

Dar es Salaam Bus Rapid Transit (BRT): Enhancing Urban Benefits?

The implementation of the BRT in Dar es Salaam has reduced travel. Further efforts are being made to secure benefits for the poor and increase women's safety.

Dar es Salaam, the economic hub of Tanzania, has faced rapidly worsening traffic congestion, which threatened its economic growth prospects. In 2016, people's commute speed was 8.5 km per hour. In 2003 the Dar es Salaam City Council decided, as the core of its strategy to battle urban traffic congestion, to embark on the implementation of a city-wide BRT system. In May 2016 the first of six planned phases of the BRT started operations. So far, the BRT has improved urban mobility, but it has also increased costs of transportation. Analysis, coming soon, about the changes in income will show if comparative higher transport costs are compensated by access to more and better paid jobs.

Bus Rapid Transit (BRT) systems have been successfully introduced in many large cities in developing countries throughout Latin America and Asia and are also increasingly adopted in developed countries. The BRT dedicate unique lanes to a bus system that provide metro-like services. By incorporating the features of a metro system such as rapid boarding and dedicated right of way, BRT

systems can, for a fraction of the cost of a metro, transport almost the same number of people.

However, there is little knowledge about the true impacts of the BRT: Does it reduce travel times? Improve safety and security of commuters? Create jobs? Boost income? Encourage firm productivity, trade and growth? Improve property values? Increase the health, wealth and happiness of Dar residents? How do all these benefits reflect differently on the poor?

A joint effort between the Dar es Salaam Bus Rapid Transit (DART) agency, the Tanzania Social Action Fund (TASAF), the World Bank, and independent researchers from Stanford University, the London School of Economics, UC Berkeley and Massachusetts Institute of Technology addresses these questions. Additionally, the joint team is developing conditional cash transfers to vulnerable populations in Dar es Salaam to facilitate their access to the benefits promoted by the BRT. World Bank researchers are carrying out a simultaneous study that aims to improve women's safety and security while using public transport.

The Bus Rapid Transit in Dar es Salaam

By 2030, half of the population of Tanzania is expected to live in major or secondary cities. Currently, urban areas in the country lead economic growth and contribute to around half of GDP. Dar es Salaam (DSM), Tanzania's business capital, is one of the fastest growing cities in Africa, as well as the main economic hub of Tanzania. It also holds around 40% of the country's urban population. However,

rapid urbanization poses challenges to the city's efficiency –as population grows, pressure on transport demand increases the cost of access to jobs and urban services.

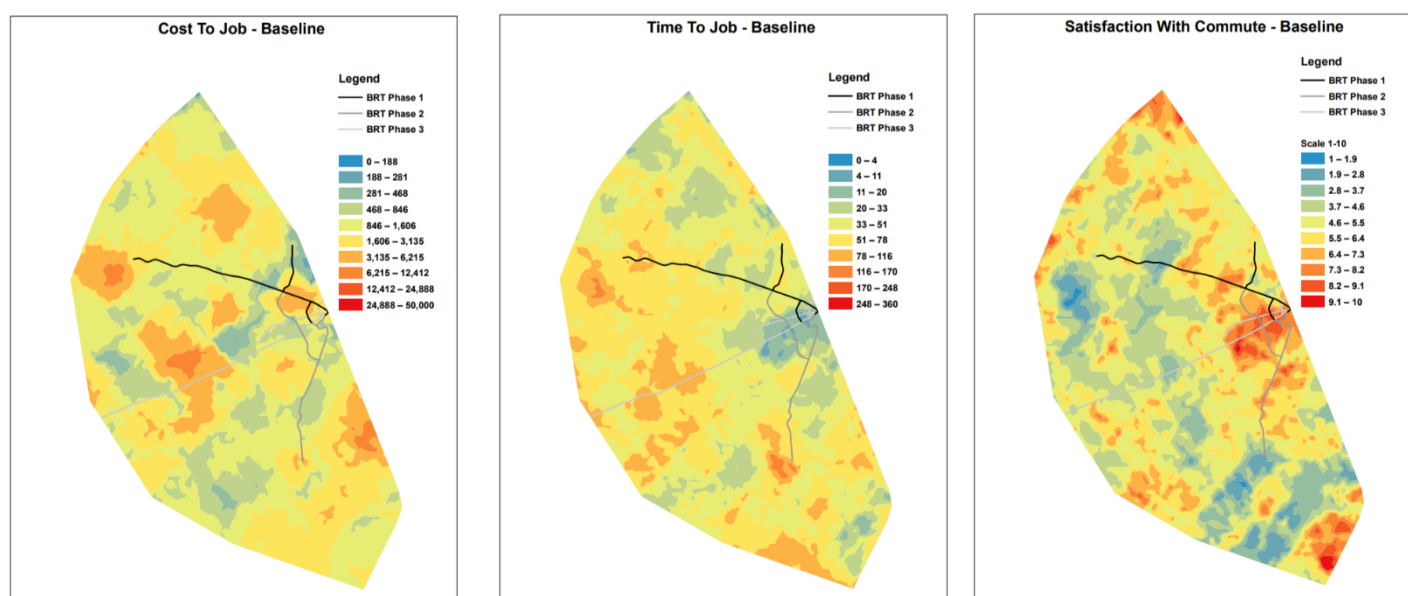
The onerous commute in DSM takes a significant toll in the lives of many of the capital's citizens, particularly the poor. Case studies conducted in

2008 at DSM's Ubungu bus terminal, prior to the introduction of the BRT, show that the average travel time for journeys of below 15km exceeds 90 minutes¹, a number much greater than that of other comparable urban areas in Africa. The time citizens waste in their daily commute not only directly affects productivity and labor market opportunities in the aggregate level, but is likely to widen inequality, given that the poor are more likely to suffer the most from such constraints.

In 2016, people in DSM traveled on average 7km to the location of their main economic activity,

spending around 49 minutes in transit and 1,889 Tanzanian shillings (est. USD 0.84) on a one-way trip. Time to job tend to increase with distance from the city center, hence, it is not a surprise that satisfaction with commute falls. There are pockets of high transport costs across the city. The figures below show the travel cost to work (below left) and travel time to main job (below center) throughout DSM in January 2016, prior to the implementation of the BRT. An overlay of the first three planned phases of the BRT is included, for reference.

Figure 1. Time to job increases with distance from the city center while satisfaction falls



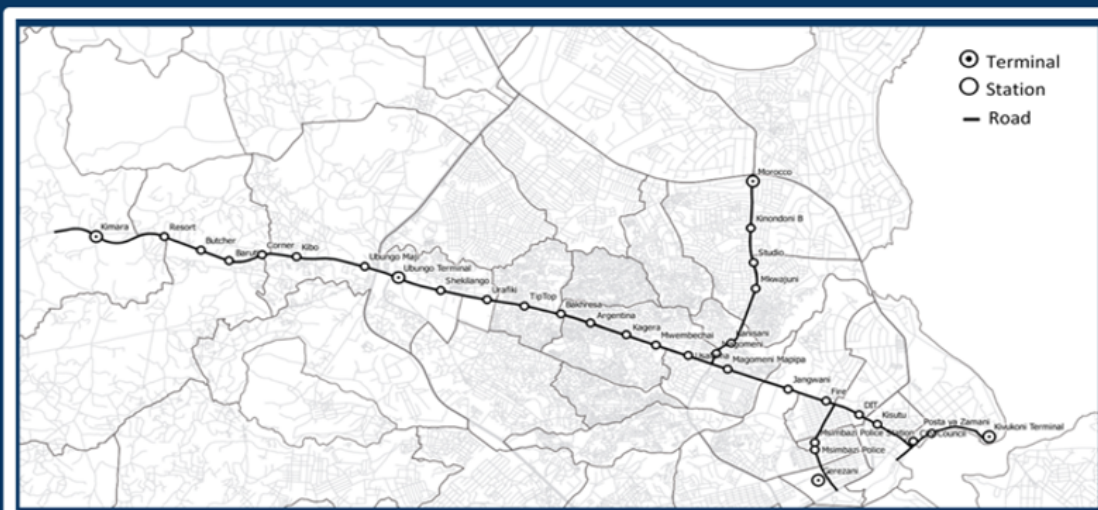
Additionally, satisfaction with public transport throughout the city was low. People were not satisfied with their transportation options. When asked what they liked and disliked about their residence location, 43% of respondents disliked the access to transport, while only 4% liked this feature.

Tanzania (GoT), decided to invest in a Bus Rapid Transit system (BRT) that aims at improving

the quality of public transportation and reduce the long commute in the city. The total BRT system comprises six phases, with a total of 140.1 km of BRT segregated corridors across the city. Phase 1 of the BRT was launched in May 2016, running along 27 stations and 5 terminals, connecting the Central Business District (CBD) with low and middle-income residential areas. Since initial implementation in 2016, ridership has quickly increased.

¹ Cited in the Second Central Transport Corridor Project's Appraisal Document (World Bank 2008)

DAR ES SALAAM BUS RAPID TRANSIT PHASE 1 PROFILE



INFRASTRUCTURE

20.9 Kms of Trunk Road

27 Stations

5 Terminals

1 Depot



OPERATIONS

140 Buses*

7 Routes

✓ Express Service

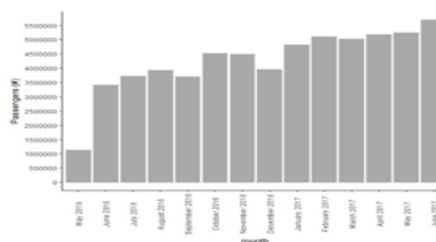


RIDERSHIP

165,000 Passengers per day**

650 TZS Fare - Trunk Service

✓ Paper Tickets

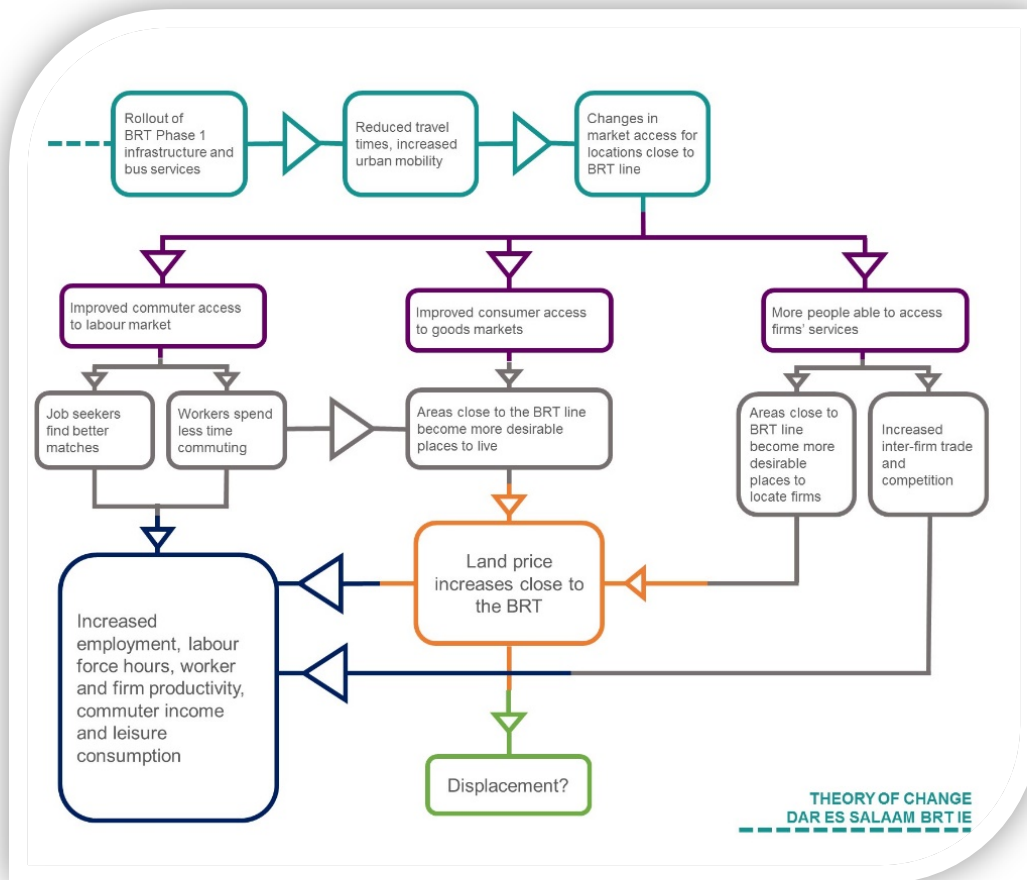


Evaluating the Impacts of the BRT

The DSM BRT is expected to reduce commuter travel times and urban congestion positively affecting a range of economic, social and

environmental indicators. The Theory of Change of the BRT in DSM is illustrated below.

Figure 2. The BRT is expected to have positive socioeconomic impacts



The BRT is expected to alter market access for certain locations in the city, meaning that:

- A location that is close to the BRT line will see improved access to the labor market. This is hypothesized to have two effects: job seekers will be able to find better matches - as they have access to more employers and because of shorter potential commute times - resulting in higher productivity.
- Consumers living in areas close to the BRT line will see an increase in access to goods markets, making the area a more desirable place to live, and reducing the time spent in daily chores.
- Firms located close to the BRT will have greater market access, because more people will be able to access their goods and services. This will lead to an increase in the number of firms in the area.

Overall, these three forces are expected to lead to an increase in land prices, transformation of land

As the project progresses towards Phase 2 implementation, the World Bank research team is assessing whether the BRT has caused changes in key outcomes of interest. More specifically, the goal is to understand whether the BRT has reduced travel times, improved safety and security of commuters, created jobs, boosted income, encouraged firm productivity, trade and growth, improved property values, and increased the health, wealth and happiness of Dar residents – especially the poor.

To evaluate the impacts of the first phase of the BRT, the World Bank researchers are using a spatial triple-differences methodology (difference-in-difference-in-differences). This means that they will be measuring outcomes and comparing the results:

- From places near (A^*) and far (B^*) from Phase 1 – (first difference)
- From places near (A') and far (B') from planned Phase 2 – (second difference)
- Before and after the implementation of BRT Phase 1 – (third difference)

The use of this approach enables them to confirm that changes detected were not caused by factors other than the BRT. For instance, if the BRT were constructed in high-growth neighborhoods, we would expect to see more jobs, higher income – but not caused by BRT. Similarly, if the BRT attracts low-income people to move closer, we would see drop in income – but not because BRT made people poorer.

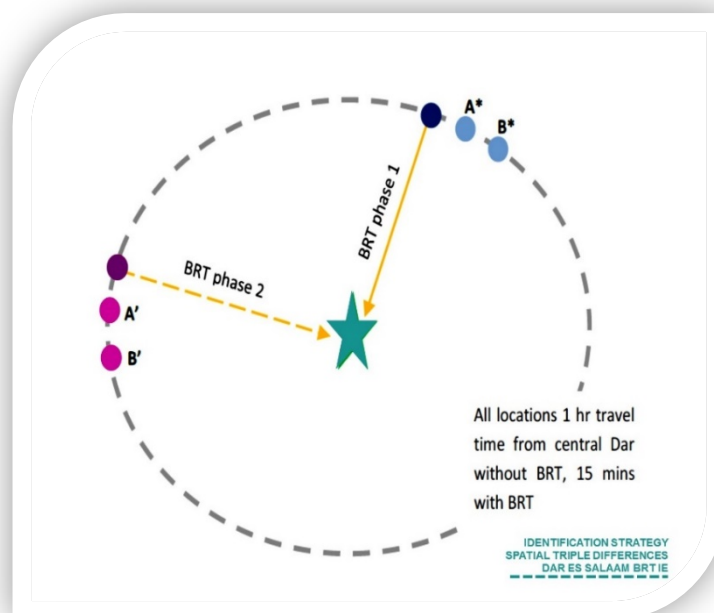
This approach also allows the researchers to create a comparison (“control”) group, by finding locations and individuals that look like those affected by BRT. The objective is to allow for

use, and changes in the socio-economic make-up of the population living in the area.

comparison of “treatment” and “control” groups, similar to a medical experiment.

The researchers have designed a dense geographical sampling strategy to ensure that the intended effects are captured. They defined their sampling strategy by taking 12 arcs with radii increasing at 1.5 km intervals out from the center of Dar es Salaam. Along each arc, they selected a series of clusters separated at equal intervals (blue dots in *Figure below*). This exercise produced a total of 141 clusters² across the city. In each of these clusters, they sampled 12-14 households.

Figure 3. Spatial triple-difference design



This type of sampling method ensures coverage inside and outside catchment areas of Phases 1-6 of the BRT. Therefore, the data collected can be used as a baseline for impact evaluations of the future phases of the BRT. Two rounds of surveys have been implemented, following 1749 households (January

² From the 141 GPS coordinates submitted, surveying could not be conducted at 16 because they were not residential (e.g. airports, ports) or were restricted military / police locations.

2016, October 2017). Mobile tracking surveys were implemented in the interim, to get high frequency data on key outcomes relating to employment.

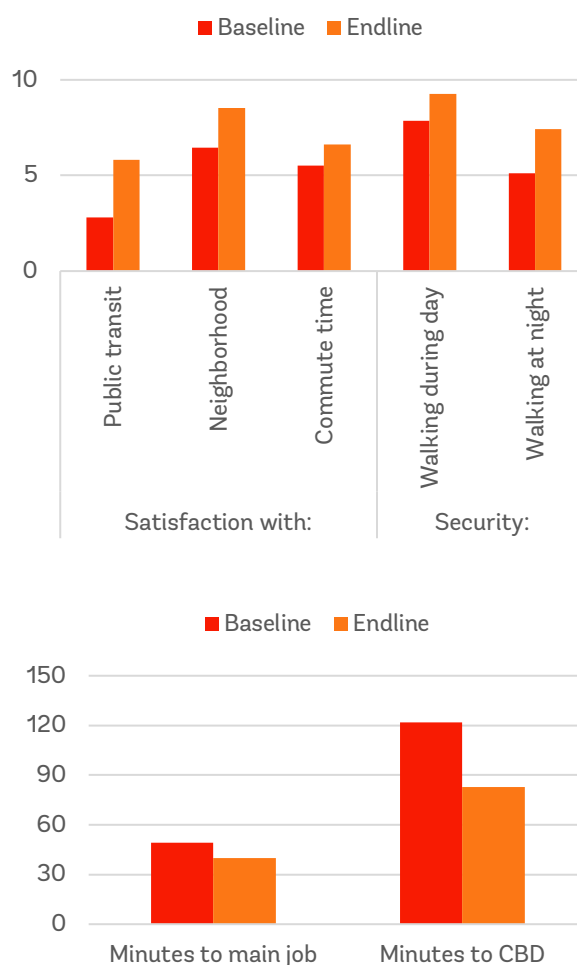
■ Preliminary Results

Today Dar es Salaam faces less congestion, improving connectivity between workers and employers, and households and markets. While employment characteristics show less change before and after the BRT Phase 1 began operations, there have been large reductions in travel time and satisfaction with transportation in general. Travel time from the residence to the main job decreased by about 10 minutes for people who work. The result holds for both people who changed and did not change residence between these two time periods. Benefits seem to have extended throughout the city since travel time to the city center decreased by about forty minutes, from 122 minutes in 2016 to 83 minutes in 2019. People are also more satisfied with public transit and security, and slightly more satisfied with travel times. Figure 4 shows mean values for 1,982 individuals we interviewed in both 2016 and 2019 and are living in the Dar es Salaam and Pwani region.

Nonetheless, improvements in commuting times cannot be uniquely attributed to the BRT. In the past years, Dar es Salaam has also invested in other transport infrastructure. For instance, in 2019 a higher share of households lives on a paved road compared to 2016. In addition, the BRT is not the

main mode of transport used by most Dar residents and modal change away from private transport has not occurred. While the main mode used for commuting by individuals living within 2 km of Phase 2 has not substantially changed between the baseline and endline, more than 10% of people living near Phase 1 are using BRT instead of daladala. There

Figure 4. Satisfaction with public transport has increased



has also been modal switch from daladala to bajaj and bodaboda in this area, both modes that add to congestion compared to vehicles with higher person-capacity such as buses.

Preliminary results suggest the BRT reduces travel time but has lower reductions in commute cost. Between 2016 and 2019, the average commute for

respondents within 2 km of Phase 1 fell 16.5 percentage points more than for respondents near Phase 2. On the other hand, the cost decreased 15.7 percentage points less. Further analysis shows the extent to which these changes can be attributed to

the BRT and if comparatively higher transport costs are compensated by access to more and better paid jobs.

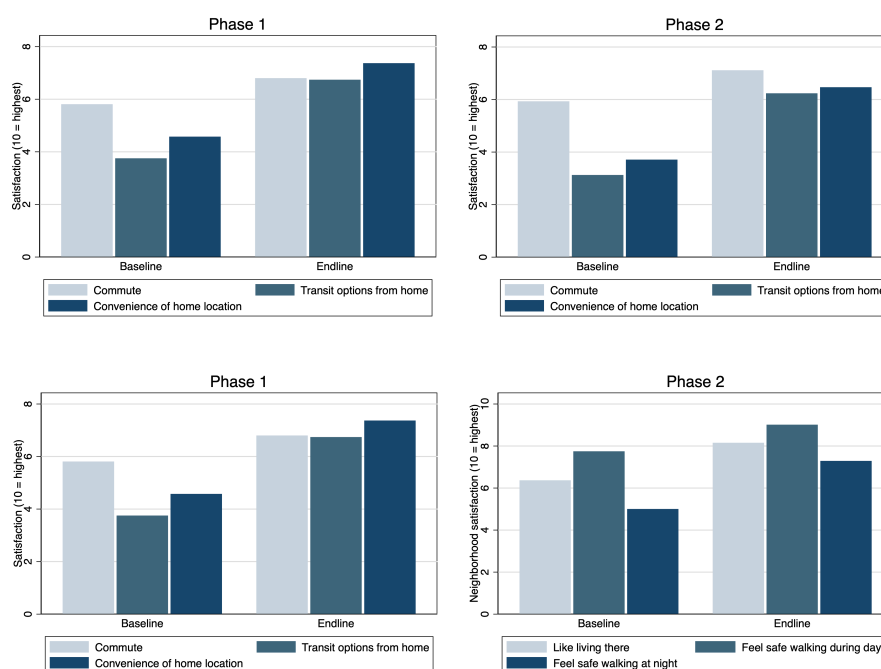
Table 1. Commute cost and time to work for people living near BRT Phase 1 and 2

	BL	EL	EL - BL	(EL-BL)/BL (%)
Cost to main job (Tsh.)				
Near Phase1	1,578	1,168	-410	-26
Near Phase2	1,354	790	-564	-42
Phase 1 - Phase 2			154	16 p.p.
Time to main job (min)				
Near Phase1	45	29	-16	-36
Near Phase2	42	34	-8	-19
Phase 1 - Phase 2			-8	-17 p.p.

People living closer to Phase 1 does not seem to be more satisfied with commuting than people living closer to Phase 2. There are no differences in the changes in satisfaction with the location of the residence, transport options and commuting time between the baseline and endline, and people living

near BRT Phase 1 and Phase 2. The two groups reported to be more satisfied with their location and commuting in 2019 than they did in 2016, nonetheless, people living closer to Phase 1 are noticeably happier with their transit options from home.

Figure 5. Satisfaction with commuting and neighborhood amenities



As the system extends to other parts of the city, it will benefit a larger share of the population. BRT Phase 1 is already frequently used by a large share of the population: 70% has used it at least once, 21% use it multiple times per week and 46% a few times per month. As expected, people living closer to the BRT are more likely to have used the BRT at least once: in the map below colors get warmer as they approach BRT Phase 1. BRT frequent users are also similar to other commuters in terms of income and age but are more likely to be employed and to be a man (Table 2). On average, people feel safer regarding the condition of the vehicle in the BRT than in a daladala, however, they do not feel safer regarding other passengers or while waiting to board this vehicle.

Figure 6. People living closer to the BRT are more likely to use it

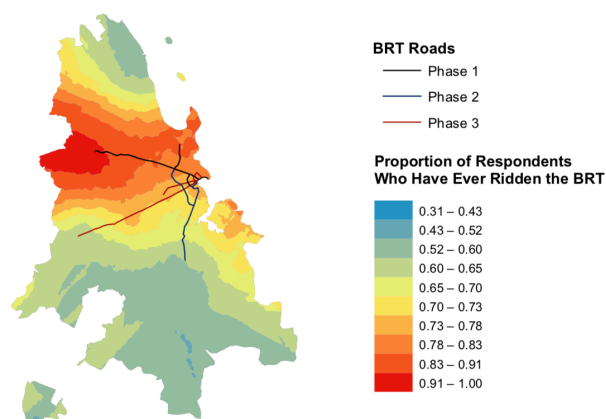


Table 2. Characteristics of frequent BRT users

	All respondent	Frequent BRT user
Median age	39	39
Female	52%	48%
Employed in the last 7 days	43%	51%
Median monthly income	TZS 300,000	TZS 300,000

The high costs of using and residing near the BRT have direct implications for the design of transport safety nets. Enabling the urban poor to benefit from the economic opportunities offered by the BRT requires targeted incentives to offset these costs. The World Bank, together with local stakeholders³ agreed that this could be achieved through conditional cash transfer (CCT) programs designed to encourage the urban poor to relocate

near the BRT and use the improved transport system to search for jobs and other economic opportunities. CCTs were considered preferable to traditional subsidy programs because they offer far better targeting while leaving in place market incentives for service providers, thereby reducing distortions and helping maintain the quality of service provision.

Next Steps

Three additional components of the BRT project are currently in the design and piloting phase and are expected to be rolled out in 2020. The GoT and the

World Bank have partnered with the Dar es Salaam Rapid Transit Agency (DART) and Tanzania Social Action Fund (TASAF) to test two of these

³ In discussions with the Country Management Unit of the World Bank (CMU), Dar es Salaam Rapid Transit Agency (DART), and Tanzania Social Action Fund (TASAF)

components, which are aimed at improving access to transport through using CCTs⁴ to offset fare and rents:

- **Fare CCT (FCCT):** aims at offsetting the cost of BRT fare for those unable to afford it. Poor commuters identified and enrolled into the FCCT program will receive a uniquely identified smartcard for the BRT. The smartcard will cover the cost of riding the BRT twice a day during the 22-day work month.
- **Location CCT (LCCT):** aims at offsetting the cost of living for those unable to afford living near BRT. Poor households at risk of being unable to afford living near the BRT will be offered a temporary cash transfer if they choose to reside near a BRT station. Poor households currently residing far from the BRT will be offered the same cash transfer, along with an up-front payment to offset moving costs, if they choose to relocate to a neighborhood within the BRT Phase 1 catchment area. This short-term transfer is intended to help the urban poor cover search costs while looking for a job and will be offered for a maximum of 8 months. The condition (living near the BRT) will be enforced through spot-

checks, phone calls, and monitoring. The World Bank research team is currently rolling out a pilot of this program to better understand the logistical challenges of this LCCT.

DART, TANROADS and TASAF will have overall ownership of these two components, and the project will be financed under the Dar Urban Transport Improvement Project (DUTP). The World Bank will provide technical support in the design, implementation and monitoring of the programs. In targeting the beneficiaries of these CCTs, priority will be given to commuters from TASAF beneficiary households. Researchers will conduct an impact evaluation through randomized controlled trials, in which households offered the CCT will be compared with households that received Unconditional Cash Transfers (UCT) and with a control sample. Findings will feed into design of future BRT phases and TASAF activities.

The third additional component of the BRT aims at improving women's safety and security in public transport, by understanding and addressing Gender-Based Violence (GBV) in public transportation. Under this initiative, World Bank researchers will document the nature and extent of sexual harassment and GBV experienced by women in their daily commute and estimate BRT's impact on reducing GBV in women's daily commute.

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Tanzania Social Action Fund (TASAF)
Tanzania Commission for Science and Technology (COSTECH)
Innovations for Poverty Action (IPA)
Tanzania
Usafiri Dar Rapid Transit (UDART)

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⁴ The GoT is already implementing CCTs through TASAF (1.1m beneficiaries, 30,000+ in Dar)