

# THE EFFECTIVENESS OF BUS RAPID TRANSIT AS PART OF A POVERTY-REDUCTION STRATEGY: SOME EARLY IMPACTS IN JOHANNESBURG

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## ABSTRACT

Bus Rapid Transit (BRT) systems are being promoted in South Africa and elsewhere as a potentially effective way of delivering greatly improved public transport services to marginalised urban communities and thereby reducing exclusion-related poverty. This paper provides an early assessment of the actual poverty impacts of the Rea Vaya BRT in Johannesburg, using data from a small-sample household survey conducted for this purpose in Soweto. The data suggest that the main benefits of the first phase BRT lie in its enhancement of access to a variety of activities, rather than its direct expansion of accessibility to work opportunities. Both time and cost savings are substantive, in the region of 10 to 20% compared to previous levels, but these benefits accrue largely to medium-income households rather than to the poorest commuters in the area. Rea Vaya also makes a modest contribution to community satisfaction with transport and living conditions in general, which might augur well for improving social cohesion and for leveraging further investment in the area. Although it is too early to draw any long-term conclusions, the key findings suggest that more specific targeting is needed for the BRT to deliver significant poverty reduction benefits.

## 1. INTRODUCTION

Bus Rapid Transit (BRT<sup>1</sup>) systems are being promoted in South Africa and elsewhere as a potentially effective way of delivering greatly improved public transport services to marginalised urban communities and thereby reducing exclusion-related poverty (DOT, 2007). As we embark on putting this into practice, it is important to capitalise on the opportunities presented by the BRT systems that have been implemented to assess whether poverty reduction goals are indeed being met, and if so, under what circumstances, in order to plan and build better systems into the future. This paper attempts to open an early window into the possible long-term poverty impacts of BRT systems in South Africa, by examining some of the early impacts of Johannesburg's Rea Vaya BRT system. In doing so two important provisos apply: firstly, Rea Vaya had been in operation for only two years (at the time of research), so that any findings are necessarily short-term in nature, and would not necessarily hold in the long run. Secondly, Rea Vaya

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<sup>1</sup> The term BRT is used interchangeably with Integrated Rapid Transit (IRT) in South Africa..

operates in a particular historic, spatial, and social context: results are not necessarily transferable to other places. However, we attempt to understand the underlying reasons for our findings, in order to make them as useful as possible elsewhere. We also see short-term results as opportunities for early identification of potential long-term trends and problems, which is a useful learning experience in itself.

## **2. BACKGROUND: BUS RAPID TRANSIT AND POVERTY REDUCTION**

Although BRT systems worldwide display great variation, for the purpose of this study we identify three key characteristics: (i) dependence on upgraded infrastructure, including (at least some) dedicated lanes and purpose-constructed bus stations, (ii) authority-planned routes to evolve into a coordinated network (even if it is rolled out incrementally over time), and (iii) an explicit emphasis on high service quality, through employing for instance modern vehicles, sophisticated control systems, and user-friendly designs. These key characteristics alone suggest that BRT offers a number of potential benefits in terms of poverty reduction:

1. By reducing passengers' travel times and travel costs, their livelihoods may be enhanced by effectively improving their retained income.
2. To the extent that BRT networks are designed to be well integrated with a wider coverage (as compared to uncoordinated unimodal routes), access may be provided to a greater range of opportunities than what was available before, thus enhancing options for finding work or reaching other activities, especially to previously underserved parts of the population such as people with disabilities and children.
3. Indirect benefits might accrue to passengers and non-passengers alike, including enhanced safety or environmental benefits.
4. Leveraging of the infrastructure investment programme to pursue more wide-scale urban regeneration and upliftment, for instance through upgrading of roads and intersections and the provision of cycle ways parallel to bus lanes, and upgrading of station precincts via redevelopment and landscaping. To the extent that such efforts enhance community cohesion, quality of life, and property values, secondary poverty alleviation and development benefits might ensue.
5. Employment benefits might accrue to workers within the transport industry, depending on the extent to which BRT replaces existing public transport services, and re-employs low-wage workers at better pay scales or under better working conditions.

The small number of studies that have looked at poverty impacts and BRT in Latin America have tended to confirm these impacts to varying degrees (e.g. Rodriguez and Targa, 2004; Gilbert, 2008; Hidalgo and Yepes, 2005).

This study elected to focus on only the following key questions:

- Does Rea Vaya improve travel conditions (including access to transport, travel times, and travel costs) for all users?
- Do these benefits accrue specifically to lower-income or poor users?

- Does Rea Vaya and its associated infrastructure affect the general perception of residents with respect to the urban environment?

We thus exclude considerations of indirect (safety and environmental), traffic (e.g. reduced congestion), macro-economic, or labour benefits or disbenefits<sup>2</sup>.

### 3. STUDY AREA AND DATA

At the time of the study (early 2011) Johannesburg's Rea Vaya operated a 26 km long dedicated trunk line with 27 median stations, stretching between the CBD and Thokoza Park in Soweto. Several feeder routes and complementary services stretch from the trunk route into neighbourhoods, providing additional connectivity for users elsewhere beyond the immediate catchment area of the stations. The residential area of Orlando, located in the eastern half of Soweto, was chosen as the case study area. Orlando is bisected by the BRT trunk line, with three trunk stations (Orlando Stadium Station, Orlando Police Station, and Boomtown Station) located within it. Residents also have access to existing bus, taxi, and train services. Housing consists of a mix of formal self-built, RDP (subsidised), and backyard dwellings, and informal shacks. Although Orlando is atypical of South African townships in terms of its relatively good access to a variety of public transport services, it provides a useful analysis site as it includes households across the range of socio-economic strata and incomes.

Data was collected by means of a face-to-face household survey, conducted between December 2010 and April 2011. Sampling was based on a stratified random sample of dwellings in the selected study area, to cover households located at varying distances from the trunk line (see Figure 1). A total sample size of 150 households was obtained. The survey questionnaire collected data on household composition and demographics, housing, transport and travel patterns, and perceptions and satisfaction.

Comparison of the sample with Census data for Orlando showed that the sample was representative of the general population, except that it captured a higher proportion of working persons than the general population in Orlando (46% vs. 36%), which will skew the trip data slightly towards working trips, and the sample towards the higher-income end of the scale. The median income is between R2500 and R8000 per household.

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<sup>2</sup> For a description and assessment of the impacts of Rea Vaya on local minibus-taxi operators, some of whom were displaced by and became contracted operators of Rea Vaya, see McCaul and Ntuli (2011) and Venter (2011).

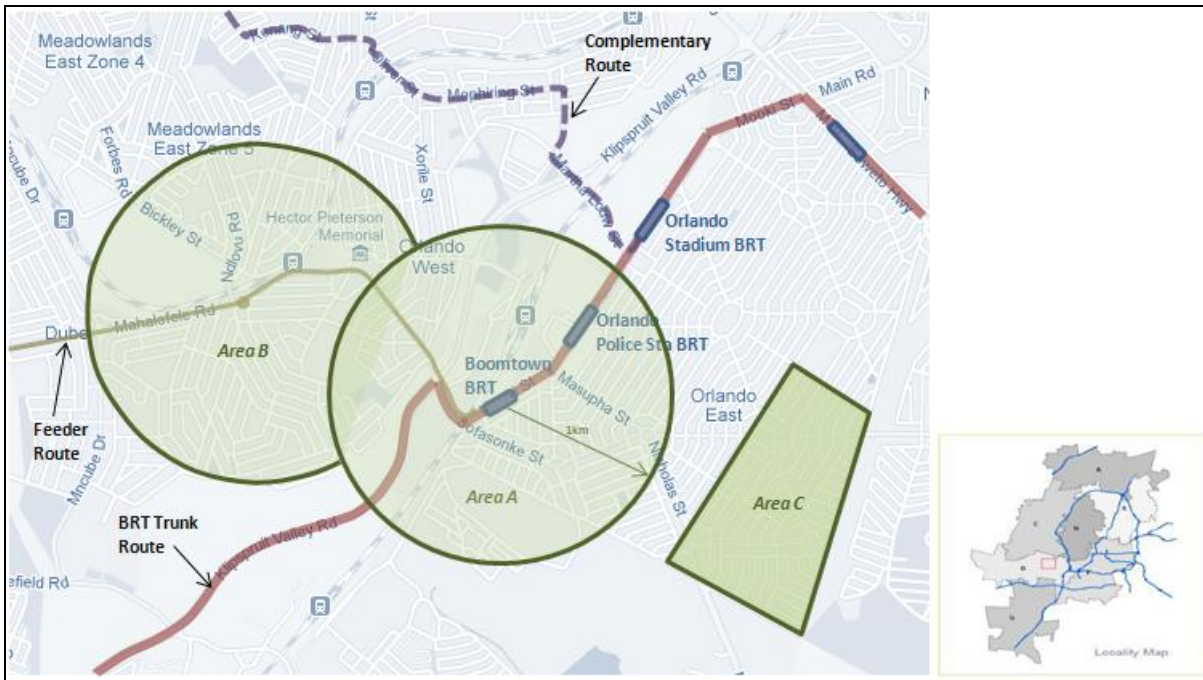
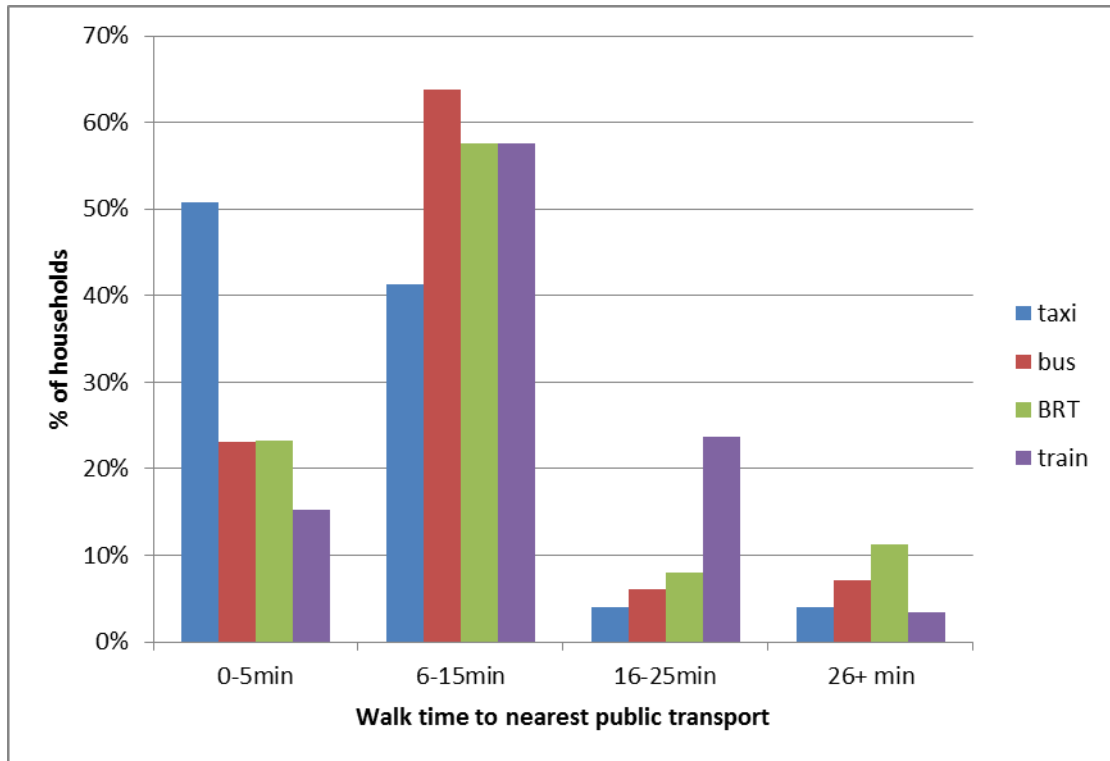


Figure 1: Case study areas and BRT routes in Orlando, Soweto

## 4. RESULTS

### 4.1 Access to public transport

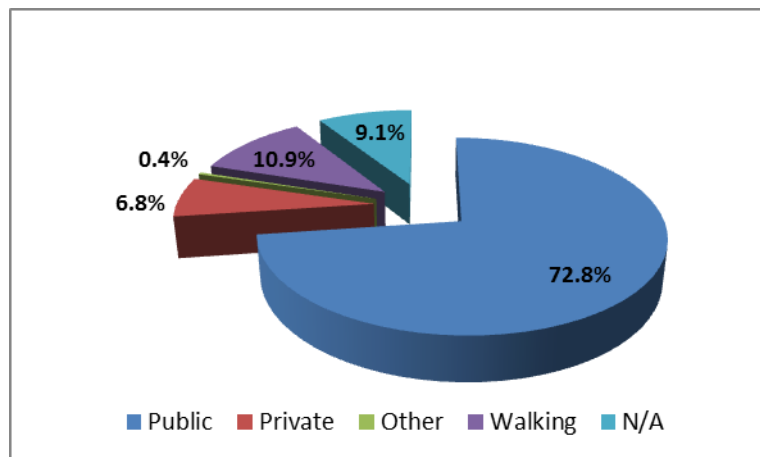
Respondents were asked to estimate the walking time to the nearest public transport (including the nearest train, bus, BRT, and taxi), as an indication of the general accessibility to public transport. Figure 2 indicates that taxis are widely accessible within a 5-minute walk from the home. The BRT has a similar accessibility as the regular bus (Metrobus and Putco) mode, with the majority of households located within a 15 minute walk from either a BRT station or a feeder route. Given the already high levels of public transport access in the area, it is clear that Rea Vaya does not in general provide any better accessibility within the neighbourhood than existing public transport services. This is to be expected, as BRT routes by design follow major arterials which are also typically used by existing taxi and bus routes.



**Figure 2: Household Access to Public Transport**

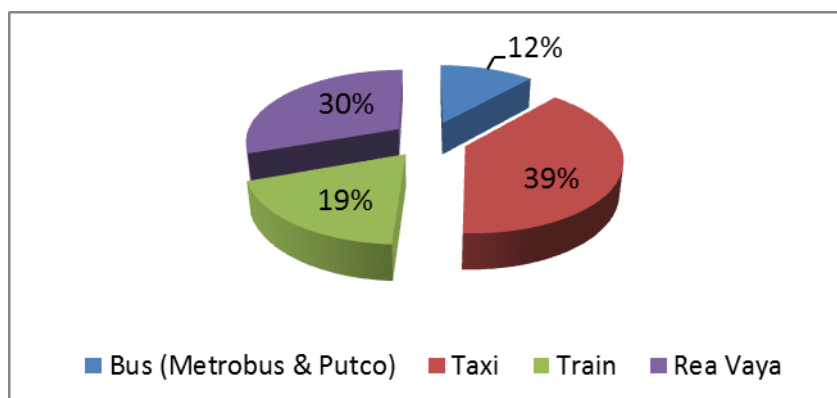
#### 4.2 Extent of Bus Rapid Transit Usage

The popularity of the BRT (versus other modes) is important as it indicates the extent to which it fulfils a need amongst would-be travellers and provides an attractive alternative to existing modes. The modal split for work-related trips is shown in Figure 3. Most workers use some sort of public transport to travel to work, while less than 7 percent use private vehicles and about 11 percent walk.



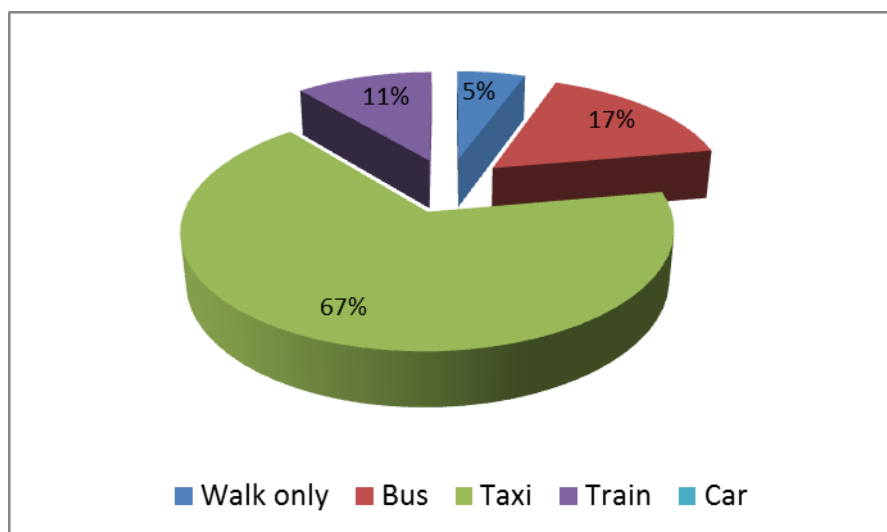
**Figure 3: Mode of Travel to Work**

Amongst public transport trips to work, the Rea Vaya commands a respectable 30% of trips, making it the second most used mode after the taxi (Figure 4). (Note that these trips include multi-mode trips, where only the mode that is used for the longest part of the journey is counted).



**Figure 4: Public Transport Modes to Travel to Work**

Which modes did Rea Vaya users use before? The survey responses indicated that about two-thirds of Rea Vaya commuters from Orlando were previously on the taxi, and small numbers also on other buses and the Metrorail train (Figure 5). This indicates that BRT is competitive with the minibus taxi, as indeed it is designed to be (note that the Phase 1A BRT trunk routes replaced about 580 minibus-taxi vehicles from the Soweto-CBD corridor). But it also seems to offer an attractive alternative to some other public transport users and even some who walked to their destinations before. Significantly, no Rea Vaya users switched from travelling by car to using the BRT.



**Figure 5: Previous mode to work used by current Rea Vaya commuters**

In order to assess the extent to which Rea Vaya enhances access to work located in specific areas, the mode shares for various groups of work destinations in the sample are tabulated in Table 1. Destination areas located close to the BRT trunk line – including the Johannesburg CBD, and the industrial areas just to the south of the CBD – attract the highest BRT usage, and thus benefit the most in terms of enhanced access from Soweto. These areas are however traditionally well-served by other modes of public transport; they are located close to rail lines or bus routes from Soweto. The marginal increase in accessibility to these areas provided by the BRT is likely limited.

It is however significant that the BRT carries a relatively high share (36%) of trips made to work places within Orlando or other parts of Soweto. This is somewhat surprising, given the fact that BRT is typically described more as a way of enhancing longer-distance connectivity within an urban area – as indicated by the flat fare pricing, as well as the provision of an exclusive busway between Soweto and the CBD, which generates travel time benefits especially for longer trips. It appears that BRT might have a role as a local mobility mode within former township areas that might be very beneficial for the future integration and economic development of these areas. Key to this is the fact that Rea Vaya trunk service is priced competitively with the taxi even for short-distance local trips.

There is also some evidence that, for more remote destinations such as Rosebank, Sandton, and Midrand, Rea Vaya seems to be used sometimes as a part of a multiple-trip journey – commuters take the BRT to the CBD where they transfer to another bus or taxi for the rest of the trip. This suggests that, even with a spatially limited starter network, BRT can provide accessibility enhancements to destinations much further afield.

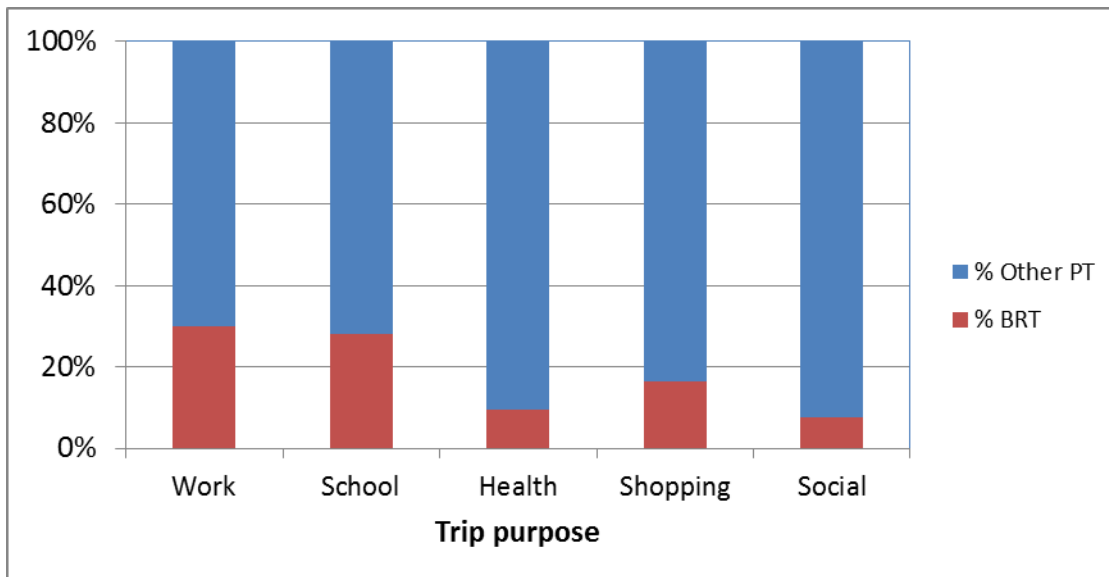
Did Rea Vaya lead to an increase in employment? This question cannot be answered with the current sample, as it requires both a control group and a before-after experimental design. However, during the interview process some anecdotal evidence emerged that some respondents had used Rea Vaya when looking for work, especially casual jobs. It is likely that, in the long run, Rea Vaya could play a role in getting more people to work.

**Table 1: Mode use to major work destinations**

Destination	Number of work trips made per mode							
	Walk only	Bus	Taxi	Train	Car	BRT	BRT + other PT	BRT share
Johannesburg CBD	2	6	24	18	7	17	2	25%
Industry South of CBD (Booyens, Turffontein)	0	1	4	0	2	3	1	36%
Soweto	10	1	4	0	1	5	4	36%
Northern Suburbs (Rosebank to Midrand)	1	6	14	3	3	1	4	16%
Inner West (Industria to Florida)	0	1	2	3	1	0	1	13%
Other outlying (East Rand, West Rand, far South)	0	0	2	0	1	1	0	25%

It is important not to focus on work trips only, but to assess the extent to which BRT enhances access to non-work destinations. Given the fact that public transport in South Africa traditionally tends to prioritise work access, mobility options to other livelihoods activities such as shopping and leisure are typically more constrained. Figure 6 plots the share of trips for school/college, health, shopping, and leisure/visiting taken on Rea Vaya, as a percentage of all public transport trips. While the mode share for Rea Vaya is highest for work trips (as can be expected given its route orientation towards the CBD), not insignificant numbers of trips for education (28%) and shopping purposes (16%) are also

made on the BRT. Neither health trips (typically made to local clinics) nor social trips (typically made to destinations outside the city) make significant use of the BRT. The overall implication, however, is that BRT has become more than a dormitory township-style home-to-work transport service – and thus succeeds in moving away from the traditionally more restricted role of public transport as a labour service. It serves a more varied transport demand, and thus contributes towards achieving a wider set of livelihood objectives.



**Figure 6: BRT mode share of public transport trips for various trip purposes**

#### 4.3 Travel time benefits of BRT

Work trip data from the surveys were used to compare the door-to-door travel time between BRT trips and trips by other public transport modes. Figure 7 shows the results. Many Rea Vaya users clearly have shorter travel times than users of other modes. The spike at 50 minutes corresponds to the travel time from Orlando to the Johannesburg CBD (including access time on both ends). Longer travel times are for trips that require transfers to other modes before reaching the destination, or for trips with longer walk components.

A difference in travel times between modes does not in itself indicate that BRT offers advantages to other modes: travel time differences could result simply from different destinations being served by different modes. To get a more accurate idea of whether the BRT offers travel time advantages to the same destinations, Rea Vaya users were asked to recall their travel time via the previous mode they used before switching to the BRT. The responses indicated that, on average, Rea Vaya users saved 13 minutes per one-way trip to work at the same destination. Some respondents had trouble answering this question (probably due to recall problems), so this figure is probably higher than the true value. On the other hand, the survey area is near the inner edge of Soweto; the travel time savings delivered to travellers from other parts of Soweto (who would benefit from the exclusive buslane for even longer distances) are likely higher than for this sample. So it seems very



likely that, on average, Rea Vaya does provide significant benefits to its users in terms of travel time savings of between 10% and 20%.

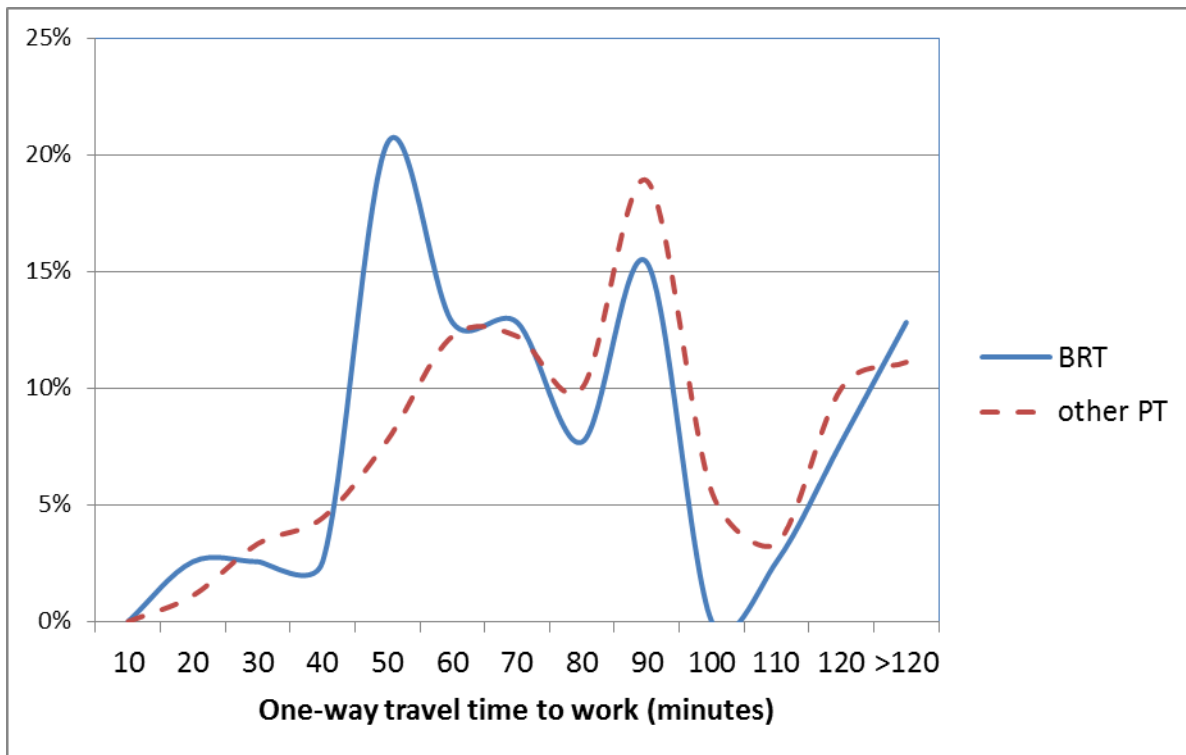


Figure 7: Door-to-door travel times for work trips by public transport

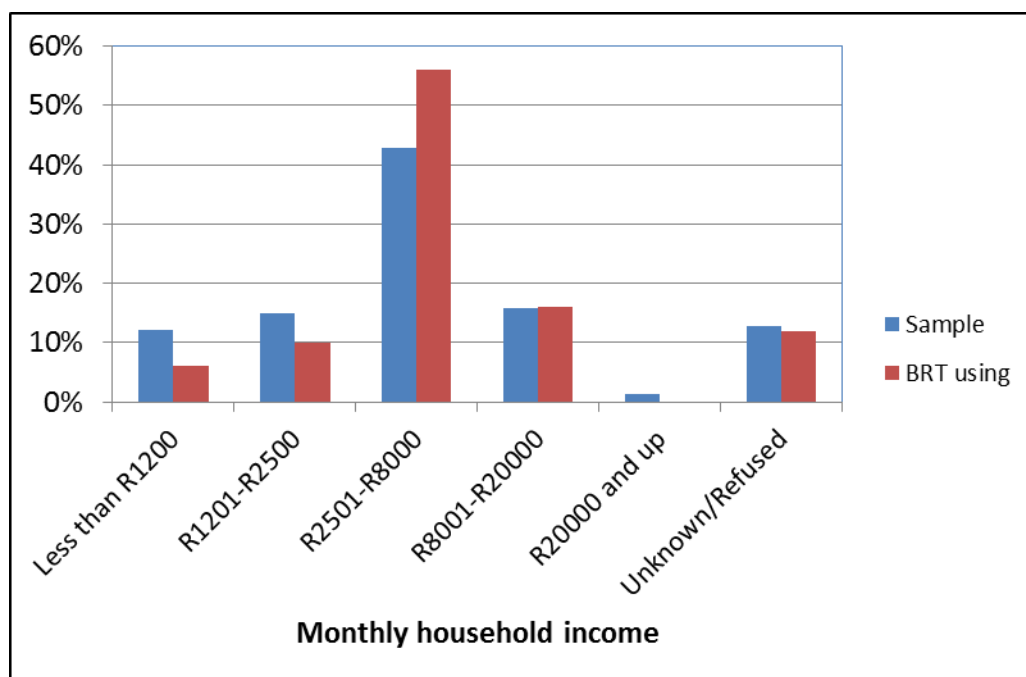
#### 4.4 Travel cost impacts of BRT

The average travel cost for Rea Vaya users comes to R10.20 per one-way trip to work, as compared to R11.70 for other modes. Once again, controlling for destination differences by comparing Rea Vaya costs to the cost of the previously used public transport mode, Rea Vaya is reported to be a modest 20 cents per one-way trip cheaper on average. This amounts to less than a 2% saving in fare, on average.

It appears that Rea Vaya users consist of two distinct sub-groups: those that save money by using Rea Vaya, and those that do not. About two-thirds of Rea Vaya users are in the first category; on average, they save R2.50 per trip, which is a significant 21% saving in travel cost. The remaining third of Rea Vaya users indicated that they pay more for their Rea Vaya trip than for the previously used mode. These might be non-price sensitive users (probably with higher incomes), who switch to Rea Vaya for reasons other than cost savings. It cannot be assumed that cost savings is a significant benefit to all Rea Vaya users.

#### 4.5 Benefits to lower-income residents

The above result suggests that Rea Vaya could benefit lower income passengers by offering a more affordable travel option, thus effectively improving their retained income. But do low income passengers actually choose to use the BRT? Figure 8 plots the income



**Figure 8: Income distribution of households using BRT and all households**

distribution of the entire sample and of Rea Vaya users only. Clearly some people with low incomes do use the BRT and potentially realise travel cost savings. But persons living in households earning less than R2500 per month are under-represented on Rea Vaya. By far the majority of Rea Vaya users are in the mid-income range of R2500 to R8000 per month. The conclusion drawn from this is that Rea Vaya does not seem to attract lower-income persons as much as medium and higher-income passengers.

One explanation that can account for this, is that lower-income persons are simply less mobile – including more unemployed or retired persons, for instance – and are therefore less likely to travel at all; they would thus be underrepresented on all transport modes. To test for this, the above calculation was repeated but only for mobile households – households with either workers or scholars using public transport on a daily basis. The results were substantially the same: even among mobile households, Rea Vaya is relatively less popular among lower income groups.

This is broadly in line with similar results found in other BRT systems, such as Bogotá's TransMilenio (Hidalgo and Yepes, 2005) on which Rea Vaya is largely modelled. In TransMilenio's case the explanation is that the route network (at the time) was mostly oriented towards medium-income neighbourhoods, making it less accessible to lower income people. This argument might indeed apply to Rea Vaya (given that its current (limited) network does not (yet) serve Johannesburg's many informal settlements); but it

cannot explain the results stated above, as we are only considering households in one origin area with largely similar access to the BRT.

A remaining explanation is that lower-income passengers prefer to use another mode for reasons of affordability. This is plausible, as Rea Vaya fares are higher than those of the rail (when using a weekly or monthly pass), and it is known that rail is used by many low-income commuters. Rea Vaya serves many of the same destinations as the rail, but seems to offer a faster service with a higher service quality, but at a slightly higher price – a price which is not attractive to many price-sensitive low-income passengers with cheaper alternatives.

#### 4.6 Impacts of BRT on community perceptions and satisfaction

The perception questions aimed at determining levels of satisfaction among Orlando residents with the public transport services at their disposal, and with life in the neighbourhood in general. The majority of residents (between 50% and 70%) did feel that transport had improved for them over the preceding two years, showing that the Rea Vaya and the associated street upgrades – the major transport improvements that could give rise to such perceptions – did contribute to a positive perception in the community. These perceptions were strongest in area A (within 1km of the trunk line and stations), where all residents could benefit more directly from street improvements. However such positive perception is not necessarily associated with use of the Rea Vaya. A sense of improvement is more evident among Rea Vaya users in areas further away from the trunk line, than among Rea Vaya users closer to it. Rea Vaya users living closer to the trunk line did not perceive as much of an improvement, probably as they were already mobile and well-served. The incremental improvement is evidently most appreciated by people living further away, who were underserved in the past.

## 5. CONCLUSIONS

This study of the early impacts of Rea Vaya in Johannesburg – those that can be observed within the first two years of the start of operation – offers some empirical insights into the ways in which substantial public transport investment in South African cities can be used as a part of a strategy for long-term poverty reduction.

One set of potential advantages of Bus Rapid Transit relates to providing enhanced accessibility to livelihood opportunities – either through:

- putting public transport within closer reach of more people's homes; or
- through connecting people to a larger set of destinations; or
- through extending the range of destinations (especially non-work) that might be reached during different times of the day or week.

The results from Orlando indicate that BRT at present does not significantly enhance accessibility in terms of the first two aspects – either origin or destination accessibility – but that its major access benefit seems to lie in the greater range of activities served, especially during the off-peak and over weekends. These characteristics are there by

design: the first Rea Vaya routes follow the existing high-volume corridor between Soweto and the Johannesburg CBD, which is already well-served by minibus-taxi, bus and rail modes. In fact, this is likely to be the case for most BRT services in SA cities, as BRT by its nature requires relatively high passenger volumes to perform optimally, and is thus more likely to be placed along existing public transport corridors. There is no particular evidence that Rea Vaya directly enhances access to work opportunities.

However, in line with the vision of BRT as a basic mobility service (rather than just a dormitory township-style home-to-work service), BRT serves a varied transport demand, including school, shopping and leisure activities during peak and off-peak hours, and thus contributes towards achieving a wider set of livelihood objectives. The long-term implication is that BRT might be a valuable strategy in supporting the development of more mixed land uses within former township areas and along priority corridors, thus supporting the diversification and strengthening of local economies by knitting together areas that were formerly divided. In support of this, Rea Vaya seems to be an unexpectedly popular mode for travel within Soweto itself: it captured about a third of public transport trips to work places within Soweto. The planning and design of future BRT systems – including route selection, station placement, and fare policy – might do well to keep this possibility in mind, and avoid focusing on long-distance mobility only.

The notion of accessibility, and its value to low-income users, is also linked to the cost and time of travel, and it is here where BRT might be expected to offer more substantive benefits, due to its explicit emphases on speed, network connectivity, and a progressive fare policy.

The data indicates that, indeed, Rea Vaya seems to achieve these benefits, but not for all its users. On average, Rea Vaya saves users between 10% and 20% of their travel times, which is a significant benefit. Cost savings are not significant for all users: while about two-thirds of users pay less than they did before – saving about 20% on travel costs – about a third of users pay more. This indicates that the BRT market is stratified, with some portion of its users less sensitive to price, and perhaps more sensitive to other service quality aspects such as its speed or reliability. These are signs of a maturing public transport market; it might warrant the introduction of more differentiated services such as express routes, perhaps at higher fares.

To the extent that passengers can spend time and fare savings on other goods, Rea Vaya contributes to poverty reduction. However, it seems that the poor benefits less from these savings than might be supposed. In the case study area, which includes both lower and middle income households, Rea Vaya seems to be used disproportionately by middle-income users. The fact that it does not attract as many low-income users is probably due to one factor: Rea Vaya is priced higher than the cheapest available public transport alternative, the commuter rail, which remains the mode of choice for the poorest commuters. Overall, therefore, the direct benefits of Rea Vaya are skewed in favour of middle rather than lower income residents. Can this be expected to be a general characteristic of Bus Rapid Transit in South African cities? Clearly not: local specifics, such as the availability of other modes, pricing policy, and destinations served, would determine

its impacts on the poor. But it does caution against claims that BRT is *automatically* an effective vehicle for achieving poverty reduction goals.

In terms of more wide-ranging benefits of Rea Vaya on community perceptions and satisfaction, it seems to make a modest contribution to people's satisfaction with the area in general, satisfaction being driven more by other issues such as housing and employment. Significant, however, is the sense of local improvement that people seem to associate with the Rea Vaya – a majority of people feel that transport has improved for them in recent years, and this feeling is strongest among people who actually use the Rea Vaya. This implies that Rea Vaya, with its associated streetscape upgrading, is perceived as a positive intervention by the state in people's lives – a perception that might contribute to greater local pride and cohesion within the community, and leverage further social benefits in the future.

## ACKNOWLEDGMENTS

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