exclusive lanes at signalised intersections that are used to allow BRT vehicles to jump to the head of the line and bypass stopped automobiles and traffic.

B: Vehicles – modern, low-floor, high-capacity rubber-tired vehicles that accommodate high volumes of riders and fast boarding and exiting. BRT vehicles often use clean fuels or alternative power.

C: Stations – ranging from protected shelters to large transit centers, BRT stations are located within the communities they serve and provide easy access to the system.

D: Route Structure and Schedule – established to maximise direct, no-transfer rides to multiple destinations and to create more flexible and continuous service (reducing the need for a schedule) for local and express bus service.

E: Fare Collection – designed to make it fast and easy to pay, often before boarding the vehicle, BRT fare collection systems include the use of self-service proof-of-payment systems or pre-paid stored-value fare cards, such as a smart card system.

F: Advanced Technology – the use of advanced technologies (or intelligent transportation systems) to improve customer convenience, speed, reliability, and safety. Examples include systems that provide traffic signal preference for buses at intersections and cross streets, as well as global positioning systems to provide passenger information such as real-time bus arrival information.

Pedestrian

Among the key components of BRT design and planning is pedestrian safety, and safe, easy access to the boarding facility. If these are not put into proper consideration, commuters will be discouraged about the system. The pedestrian access of Rea Vaya and My Citi are controlled by traffic lights; the passengers are at low risk when going to the station to board. With Libhongolethu, some places are not controlled by a traffic light.

Transport vehicle option

The Rea Vaya system makes use of a standard bus with double side doors for alighting and boarding, in order to minimise delay as do the the My Citi and Libhongolethu systems. My Citi is a combination of both articulated and standard buses, but the Libhongolethu system makes use of articulated buses throughout.

Interpretations based on the assessment of the EMA BRT system

It could be deduced that there is pressure on public transport based on the population, according to Current Public Transport Records, and the demand analyses, discussed in Table 2 (Part 1, ***IMIESA*** *June 2014*), in the eThekwini Municipal Area.

The population count shows that the routes will experience passenger demand in the order as listed below (in descending order). Note that C2 and C8 are not included below because they are rail tracks:

- C1 Bridge City to Warwick/CBD
- C5 Mpumalanga & Pinetown to Warwick
- C7 Hillcrest & Umhlanga to Durban
- C3 Bridge City to Pinetown
- C6 Mpumalanga & Pinetown to Warwick
- C9 Bridge City to Umhlanga
- C4 Bridge City to Merebank and Rossburgh.

Access to facilities like offices, residences, schools and malls are another factor that is assessed along the routes, so as not to create obstructions to other road users, because the primary aim of this BRT system is to reduce the travel times experienced by the commuters. Route C1 comprises offices, malls, residences and schools. Along the route C5, it is mainly businesses, schools, malls and residential buildings. Routes C7, C3, C6 and C4 are roads commuters ply every day to reach businesses, schools, shopping and recreational activities, and residential areas. Merebank and Rossburgh are suburbs of Durban; commuters living along these places would have ease of travel to their various destinations. The terrain along the routes C1, C3, C4, C5, C6 and C7 consists largely of mining terrain, which is usually flat but curvy.

Conclusions and recommendations on the in-depth literature review of BRT systems

Kerbside and median lane configurations are less expensive than a segregated BRT system because of its aerial or underground busway. Kerbside BRT systems do not need a pedestrian bridge, while a median needs a pedestrian bridge, which is safer than an at-grade pedestrian crossway.

It is better to have a pedestrian bridge, which seems to be safer than a crosswalk, and a crosswalk controlled by traffic lights is preferable to one that is not. It is good for kerbside and median BRT configurations to have a pedestrian bridge for access, compared to a crosswalk. Also, for physically challenged commuters, kerbside and segregated BRT systems would be preferable because of the access to the station being much more convenient.

Commuters using a kerbside station/BRT system tend to be safer when compared to median stations because they do not need to cross the traffic to access the service, but a segregated BRT lane configuration is safer than both the median and kerbside lane configurations.

Vehicle manoeuvring would pose a delay for a kerbside BRT system but the other lane configurations would be suitable. If a kerbside system were adopted, implementing a shoulder lane, where automobiles can park and make U-turns to their destination, would improve the system.

This research study recommends the following:

To be able to select the appropriate vehicle option for a BRT system for a particular area/corridor, the transport demand, coverage/distance to be covered and length of public transport delay, due to general traffic conditions, must be put into proper consideration.

If the transport demand and coverage are low, a standard bus could be selected over other options and, in order to enhance rebranding and marketing strategies, a stylised bus could be picked over others, provided the condition is the same as above.

Any form of BRT system should be considered or implemented because it offers increased levels of mobility, fewer stops and greater accessibility than traditional public transportation. It could also serve as an attractive means to get drivers or car owners to use the system.

A BRT system should not be operated in mixed traffic because it poses delays. The introduction of a dedicated bus lane would increase reliability and transit speed and have a positive effect on the commuters. The level of service of a segregated BRT system is much higher than that of kerbside and median BRT systems. The level of service of a kerbside system could be improved by the provision of a shoulder lane, where vehicles can hover or park to execute their task.

It is only when there is no space for expansion that a BRT system should be operated in a mixed traffic setting, since the implementation of any mode of BRT system depends on the availability of space. For able and physically challenged pedestrians, a segregated BRT system would be preferable. However, cost will be the major deciding factor. Segregated and median BRT systems should be considered over kerbside, owing to vehicle manoeuvring.

Conclusions and recommendations on South African BRT systems

This section gives the conclusions and recommendation on the evaluation of the three main functional BRT systems in South Africa.

Rea Vaya BRT system, Johannesburg

Using this mode of BRT system poses improvement in travel time, reliability, safety and speed when compared to other public transport and automobiles travelling in mixed flow traffic lanes because they operate on a dedicated bus lane. A separate lane enables the system to have lower headways and accommodate higher peak period loads. When further combined with signal priority, delay is greatly minimised at intersections.

Conclusively, it is commuter/user friendly and cost-effective over a long distance, when compared to other public transport, because it operates at a flat rate. In the system, pedestrian safety and convenient and secure access to the facility for physically challenged and able commuters are fully guaranteed, which helps commuters not to be discouraged about the system. The installed ITS help the passengers to know the exact time and place to alight, especially those who do not know their exact bus stop destination.

The research study recommends that high maintenance should be the watchword and if there is the need for BRT system diversification in Johannesburg, other lanes should be implemented, using other forms of a BRT system, adopting bicycle and car parking at the main station, which will enable a complete comparison in terms of service reliability and delay. If there is population intensification, articulated standard buses should be adopted. The use of smart cards should be solely adhered to, which will help the commuters to load more than a day fare on it depending on their financial capacity. Another mode of the BRT system, especially segregated, should be employed in case of future BRT intensification. Its cost-effectiveness is justified by the high grade of efficiency, reliability and speed.

My Citi BRT system, Cape Town

The use of a dedicated bus lane should be encouraged throughout the routes, due to its improvement in travel time, reliability, safety and speed when compared to other road public transport modes. A separate lane enables the system to have lower headways and accommodate higher peak period loads. When further combined with signal priority, delay is greatly minimised at intersections. Use of automatic vehicle location helps the passengers to know when the bus would arrive at the station and the exact place to alight, especially those who do not know the exact location of their destinations. AVL is more preferable to audio announcement in the bus. Having no phone booth and information display systems, in either bus or station, keeps the system below standard when compared to an ITS BRT station. It could be noticed that where a segregated lane is used, it is more efficient than median, at-grade median, or mixed traffic lanes.

Conclusively, it is commuter/user friendly and cost-effective over a long distance, when compared to other road public transport, because it operates at a flat rate. In the system, pedestrian safety and convenient and secure access to the facility for physically challenged and able commuters are fully guaranteed, which helps commuters not to be discouraged about the system.

It is recommended that high maintenance should be the watchword and if there is a need for BRT system diversification in Cape Town, other lanes should be implemented using other forms of BRT systems, adopting bicycle and car parking lots at the main station, which will enable a complete comparison in terms of service reliability and delay. Mixed flow traffic lanes should be totally discouraged. Other BRT systems, especially segregated modes, should to be employed in case of future BRT intensification. Phone booths, comfortable seating, bicycle space and an ITS should be fully installed at the station.

Libhongolethu BRT system, Port Elizabeth

Use of a dedicated bus lane should be encouraged throughout the routes because there is great improvement in travel time, reliability, safety and speed with a dedicated BRT system when compared to other road public transport travelling in mixed flow traffic lanes. It makes use of articulated standard buses to accommodate more passengers. The system is far below standard because it has no AVL, information kiosks, phone booths or full weatherproof shelters.

Conclusively, it is commuter/user friendly and cost-effective over a long distance, when compared to other public transport, because it operates at a flat rate and also commuters can be transferred within 30 minutes of purchasing the ticket within IPTS Zone 1. In the system, pedestrian safety and convenient and secure access to the facility for physically challenged and able commuters are fully guaranteed, which helps commuters not to be discouraged about the system.

It is highly recommended that proper maintenance should be the watchword and, if there is a need for BRT system diversification in Port Elizabeth, other lanes should be implemented using other forms of BRT systems. A full weather protection streamlined station should be implemented adopting bicycle and car parking lots, phone booths,

BRT systems in South Africa would be a good yardstick in the implementation of the proposed BRT system in the eThekwini Metropolitan Area

TABLE 4 Decisions on Phase 1 BRT routes in EMA

Routes	C1: Bridge City to CBD via KwaMashu	C3: Bridge City to Pinetown	C9: Bridge City to Umhlanga
Route length (km)	25.3	27.5	13
Lane configuration	Median Kerbside (where C1 and C3 share a dedicated ROW from the junction (M25 W) running kerbside along the southern edge of the M25 up to Malandela Road)	Median (where C1 and C3 share a dedicated ROW from the junction (M25 W) running kerbside along the southern edge of the M25 up to Malandela Road)	Median
BRT lane width	Single BRT lane width: 3.5 m At stations: where passing lanes are provided, the lane alongside the station will be reduced to 3.0 m, with 3.5 m width maintained for the passing lane	Single BRT lane width: 3.5 m At stations: where passing lanes are provided, the lane alongside the station will be reduced to 3.0 m with 3.5 m width maintained for the passing lane	Single BRT lane width: 3.5 m At stations: where passing lanes are provided, the lane alongside the station will be reduced to 3.0 m with 3.5 m width maintained for the passing lane
Vehicle transport option	Standard bus (35-70 capacity, 14.5 m length, 2-3 doors for boarding and alighting on both sides)	Standard bus	Standard bus
Demand analysis 2015 (millions per annum)	31.3	20.56	12.96

TABLE 5 Guidelines for the remaining proposed BRT routes

Routes	C4: Bridge City to Mobeni and Rossburgh	C6: Hammarsdale and Pinetown to Warwick	C7: Hillcrest to Chatsworth	C8: Tongaat and Airport to Umhlanga and Warwick
Route length (km)	34	64	36	41
Lane configuration	Fully coloured median lane configuration with median aesthetic bus station	Fully coloured median lane configuration with median aesthetic bus station	Fully coloured median lane configuration with median aesthetic bus station	Segregated lane configuration *road width extension OR Fully kerbside lane configuration and aesthetic kerb station * provision of shoulder lane
BRT lane width	Single BRT lane width: 3.5 m At stations: where passing lanes are provided, the lane alongside the station will be reduced to 3.0 m with 3.5 m width maintained for the passing lane	Single BRT lane width: 3.5 m At stations: where passing lanes are provided, the lane alongside the station will be reduced to 3.0 m with 3.5 m width maintained for the passing lane	Single BRT lane width: 3.5 m At stations: where passing lanes are provided, the lane alongside the station will be reduced to 3.0 m with 3.5 m width maintained for the passing lane	Single BRT lane width: 3.5 m At stations: where passing lanes are provided, the lane alongside the station shall be reduced to 3.0 m with 3.5 m width maintained for the passing lane
Vehicle transport option	• Low emission technology vehicle • Standard bus • Door ramp for physically challenged commuters • Air-conditioner with heater • Emergency exit • Separate comfortable seats of different colour for aged commuters • Separate comfortable seats of different colour for physically challenged commuters	• Low emission vehicle technology • Standard bus • Door ramp for physically challenged commuters • Air-conditioner with heater • Emergency exit • Separate comfortable seats of different colour for aged commuters • Separate comfortable seats of different colour for physically challenged commuters	• Low emission vehicle technology • Low-floor standard bus • Door ramp for physically challenged commuters • Air-conditioner with heater • Emergency exit • Separate comfortable seats of different colour for aged commuters • Separate comfortable seats of different colour for physically challenged commuters	• Low emission vehicle technology • Stylish articulated standard bus (≥ 70 capacity, 18.5 m length, 2-5 doors for boarding and alighting on both sides) • Door ramp for the physically challenged commuters • Air-conditioner with heater • Emergency exit • Separate comfortable seats of different colour for aged commuters • Separate comfortable seats of different colour for physically challenged commuters
Demand analysis 2015 (millions per annum)	11.5	16.86	25.96	11.76

CCTV, AVL, comfortable seating and information maps at each station. Mixed flow traffic lanes should be totally discouraged. Other modes of BRT systems, especially segregated modes, should be employed in case of future BRT intensification. If there is population intensification, bi-articulated standard buses should be adopted. The use of smart cards should be solely adhered to, which will help the commuters to load more than a day fare, depending on their financial capacity.

Conclusions based on the assessment of the EMA BRT system

Decisions made on the Phase 1 BRT systems of eThekwini Municipal Area by ETA

Table 4 shows the decisions taken on Phase 1 of the EMA BRT system. Although they have not been carried out, they are on paper, with the intent of being executed. A standard high-capacity bus was chosen in all the Phase 1 routes, with which this research study agrees. Based on the passenger population, C1 would experience the highest demand, then C3 and C9 in the eThekwini Municipal Area. This study suggests articulated buses for C1 and standard buses for C3 and C9. The suggestion comes as a result of the commuter demand analyses of the routes, coupled with the literature underpinning this research, and the vehicle transport options being used by the three functional BRT systems across the nation.

The lane configurations were decided on considering the access to property like offices, residences, shopping malls, etc. on those routes. This research study concurs with the lane configurations stated in Table 4 germane to the route inspection and access to property: factors considered in the selection of a BRT system and the evaluation of the Johannesburg, Cape Town and Port Elizabeth BRT systems.

Funds would be released by the government for consequent phases only if Phase 1 has been implemented successfully. The success of it has a positive outcome on the implementation of others. It would be executed one phase after the other.

Guidelines for the remaining proposed BRT routes in the eThekwini Municipal Area

Table 5 shows the remaining proposed BRT routes in the eThekwini Municipal Area yet to be implemented. These decisions are based on the access to residential and other activities on the remaining routes, evaluations of the three functional BRT systems in South Africa, demand analyses of the routes, factors necessary to be considered when implementing the system and an in-depth literature review within the scope of the study.

This research study concludes that the documented guidelines, conclusions and recommendations of in-depth literature and the assessment of the three functional BRT systems in South Africa would be a good yardstick in the implementation of the proposed BRT system in the eThekwini Municipal Area. 3S