

Scan to know paper details and author's profile

### Challenges of Pedestrian Safety Management Along Bus Rapid Transit (BRT) Corridor in Dar Es Salaam City

Wilfred Gordian Kazaura Ardhi University

#### ABSTRACT

Bus Rapid Transit (BRT) corridors is hardest hit of daily accidents to pedestrian in Dar es Salaam City. There are various measures taken by the government, transport agencies, safety enforcement agencies, Non-Governmental Organizations, Community Based Organizations to reduce traffic accidents at the time of entry and exit of bus stops, and crossing road sections and junctions. Among the applied measures include effective installation of traffic signs, promotion safety rules to school going children, disabled and special groups, and creating awareness to BRT users. The applied safety enforcement measures and traffic regulations have indicated relative decrease of accidents along BRT corridor; however, more effort is needed to change the community motives on safe walkability. On the other hand, corridor connectivity with feeder and access roads together with BRT bus stops requires systematic ways of managing movements and interactions. The potentiality of public transport services in Dar es Salaam has essentially indicating the necessity of safely management of pedestrian movements to reduce loss of life, damages, grievances, injuries and crashes along BRT corridor.

*Keywords:* pedestrian movement, safety management, brt corridor, accident.

Classification: FOR CODE: 880109

Language: English



LJP Copyright ID: 573333 Print ISSN: 2515-5784 Online ISSN: 2515-5792

London Journal of Research in Humanities and Social Sciences

#### Volume 21 | Issue 1 | Compilation 1.0



© 2021. Wilfred Gordian Kazaura. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncom-mercial 40 Unported License http://creativecommons.org/licenses/by-nc/40/), permitting all noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited.



### Challenges of Pedestrian Safety Management Along Bus Rapid Transit (BRT)Corridor in Dar Es Salaam City

Wilfred Gordian Kazaura

#### ABSTRACT

Bus Rapid Transit (BRT) corridors is hardest hit of daily accidents to pedestrian in Dar es Salaam City. There are various measures taken by the *government*, transport agencies, safety enforcement Non-Governmental agencies. Organizations, Community Based Organizations to reduce traffic accidents at the time of entry and exit of bus stops, and crossing road sections and junctions. Among the applied measures include effective installation of traffic signs, promotion safety rules to school going children, disabled and special groups, and creating awareness to BRT users. The applied safety enforcement measures and traffic regulations have indicated relative decrease of accidents along BRT corridor; however, more effort is needed to change the community motives on safe walkability. On the other hand, corridor connectivity with feeder and access roads together with BRT bus stops requires systematic ways of managing movements and interactions. The potentiality of public transport services in Dar es Salaam has essentially indicating the necessity of safely management of pedestrian movements to reduce loss of life, damages, grievances, injuries and crashes along BRT corridor.

*Keywords*: pedestrian movement, safety management, brt corridor, accident.

*Author:* Department of Urban and Regional Planning, School of Spatial Planning and Social Science, Ardhi University, Dar es Salaam, Tanzania.

#### I. INTRODUCTION

Bus Rapid Transit (BRT) is a high quality bus based transit system that delivers fast,

comfortable and affordable public transport service in Tanzania. The BRT system started its operation in Dar es salaam City in 2016. Phase one that covered two major corridors of Morogoro and Kawawa roads has been found to be an effective solution for urban public transport problems in the city. In 2019 the BRT systems have been expanded to cover all major roads in Dar es Salaam City, and BRT networks has been proposed as the public transport solutions in the Master Plans of all cities in Tanzania, including Mbeya City master plan approved in 2020, Arusha City Master Plan of 2018, Mwanza city master plan of 2017 and Dodoma Capita City approved in 2020 (BRT Corridor Development Strategy, 2017). BRT is reported as great achievement of the government of United Republic of Tanzania that struggled since 1980's to eliminate the transport problems in the city with slight success. For more than fifty years, residents of Dar-es-Salaam city faced public transport problems including delays to work due to congestions, unregulated and unreliable public transport during peak hours, high transport costs. More changes are observed in provision of dedicated bus lanes and iconic stations aligned to the centre of the road, off-board fare collection and regular time schedule operations (Chengula and Keneth, 2019).

Currently, BRT is operated by UDART (Usafiri Dar es Salaam Rapid Transit) under the surveillance of LATRA (Land Transport Regulatory Authority). The corridor is serviced by more than140 buses, providing express and local service from 0500 to 2300 hours. Geometrically, BRT lanes are centrally located enclosed with two lanes of dual carriageways and walkways in both sides. The enclosed lanes contain high flow of vehicles, motorcycles, tricycles and walkways with big volume of pedestrians. As presented Dar es Salaam City Public Transport Master Plan 2017, the Average Daily Traffic (ADT) of different sections in Morogoro is 15,099 in Fire -Magomeni road section and 19,183 in Ubungo -Kimara road section. In Kawawa road, the ADT is about 12,022 Magomeni – Mkwajuni road section and 9,714 in Mkwajuni - Morocco road section. Generally, the traffic volumes in the major roads in Dar es Salaam including Morogoro and Kawawa roads are dominated by private cars which covers about 37%, minibuses (29%), tracks 6%, motorcycles and tricycles which also covers about 28% (Kazaura and Burra, 2017). The mixed traffic flowing on both sided dual carriageways obstruct pedestrian which cross the road and reach BRT lanes. Pedestrians are not safe, and sometimes forces to cross, which result to the course of accidents.

The corridors consist of 5 terminals and 27 bus stops, that serve about 500,000-600,000 commuters per day. As indicated by Kazaura (2019), commuters are overflowing in the bus terminals and bus tops especially during morning peak hours between 0630 up to 0900 and evening peak hours between 1600 up to 1930. At peaks terminals and bus stops fails to accommodate all passengers which often causes queue in ticket offices and sometime result to scumbles during entering and exiting in the bus stops, and during boarding the bus. Seldom traffic police can help commuters to cross the roads, but in most cases, commuters especially disabled, women, children, and elders are suffering to cross the roads, secure tickets and board buses. The consequences result to frequent accidents, death, injury, permanent disability and loss of properties.

Safety management for pedestrian is very challenging worldwide, and more serious in developing countries especially the fast-growing cities. In BRT corridor, the road accidents reached 223 which is about 27.31 percent of the annual total road accidents in the City (Safety report, 2018). In most cases accidents take place at entering from the bus stops, exit from bus stops and during crossing the road section. Most of pedestrians are crashed by motorcycles, tricycles and private cars, and there are few accidents caused by passengers themselves.

The government of Tanzania has made a strong commitment to deal with road safety problems by developing National Road Safety Policy of 2009, Road Traffic Act of 2019 and Road Traffic Regulations of 2019. The legislations created the base for establishment of comprehensive road safety management frameworks that focuses on protecting pedestrians. However, the remedy from the current road safety management challenges should focus on changing community motives in adopting rules and legislation and enaction of modern and improved enforcement mechanisms. Awareness should be raised through training and education to the local community, vehicle inspectors, and post-collision assistance. Recommendations are provided as to what still remains to be done to reverse the current situation to help mitigate the number of accidents in BRT corridors.

#### II. LITERATURE REVIEW

In developing countries especially in Sub Saharan region there has been a rapid increase of road accidents reflecting the growth rates and use of motorized vehicles. It is noted by Zahabi et al, (2011) that few countries in this region have significantly reduced the number of roads accidents, but in fast growing cities including Dar es Salaam the number accidents are relatively increasing (Zhang et al, 2019). Our cities in Tanzania particularly Dar es Salaam are the hardest hit by the road accidents. The Surface and Marine Transport Authority (SUMATRA) reports and studies presented in Table 1 count drivers' behaviours that encompasses over speeding, careless driving and overtaking as the main cause of road accidents. It sums about 57.2% of total accidents in the city. Other reason such as factors include impatience, stress, human reckless, crossing road while drunk, using phones while driving or crossing roads, ignoring traffic signs especially during pedestrian crossing, driving while in stress, obstructing other drivers. Distracting activities while driving include texting, talking on the phone and drinking behind the wheel.

Challenges of Pedestrain Safety Management Along Bus Rapid Transit (BRT) Corridor in Dar Es Salaam City

Category	Causes of accidents	Percentage	Number
Driver's behaviour	Over speeding	25.1	1500
	Careless driving	20.1	1200
	Overtaking	12.0	720
Human factors	Crossing pedestrian	10.0	600
	Intoxication	5.0	300
	Inattention and negligence	4.4	265
Infrastructure condition	Bad road conditions	6.7	400
	Obstruction	0.7	40
Vehicle condition	Mechanical defect	14.0	840
	Uncontrolled cyclist	2.0	120
Total		100	5985

Lin et al, 2019).

Table 1: Causes of accidents in Dar es Salaam City

Traffic safety management is the term used to describe a wide range of technical practices undertaken to manage traffic across the road networks. It includes prioritization of nonmotorized movements by slowing down or stopping the vehicle to allow pedestrians, cyclists and animals to cross the road safely (Shankar, Prasad and Reddy, 2013). Among the applied traffic control devices are stop sign, yield sign, school zone devices, flashing signal, zebra crossing, speed limiters, humps and bumps. The installations and effective use of road signs and traffic signals decreases the probability of occurrences of accidents to pedestrian, cyclists and other road users (Lin et al, 2019 and Chimba et al,. 2014).

The geometrical design elements such as road width, land use type, the absence of designated bus stop facility, inadequate sight distance, average daily traffic and pedestrian volume, and pedestrian–vehicular interaction considerably affect pedestrian safety at the intersections (Kazazi et al., 2016). On the other hand, road width, land use type, inadequate sight distance, the absence of designated bus stop facilities significantly influences pedestrian safety at midblock road segments (Mukherjee & Mitra,

*Source: SUMATRA 2007* 2019). The design and implementation of effective actions and measures to encourage the use of sustainable travel modes in urban areas require the identification of factors that influence the decision to walk and cycle (Manyara, 2016 and

Pedestrian safety in BRT requires safe, accessible and comprehensive facilities prioritising the needs of pedestrians. The roadway may increase or reduce traffic risk for pedestrians through presence or absence of pedestrian facilities such as separated roadways, marked sidewalks and signalised crossings (WHO, 2013). The BRT roadways enhance safety and security for pedestrians normally consider location of bus stops, entry and exist of passengers and ticketing system. The evidence on the risks that pedestrians face in BRT service is the major challenge implicated by the geometrical alignment of rapid transit roadways and location of bus stops (Arroyo, et al., 2018). Roadways and bus stops which are centrally located are more dangerous to pedestrian compared to roadways sided located. The choices of design for transit roadways need to minimize risk for pedestrians and other road users (Stoker et al., 2015)

Challenges of Pedestrain Safety Management Along Bus Rapid Transit (BRT) Corridor in Dar Es Salaam City

Safety management in BRT roadway is mainly challenged by fast vehicle movement on sided roads, signalized and non-signalized intersection, use of signs at pedestrian cross-ways and severity of pedestrian injuries from collisions (Zahabi, et al, 2011). A major challenge facing transport transportation engineers planners, and pedestrian-safety advocates is the lack of detailed high-quality pedestrian-exposure data (Singh, 2017). Exposure is defined as the rate of contact with a potentially harmful agent or event (Raford and Ragland, 2004). Pedestrian exposure is therefore defined as the rate of pedestrian contact with potentially harmful situations involving moving vehicles especially in crossing an intersection. Pedestrian risk is defined as the probability that a pedestrian-vehicle collision will occur, based on the rate of exposure.

This report discusses approaches to addressing the need for better and more widely available pedestrian volume data in the state of California. While a variety of approaches could be used, this report focuses on the strategy of a statewide pedestrian volume database.

This database would meet a variety of data needs for different stakeholder groups. One of its principal purposes would be to allow safety professionals at the state and local levels to estimate pedestrian exposure to risk at specific sites.

Since exposure data is essentially equivalent to facility usage data, a pedestrian exposure data would be used for many purposes beyond risk analysis. Facility usage data might be used by municipalities to pinpoint new infrastructure needs, or to determine whether new infrastructure encourages more pedestrian activity. Facility usage data might also be used by advocacy groups as a means to promote new facility investments.

If the database includes information beyond pedestrian volumes, such as facility characteristics (e.g. the availability of sidewalks and intersection crossings) or planning variables (e.g. land uses and population densities), it may be used as a means to improve pedestrian demand modeling techniques or to investigate the relationship between pedestrian environmental quality and pedestrian demand. Furthermore, if facility funding data are included, the database may also be used as a means to track spending on pedestrian projects.

In short, there is a wide range of usage for a pedestrian volume database. In designing the database, it is important to maximize its utility to pedestrian stakeholder groups while recognizing the costs associated with increased complexity This report discusses approaches to addressing the need for better and more widely available pedestrian volume data in the state of California.

While a variety of approaches could be used, this report focuses on the strategy of a statewide pedestrian volume database.

This database would meet a variety of data needs for different stakeholder groups. One of its principal purposes would be to allow safety professionals at the state and local levels to estimate pedestrian exposure to risk at specific sites.

Since exposure data is essentially equivalent to facility usage data, a pedestrian exposure data would be used for many purposes beyond risk analysis. Facility usage data might be used by municipalities to pinpoint new infrastructure needs, or to determine whether new infrastructure encourages more pedestrian activity. Facility usage data might also be used by advocacy groups as a means to promote new facility investments.

If the database includes information beyond pedestrian volumes, such as facility characteristics availability of sidewalks (e.g. the and intersection crossings) or planning variables (e.g. land uses and population densities), it may be used as a means to improve pedestrian demand modeling techniques or to investigate the relationship between pedestrian environmental quality and pedestrian demand. Furthermore, if facility funding data are included, the database may also be used as a means to track spending on pedestrian projects.

Challenges of Pedestrain Safety Management Along Bus Rapid Transit (BRT) Corridor in Dar Es Salaam City

In short, there is a wide range of usage for a pedestrian volume database. In designing the database, it is important to maximize its utility to pedestrian stakeholder groups while recognizing the costs associated with increased complexity This report discusses approaches to addressing the need for better and more widely available pedestrian volume data in the state of California. While a variety of approaches could be used, this report focuses on the strategy of a statewide pedestrian volume database.

This database would meet a variety of data needs for different stakeholder groups. One of its principal purposes would be to allow safety professionals at the state and local levels to estimate pedestrian exposure to risk at specific sites.

Since exposure data is essentially equivalent to facility usage data, a pedestrian exposure data would be used for many purposes beyond risk analysis. Facility usage data might be used by municipalities to pinpoint new infrastructure determine whether needs, or to new infrastructure encourages more pedestrian activity. Facility usage data might also be used by advocacy groups as a means to promote new facility investments.

If the database includes information beyond pedestrian volumes, such as facility characteristics availability (e.g. the of sidewalks and intersection crossings) or planning variables (e.g. land uses and population densities), it may be used as a means to improve pedestrian demand modeling techniques or to investigate the relationship between pedestrian environmental quality and pedestrian demand. Furthermore, if facility funding data are included, the database may also be used as a means to track spending on pedestrian projects.

In short, there is a wide range of usage for a pedestrian volume database. In designing the database, it is important to maximize its utility to pedestrian stakeholder groups while recognizing the costs associated with increased complexity This report discusses approaches to addressing the need for better and more widely available

pedestrian volume data in the state of California. While a variety of approaches could be used, this report focuses on the strategy of a statewide pedestrian volume database.

This database would meet a variety of data needs for different stakeholder groups. One of its principal purposes would be to allow safety professionals at the state and local levels to estimate pedestrian exposure to risk at specific sites.

Since exposure data is essentially equivalent to facility usage data, a pedestrian exposure data would be used for many purposes beyond risk analysis. Facility usage data might be used by municipalities to pinpoint new infrastructure needs, or to determine whether new infrastructure encourages more pedestrian activity. Facility usage data might also be used by advocacy groups as a means to promote new facility investments.

If the database includes information beyond pedestrian volumes, such as facility characteristics (e.g. availability sidewalks and the of intersection crossings) or planning ariables (e.g. land uses and population densities), it may be used as a means to improve pedestrian demand modeling techniques or to investigate the relationship between pedestrian environmental quality and pedestrian demand. Furthermore, if facility funding data are included, the database may also be used as a means to track spending on pedestrian projects.

In short, there is a wide range of usage for a pedestrian volume database. In designing the database, it is important to maximize its utility to pedestrian stakeholder groups while recognizing the costs associated with increased complexity The BRT pedestrian data contain a variety of data needs for different stakeholder groups. This database allows safety professionals such as transport planners and engineers at local and regional levels to estimate pedestrian exposure to risk at specific sites. Pedestrian exposure data would be used for many purposes beyond risk analysis. Some of data might be used by transport planners at local government to pinpoint new infrastructure needs, or to determine whether new infrastructure encourages more pedestrian

Challenges of Pedestrain Safety Management Along Bus Rapid Transit (BRT) Corridor in Dar Es Salaam City

safety activities. The data might also be used by advocacy groups as a means to promote new transport investments. The database includes information about pedestrian volumes, road characteristics including the availability of sidewalks and intersection crossings, together with planning variables such land uses and population densities. It may be used as a means to improve pedestrian demand modelling techniques or to investigate the relationship between pedestrian infrastructure quality and pedestrian demand. In BRT designing, the exposure database is important to maximize its utility to pedestrian stakeholder groups while recognizing the costs associated with increased complexity (Zangooei, at el., 2013).

BRT system in Dar es Salaam have improved public transportation and the city have become more attractive from the citizens' point of view (Joseph at el, 2018). Safe movement of pedestrians in the urban environment is a key factor in sustaining the social and economic relationships which are essential to the quality of life and maintaining a healthy life. To enhance pedestrian safety in BRT, there is a need to improve the pedestrian facilities at signalized intersections, enforce the safety regulations and influence the community to adopt and use safety measure.

#### III. METHODOLOGY

The study was conducted in Dar es Salaam along BRT corridor. As indicated in Map 1, the corridor comprises three main roads such as Morogoro road (Kivukoni to Kimara), Kawawa road (Magomeni to Morocco) and Msimbazi road (Fire to Kariakoo). Three categories of data were collected in the study area; the first category include driver and passenger assessment on the major causes of accident in BRT corridor. The samples size of 120 questionnaire were applied to collect data in four BRT routes and face to face interview were applied to interview 20 drivers and 100 passengers. Second category is data collected to assess the user perception and understanding the importance and use of road safety facilities in BRT corridor. It was collected by interviews performed in four BRT bus stops such as

Kivukoni, Urafiki and Korogwe in Morogoro road corridor and Mkwajuni and Magomeni in Kawawa road corridor. To determine the sample size, a random sampling method was applied to avoid biases of respondents in the bus stop. The respondent population were total number of passengers on the bus stop per day. The sample size of 120 passengers per bus stop were used to determine the user perception and usability of safety facilities in BRT corridor. The limitations during the survey include permission to interview passengers, unavailability and unwillingness of interviewees, however, about ninety two percent (92%) were achieved.

Challenges of Pedestrain Safety Management Along Bus Rapid Transit (BRT) Corridor in Dar Es Salaam City



Source: Keneth & Chengula, 2018



Third category were data collected on the traffic accidents occurred in BRT corridor. This were obtained through official interviews to BRT staff, LATRA, traffic police and Ministry of Transportation officials. Also, desk and documentary reviews were performed to collect secondary data.

#### IV. FINDINGS AND DISCUSSION

# 4.1 Major causes of accidents along BRT corridor

The movement of pedestrian crossing to adjacent road ways to approach the BRT lanes and bus stations is the major cause of accidents the corridor. Table 2 present passengers and drivers' assessment from the case study. The passengers and drivers presented major six causes of accidents in BRT corridor. The caused were mainly classified into three major categories; first category are accidents caused by drivers failing to avails rules and regulations. These are accidents related to drivers failing to maintain vehicle speed prior BRT bus stops and drivers failing to stop immediately at the traffic signs or red lights. As indicated in Table 2, about 33.3% of interviewed drivers and passengers cited this category as the main causal factors of traffic accidents in the BRT corridor.

Challenges of Pedestrain Safety Management Along Bus Rapid Transit (BRT) Corridor in Dar Es Salaam City

Category	Causes of accidents	Percentages of accidents accumulation
Drivers avails to traffic rules and regulations	Drivers failing to maintain vehicle speed	33.3
	Drivers failing to stop immediately at BRT traffic signs	25.1
Pedestrian negligence and misunderstanding	Pedestrian crossing at red lights	12.5
	Crossing on unregulated places and avoid to use zebra crossing areas	16.5
Damages and breakdowns	Failing breaks	8.1
	Other mechanical imperfections	4.5
TOTAL		100

#### Table 2: Causes of accidents in BRT corridor

The second category is accident related to pedestrian negligence and misunderstanding. Drivers and passengers survey revealed that pedestrians tend to ignore traffic signs and regulations which results to accidents. In most cases accidents to pedestrians occur at crossing the red lights, forcing to cross on undesignated places and avoid to use zebra crossing areas. The remedy to this cause required effective enforcement of laws and regulations including fines. Most of pedestrian are so ignorant to road safety rules. On the other hand, despite of recognized initiatives and different programs implemented by the government to educated Dar es Salaam community in safe use of highways and railways, but also deliberate actions should be positioned to create awareness and education to the community and the whole society on adhering traffic rules and safe use of BRT transportation systems.

Another category is the accident related to damages and breakdowns of transport facilities. These include accidents that occasionally happens at the time a vehicle fails breaks, jam of stelling rods and other mechanical imperfections. The interviewed drivers argued 'since we are using the second-hand vehicles, motorcycles and tricycles imported from abroad, the regular vehicle inspections should be properly done to avoid accidents caused by the defects of transportation vessels in the City'. The large number of vehicle defects in BRT roadways are caused by the lack of regular services and vehicle inspections.

Source: Driver and passenger analysis, 2020

#### 4.2 Accumulation of accidents in BRT corridor

BRT corridor is affected by different accidents taking place in different locations; however, 99 percent of accidents take place at the bus stops. As indicated in Figure 1, the accidents have been decreased from 413 number of accidents in years 2016/2017 up to 169 number of accidents in years 2018/2019. Collisions between BRT buses and other vehicles were very critical in 2016/17 and normally took place in junctions. Most of drivers were not keen in respecting regulations of separate lane (BRT lane) especially on major and minor junctions. Motorcycles and tricycles are also causing accidents due to the fact that they neglect regulations. Most of motorcycle and tricycle drivers are violating traffic rules, refuse to stop at zebra crossing and sometime drive in BRT lanes.

Challenges of Pedestrain Safety Management Along Bus Rapid Transit (BRT) Corridor in Dar Es Salaam City



Source: DART, 2020

*Figure 1:* Accumulation of accidents in BRT corridor

The accidents to pedestrians were taking place during crossing BRT lanes along the bus stops. The most affected locations include Manzese, Tiptop, Msimbazi bus stops and Gerezani terminal. These are highly populated areas concentrated with commercial activities and characterized by higher rate of BRT passengers per day. As indicated in Figure 2, people are facing difficulties in crossing the roadways and BRT lane to enter the bus stop or to go out of the bus stop. Number of injured include school going children, women going to shopping and visiting relatives, and few men especially youth and elders. Drunker and disabled accidents not often counted in BRT corridor.



Figure 2: Manzese BRT bus stop Dar es Salaam City

Challenges of Pedestrain Safety Management Along Bus Rapid Transit (BRT) Corridor in Dar Es Salaam City

## 4.3 Pedestrian safety management challenges along BRT corridor

### 4.3.1 Low level of road safety education to pedestrian

It has been realized that road users in Dar es Salaam including BRT passengers have a little knowledge about road safety rules. About 35% of interviewed BRT passengers had only heard about safety and road signs through radios, televisions and relatives but they had never been given such education. 5% had heard and attended road safety in schools and through community-based education programs, and 60% of all respondents admitted that they had never heard nor attended safety education. This situation accumulates the violation of road safety rules and increases the chance of accidents to road users.

Additionally, the school going children which more susceptible to traffic accidents lack safety education programs. It is only four students out of twenty interviewed students declared to be taught road safety and traffic signs from their respective schools; yet, students are the main users of public transport including BRT in Dar es Salaam City.

### 4.3.2 Non-adherence to safety rules and BRT regulations

The study revealed that road users including drivers, motorcyclists together with pedestrians have low motives in adhering safety rules and regulations. The interviews conducted to enforcers of traffic safety rules including traffic police, LATRA and Ministry of Transport indicated that road users sometimes are not ready to follow road safety rules. For instance, drivers crossing red light and cause accidents, cyclists of motorcycles and tricycles using BRT lanes during peak hours to avoid traffic jam, and pedestrian crossing in undesignated areas, avoiding to wear helmets and being not ready to follow traffic regulations. Deliberate violation of safety rules has resulted to accumulation of accidents and endangering pedestrian movements in BRT.

### 4.3.3 Deprived enforcement of traffic rules to pedestrians

It is indicated in Traffic Rules and regulations that pedestrians should be protected by other users of road ways. In these notions, pedestrians are not sentenced to fines or jail in any cause of traffic accidents in Tanzania. In BRT corridor, about twelve accidents have caused by pedestrian crossing road in unregulated areas (areas without crossing marks), passing roads while red lights and so on. It has been reported that there were no police or legal actions taken to pedestrians, rather, drivers and owners of vehicles have been offended, and sometimes penalised instead. These situations make pedestrians to relax and sometimes to attack drivers on their courses of accidents.

#### 4.3.4 Centre location of BRT lanes and bus stops

The alarming aspect reported by passengers and road users is concerned with location of BRT lanes and bus stops. As reported earlier, the geometrical design located BRT lanes and bus stops at the centre, parallel with dual carriageways and outer walkways in both sides. About 70 percent of interviewed passengers declared not being safe during crossing the roads to enter or to go out of BRT bus stop. "We feel very much afraid and unsecured at the time of crossing more than three lanes both sides. It involves escaping vehicles, motorcycles, tricycles, bicycles and another road user. It is cumbersome and sometimes dangerous especially during peak hours"; one interviewee reported.

### 4.3.5 Absence of special consideration to children crossing the roads

School going children are among reported unsafe BRT users in Dar es Salaam City. The interviewed passengers reported that school children have to enter and go out or cross BRT roadways during morning and evening peak hours. During peaks hours traffic volume along this corridor is very high and roads are experiencing rough driving. The interviewee presented the concern of the society to responsible authorities in observing the necessity of safeguarding school going child to cross the BRT roadways. It was realized that

Challenges of Pedestrain Safety Management Along Bus Rapid Transit (BRT) Corridor in Dar Es Salaam City

school going child are too young to make the right decision in crossing road sections.

#### V. CONCLUSIONS

Bus Rapid Transit (BRT) is the mass and voluminous transit system that serve highly populated areas in the city. Most of BRT users are pedestrians which start trips by walking, ride BRT in between and reach their destinations by walking. Normally, people start journeys from home to BRT and reach workplaces, business areas, schools, markets and other locations by walking. The study verifies that most of BRT users are pedestrians. The safety management for pedestrian in BRT corridor is very challenging worldwide and more serious in developing countries especially the fast-growing cities. In Dar es Salaam specifically, the growth rates in terms of urban population and increasing number of vehicles which is not proportional compared to available transport infrastructures. Roadways are too much congested with vehicles, motorcycles, tricycles, business and other activities which limit urban mobility and safe movement. This situation endangers pedestrians and other road users, and requisite a proper safety management.

The observed challenging aspects is concerned with central alignment of BRT lanes and bus stops, pedestrians' attitudes and other road users to abide traffic rules and regulations, negligence and compromise to pedestrians at the time of violation of traffic rules. The location of BRT lane forces pedestrians to cross other lanes (roadways) adjacent to BRT during entering and exiting from the bus stops. During peak hours, traffic volume is very high and a big number of people are flowing to and from BRT. It is suggested to locate BRT lanes outside the road ways to minimize risks and accidents to pedestrians or BRT users. Also, awareness campaign and fines to pedestrians who violate traffic rules are suggested to be implemented to avoid negligence that cause more unnecessary accidents to road users. Additionally, special considerations in designs, operation and management are cordially needed to create safety environment for potential BRT users including school going children, elders and people with disabilities.

#### REFERENCES

- 1. Arroyo, R., Mars, L. and Ruiz, T., 2018. Perceptions of Pedestrian and Cyclist Environments, Travel Behaviours, and Social Networks. Journal of Traffic and Safety Sustainability, 10(9), p.3241.
- Chimba, D., Emaasit, D., Cherry, C.R. and Pannell, Z., 2014. Patterning demographic and socioeconomic characteristics affecting pedestrian and bicycle crash frequency. Journal of Accident Analysis & Prevention, 32(5), pp.651-658.
- 3. Joseph, L., Neven A., Martens K., Kweka, O., Wets, G and, Janssens, D. 2018. Activity Participation and Perceptions on Informal Public Transport and Bus Rapid Transit in Dar es Salaam City
- 4. Kazaura, W. 2019. Integrated GIS-Based System for Exploring Land Use Change on Transport Demand in Tanzania; The Case of Dar es Salaam City. Journal: Scientific Research Publishing; Current Urban Studies 2019,
- 5. Kazaura W, and Burra M, 2017. Land Use Change and Traffic Impact Analysis in Planned Urban Areas in Tanzania: The Case of Dar es Salaam City. Journal: Scientific Research Publishing; Current Urban Studies 2017, 5, 1-19
- 6. Kazazi, J., Winkler, S. and Vollrath, M., 2016. The influence of attention allocation and age on intersection accidents. Transportation research part F: traffic psychology and behaviour, 43, pp.1-14.
- 7. Lin, P.S., Guo, R., Białkowska-Jelińska, E., Kourtellis, A. and Zhang, Y., 2019. Development of countermeasures to effectively improve pedestrian safety in low- income areas. Journal of Traffic and Transportation Engineering (English Edition).
- Mukherjee, D. and Mitra, S., 2019. Impact of Road Infrastructure Land Use and Traffic Operational Characteristics on Pedestrian Fatality Risk: A Case Study of Kolkata, India. Transportation in Developing Economies, 5(2), p.6.
- 9. Manyara, C.G., 2016. Combating road traffic accidents in Kenya: A challenge for an

emerging economy. In Kenya After 50 (pp. 101-122). Palgrave Macmillan, New York.

- Raford, N. and Ragland, D., 2004. Space syntax: Innovative pedestrian volume modeling tool for pedestrian safety. Transportation Research Record, 1878(1), pp.66-74.
- 11. Shankar, K.R., Prasad, C.S.R.K. and Reddy, T.S., 2013. Evaluation of area traffic management measures using microscopic simulation model. Procedia-Social and Behavioral Sciences, 104, pp.815-824.
- 12. Singh, S.K., 2017. Road traffic accidents in India: issues and challenges. Journal of Transportation research, 25, pp.4708-4719.
- Stoker, P., Garfinkel-Castro, A., Khayesi, M., Odero, W., Mwangi, M.N., Peden, M. and Ewing, R., 2015. Pedestrian safety and the built environment: a review of the risk factors. Journal of Planning Literature, 30(4), pp.377-392.
- 14. United Republic of Tanzania, 2018. Safety report, Government Press.
- 15. United Republic of Tanzania, 2009. National Road Safety Policy. Nyota Publishers.
- 16. United Republic of Tanzania, 2019, Road Traffic Act. Government Press.
- 17. United Republic of Tanzania, 2019 Road Traffic Regulations. Government Press.
- 18. United Republic of Tanzania, 2007 Surface and Marine Transport Authority report. Nyota Publishers.
- 19. United Republic of Tanzania 2017. Dar es Salaam City Public Transport Master Plan, Government Press.
- 20. World Health Organization, 2015. Global Status Report on Road Safety 2015. Available at: http://www.who.int/violence\_injury\_ prevention/road\_safety\_status/2015/en/.
- 21. Zahabi, S.A.H., Strauss, J., Manaugh, K. and Miranda-Moreno, L.F., 2011. Estimating potential effect of speed limits, built environment, and other factors on severity of pedestrian and cyclist injuries in crashes. Transportation research record, 2247(1), pp.81-90.
- 22. Zhang, C., Chen, F. and Wei, Y., 2019. Evaluation of pedestrian crossing behaviour and safety at uncontrolled mid-block

crosswalks with different numbers of lanes in China. Accident Analysis & Prevention, 123, pp.263-273.

23. Zangooei Dovom, H., Shafahi, Y. and Zangooei Dovom, M., 2013. Fatal accident distribution by age, gender and head injury, and death probability at accident scene in Mashhad, Iran, 2006–2009. International journal of injury control and safety promotion, 20(2), pp.121-133

Challenges of Pedestrain Safety Management Along Bus Rapid Transit (BRT) Corridor in Dar Es Salaam City