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SUMATRA
For Competitive, Efficient, Quality and Safe Transport Services
Surface and Marine Transport Regulatory Authority
Mamlaka ya Udhibiti Usafiri wa Nchi Kavu na Majini

REPORT
ON
CAUSES, IMPACT AND MANAGEMENT OF ROAD TRAFFIC CONGESTION IN SELECTED TANZANIA CITIES: DAR ES SALAAM AND MWANZA

CONSULTANCY SERVICE
FOR
SUMATRA -TANZANIA

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LIST OF ABBREVIATIONS

AAT: Automobile Association of Tanzania

AFC: Automatic Fare Collection

AfDB: African Development Bank

BRT: Bus Rapid Transit

CBA: Cost Benefit Analysis

CBD: Central Business District

CCTV: Closed-Circuit Television

CNG: Compressed Natural Gas

CO_2: Carbon Dioxide

CREC: China Railway Engineering Corporation

DANIDA: Danish International Development Agency

DARCOBOA: Dar es Salaam Commuter Bus Owners Association

DART: Dar Rapid Trans Agency

DCC: Dar es Salaam City Council

DMDP: Dar es Salaam Metropolitan Development Project

DMT: Dar es Salaam Motor Transport Company

DMU: Diesel Multiple Units

D.R. Congo: Democratic Republic of Congo

DUTA: Dar es Salaam Urban Transport Authority

DVELA: Driver and Vehicle Examination and Licensing Agency

EMR: Environmental Management Regulations, 2007

EMP: Environmental Management Plan

ESRF: Economic and Social Research Foundation

EU: European Union

EWURA: Energy, Water and Utilities Regulatory Authority

FRS: Fire and Rescue Services

GHG:	Greenhouse Gases
Ha:	Hectare
HC:	Human Capital
HGV:	Heavy Goods Vehicles
HIV	Human Immunodeficiency Virus
IC:	Insurance Company
ICD:	Inland Containers Depot
ISP:	Interim Service Provider
ITDP:	Institute for Transportation and Development Policy
ITS:	Intelligent Transportation System
JICA:	Japanese International Cooperation Agency
JKNI:	Julius Kambarage Nyerere International Airport
KAMATA:	Kampuni ya Mabasi Tanzania
KBMSL:	Kenya Bus Service Management Limited
Km:	Kilometer
Km/h:	Kilometer/Hectare
LAMATA:	Lagos Metropolitan Area Transport Authority
LRT:	Light Railway Train
LRRT:	Light Rapid Railway Train
MC:	Motor Cycle
MCC:	Mwanza City Council
MFEA:	Ministry of Finance and Economic Affairs
MLHHSD:	Ministry of Lands, Housing and Human Settlements Development
MRALC:	Ministry of Regional Administration and Local Government
MRC:	Mauritius Research Council
MRT:	Mass Rapid Train
MSCL:	Marine Services Company Limited
MTIM:	Ministry of Trade, Industry and Marketing
MWADECO:	Mwanza Development Corporation

NBS: National Bureau of Statistics

NEMC: National Environmental Management Council

NEMP: National Environmental Management Policy, 1997

NHC: National Housing Corporation

NPV: Net Present Value

NRSP: National Road Safety Policy

NTP: National Transport Policy

NSGRP: National Strategy for Growth and Reduction of Poverty

OECD: Organization for Economic Co-operation and Development

PHPD: Passenger per Hour per Direction

P&R: Park and Ride

PMO-RALG: Prime Minister's Office - Regional Administration and Local Government

PO-MRALG: President's Office - Regional Administration and Local Government

PSV: Passenger Services Vehicle

PVoC: Pre-Shipment Verification of Conformity

RAHCO: Reli Assets Holding Company

R.I.I: Relative Importance Index

RSB: Road Safety Board

SCE: Singapore Co-operation Enterprise

SGR: Standard Gauge Railway

SUMATRA: Surface and Marine Transport Regulatory Authority

TAMESA: Tanzania Electrical Mechanical & Electronics Services Agency

TANROADS: Tanzania National Roads Agency

TAS: Tanzanian Shilling

TAZARA: Tanzania Zambia Railways

TB: Tuberculosis

TBS: Tanzania Bureau of Standards

TC: Tricycle

TIC: Tanzania Investment Centre

tCO_2:	Tonnes of Carbon Dioxide
TDM:	Travel Demand Management
TOA:	Tanzania Osaka Alumni
TOD:	Transit Oriented Development
TOR:	Terms of Reference
TPA:	Tanzania Ports Authority
TPF:	Tanzania Police Force
TRA:	Tanzania Revenue Authority
TRL:	Tanzania Railways Limited
TSCP:	Tanzania Strategic Cities Programme
TZS:	Tanzanian Standards
UDA:	Usafiri Dar es Salaam
UDA-RT:	Usafiri Dar es Salaam Rapid Transit
USD:	United States Dollar
VOT:	Value of the time
VPO:	Vice President's Office
WTP:	Willingness to Pay

EXECUTIVE SUMMARY

E1. BACKGROUND

The present consultancy study was contracted by SUMATRA to M/s Disnney International Consultancy and conducted in accordance with terms of reference (TOR) provided by the former. The broader objective of the study was to establish the causes, impacts and cost of road traffic congestion in Tanzania's two fastest growing cities of Dar es Salaam and Mwanza with a view of proposing strategies for mitigating this increasing problem.

E2. METHODOLOGY

In conducting this study, two approaches were used. First, literature review approach was used to access information on worldwide experiences of traffic congestion and secondary data from local institutions. Second, qualitative primary data on the local context of traffic congestion were elicited from respondents through questionnaires, interview guides and observations. The aim was to reach 2,233 respondents constituted by groups of road users and public and private institutional stakeholders. That is, 1,469 (67%) from Dar es Salaam and 764 (33%) from Mwanza city. Data was collected from 1,182 (80.5%) and 692 (90.6%) respondents from the respective cities. Data collected through close-ended questions on the 4-point likert scale, was analyzed by using the relative importance index (R.I.I) model. Data collected by using open-ended questions that generated multiple responses, was analyzed by using descriptive statistics.

E3. FINDINGS

E3-1 Situation of Traffic Congestion:

Preferred modes of transport: In Dar es Salaam the most preferred modes of transport were BRT system, private cars, public transport and tricycles, while in Mwanza it was public transport and private cars in that order.

Congestion peak periods: Dar es Salaam city (6:00 -9:00 am and 3:00 -7:30 extending to 9:00 pm) and Mwanza city (7:00 – 9:00 am and 3:00 – 7:00 pm).

Congestion hotspots: In Dar es Salaam city significant hotspots were Pugu Road (Mombasa and Banana), Nyerere/Mandela; Morogoro/Mandela; Uhuru/Msimbazi; Mandela/Uhuru; and New Bagamoyo/Sam Nujoma. In Mwanza city such spots were (Nyerere/Nkrumah; Central roundabout *(Kemondo),* Pamba/Kenyatta, Buzuruga, Rwagasore, Lumumba and Kaluta).

Traffic congestion coping strategies: About 36.0% of respondents in both cities use motor- or tri-cycles; 32.0% provided for buffer travel time i.e., got up early or returned home late; 8.8% who are mainly drivers used informal and side roads.

E3.2 Institutional Set-up for Road Traffic Management

Institutional Arrangement: The institutions involved in traffic management and control together with their respective mandates and responsibilities are as follows:

Name of Institution	Mandate and Responsibilities
Ministry of Home Affairs	Administering the Road Traffic Act (Amended) No. 30 of 1973.
Traffic Police Department (TPD)	Overseeing road safety, control and management vide Road Traffic Act (Amended) No. 30 of 1973.
Ministry of Works, Transport and Communication (MWTC)	Road, railway and marineinfrastructure development and transportation management, control and safety.
Roads Fund Board	Collection and enforcement of road tolls.
Tanzania National Roads Agency (TANROADS)	Managing the countrywide trunk and regional road network
SUMATRA	Road traffic management and licensing of goods carrying and passenger service vehicles through SUMATRA Act No. 9 of 2001 and the Transport Licensing Act No 1 of 1973.
PO-RALG and City & Municipal Councils	Road and transport management through Local Governments.
Dar Rapid Transit (DART) Agency	Promoting modern and efficient urban transport system in Dar es Salaam City vide DART Agency Law, 2007.
UDA Rapid Transit (UDA-RT)	Interim operation of public transport services on BRT system.
MTIM through Tanzania Bureau of Standards (TBS)	Setting, modifying and nullifying standards including those of motor vehicles through the Standards Act No. 2 of 2009.
VPO & NEMC	Through EMA, 2004 and EMR, 2007, NEMC under VOP is responsible for sustainable management of the environment, prevention and control of pollution, waste management and environmental quality standards.
Ministry of Finance and Economic Affairs (MFEA)	Responsible for tax policies and through TRA, it is responsible for collection of revenues from vehicle registration fees; driver licensing fees; and issuance of driving licenses.
RAHCO/TRA & TAZARA	Providers of passenger and goods transport services.

Institutional inadequacies: There is little institutional coordination of efforts due to absence of legal and policy frameworks necessary for formation of a common forum to manage traffic. Again, most of the institutions lack capacity to effectively assert their mandates due to underfunding, HR skills, technology and equipment.

Government Efforts to Mitigate Road Traffic Congestion: The key efforts include, *inter alia,* improvement of road infrastructure networks; RBT system and commuter trains in Dar es Salaam; new *daladala* terminals; deployment of traffic police on roads to regulate traffic flows; preparation of master plans; implementing satellite town projects through NHC in Dar es Salaam and envisaged non-dormitory satellite town in Mwanza; and construction of dry port outside city at Kwala, Kibaha.

E3-3 Causes of Traffic Congestion

General Causes: The most significant causes of congestion reported by respondents were as follows:

- Fast urbanization i.e. high population growth, the ensuing urban sprawl and commuting population growth.
- Mono-centric structure of the cities and the consequential one directional flow of vehicles.
- Travel demands for passengers and goods and ensueing vecular growth especially private cars, buses (for public transport services), light and heavy trucks for transportation of goods and petrolium products.
- Overdependence on motorized transport for over 80% of the population.
- Inadequate road infrastructure capacity i.e. inadequate connectivity due to limited road network coverages and unmaintained roads.
- Violation of road safety and traffic laws and regulations especially by motorists.
- Delays in attending traffic incidences and accidents.
- Dysfunctional traffic lights and limited pass-through capacity of roundabouts.
- Location of ICDs within the city particularly in Dar es Salaam.

Key City Specific Causes of Traffic Congestion:

Dar es Salaam city:

- Absence of parking space along Sokoine Drive for cars serving marine passengers travelling to and from Zanzibar.
- Inadequate vehicular turning and parking spaces at Rangi Tatu – Mbagala.
- Inadequacies of public transport services especially on newly constructed feeder roads and numerous passenger buses passing through Mandela Expressway Road.
- Regulation of motor vehicles by traffic police who create congestion mayhems on other roads.
- Adhesive culture of low speed on highways.
- VIP entourages especially those going to and from JKNI airport.
- Insufficient (short) bus parking bays.

Mwanza city:

- Rocky and hilly geophysical features rendering road construction difficult and costly.
- Location of North Port and Kamanga Ferry jetties that cause traffic congestion in CBD upon arrival and departure of marine vessels.
- Location of manufacturing industries, godowns and petrol depots within CBD especially in Nofa and Mwanza South areas.
- Inadequate parking for public buses at KAUMA area and ensuing congestion on Kenyatta Road.
- Lack of public transport services for sections of Pasiasi – Usagara via Nyasaka, Buzuruga and Kisesa ring road.

E3-4 Effects of Traffic Congestion

Direct Economic Costs: The calculations of the costs attributable to congestion, were guided by the opportunity cost or value of time (VOT) model; extra fuel consumption cost; and five (5) and three (3) travel zones for Dar es Salaam and Mwanza respectively. The commuting population was assumed at 81% of the cities' 2016 population projections. The national 2016 per capita income of USD.960.00 was used as a proxy of the VOT lost at an hourly rate of USD 0.33. The estimated economic costs for year 2016 are as follows:

Name of City	Cost of VOT Lost (USD)	Cost of Extra Fuel Consumption (USD)	Total Cost (USD)
Dar es Salaam	1,510,611,926	524,586,965	**2,035,198,891**
Mwanza	109,204,481	38,147,972	**147,352,453**
Total Cost (USD)	**1,619,816,407**	**562,734,937**	**2,182,551,344**

The total economic costs of traffic congestion for Dar es Salaam and Mwanza is estimated at **USD. 2,182,551,344** equivalent to **TAS. 4.9 trillion**. The above respective costs are equivalent to 41.0% and 18.1% of the national per capita income for the two cities respectively.

Externalities:

- *Economic externalities*: Delay in reaching destinations; increase in cost of living; retardation of national development; loss of revenue; rotting of food produce; damage to infrastructure; and work truancy.

- *Social externalities:* Family conflicts and disintegration; delayed provision of social services; crimes and hooliganism; less time spent with family; and poor students' performance.
- *Environmental externalities*: Air pollution due to vehicular noxious gas emissions; noise pollution to residents living along major roads; climate changes.

- *Health externalities:* Non-contagious ailments (fatigue, lack of time for exercise, stress, frustrations, hypertension and diabetes); contagious ailments (TB, respiratory disorder; HIV AIDS and skin diseases); and accidents.

E4. RECOMMENDATIONS FOR MITIGATION OF TRAFFIC CONGESTION

E4-1 General Congestion Interventions

The proposed common intervention packages for alleviating road traffic congestion are provided together with respective policy and legal implications; priority hierarchies; implantation timing (short-, medium- and long-term); and potential challenges. These interventions are as follows:

1. Traffic Management Interventions

- Strengthening of institutional coordination capacity for traffic management efforts including the establishment of stakeholders' forum.
- Substitution of traffic police on roads with automatedvehicular volume responsive traffic lights.
- Relocation of street vendors from roads.
- Provision of real-time traffic information.
- Establishment of intelligent transportation system (ITS).
- Enforcement of Traffic and Road Safety Laws and Regulations.

2. Physical Planning Interventions

- Development of master plans that internalize and promote greater accessibility, compact high-rise neighbourhoods and transit-oriented development (TOD).
- Enforcement of urban planning law and regulations.
- Coordination of institutional efforts in implementing mater plans, transport master plans and other infrastructural development plans.
- Implementation of the current and planned satellite town projects.
- Redevelopment of unplanned settlements that are close to cities.
- Relocation of ICDs to outside of the cities.

3. Supply Side Interventions

- Improvement of road network capacity and connectivity.
- Segregation of lanes on existing roads to give public transport passage priority.
- Rehabilitation of TAZARA and TRL systems to reduce usage of heavy goods trucks.
- Implementation of pipeline project for transportation of petroleum products to upcountry regions and landlocked neighbouring countries.

4. Demand Side Interventions:

- Formalization of present *daladala* services through franchise companies or cooperatives.
- Replacement of low-occupancy buses with high-occupancy buses.
- Operate high occupancy public buses e.g. articulated buses on unsegregated lanes.
- Implementation of BRT system for mass passenger transit.
- Enhancement efficiency of TAZARA and TRL commuter train services.

- Introduction of metro rail transit (MRT) or light rail transit (LRT).
- Parking spaces close to arterial roads for feeder minibuses (daladala).
- Marine passenger transport services as alternative public transport.
- Restriction of private car from entering CBD**.**

5. Environmental Interventions

- Promotion of non-motorized mode of travel especially walking and cycling.
- Promotion of use of public transport.
- Transfering of the cost of pollution to car users.
- Technological interventions especially enforcement of vehicular emission limits.
- Mandatory age limits for motor vehicles.
- Alternative vehicle fuel e.g. CNG and unleaded petrol.
- Fiscal targeting of polluting groups.
- Creation on public awareness on environmentally sustainable transport.

6. Cross cutting issues

- Institutional capacity building in terms of funding, technology and HR skills for regulatory and traffic law enforcement bodies.
- Financing of infrastructure development and public transport services through PPP.

E4-2 City Specific Congestion Interventions

The city specific traffic congestion interventions are as follows:

1. Dar es Salaam City

- Provision of public transport services on secondary roads with high demand.
- Rerouting public transport on overcrowded Mandela Expressway.
- Construction of a multi-story parking space at AZAM jetty.
- Provision of adequate parking space at Rangi Tatu, Mbagala bus turning points.
- Increase of efficiency in coordinating VIP entourages.
- Enforcement of prescribed vehicle speeds.
- Construction of the underway Kwala ICD if still viable in the light of construction of SGR.

2. Mwanza City

- Planning and development of roads as per geophysical features.
- Rectification of central roundabout (Kemondo) in the city centre.
- Relocation of industries, godowns and petrol depots within Mwanza city's CBD.
- Restriction of motor cycles from entering the CBD.
- Introduction of the public transport route on Pasiansi – Usagara via Nyasaka.

The sets of interventions and respective measures are complementary to one another. Thus it will be imperative to implement them concurrently in a bid to alleviate congestion in both Dar es Salaam and Mwanza cities. However, pursuance of the right interventions should be guided by cost considerations, competition for financial resources and businesses, avoidance of duplication of efforts and long term viability. It is noteworthy

that, demand-side interventions that involve travel demand management for both passengers and goods transportation, have significant impact on alleviating traffic congestion compared to those that focus on road capacity expansion. Particularly for passenger transportation, interventions that promote wider use of public and non-motorized transport modes are significantly effective in this endeavour. Investment in both transport infrastructure development and public transport services will require the participation of the private sector under the PPP policy.

E4-3 Cost-Benefit Analysis

The above interventions will require capital, operational and maintenance costs. The potential benefits accruing to the societies of Dar es Salaam and Mwanza cities are related to direct economic costs and externalities especially, social, environmental and health costs imposed on the wider society by traffic congestion. The direct benefits include savings on travel time, extra fuel consumption, improved air quality, reduced health problems and improved quality of life. The potential benefits accruing from investing in each of the interventions, outweigh the expected costs.

PART ONE: BACKGROUND OF ROAD TRAFFIC CONGESTION

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Cities are expected to house about two-thirds of the world's population equivalent to more than 2 billion by 2050 (UN-Habitat, 2016, UN, 2015). This unprecedented global demographic transition hinges on the anticipated fast economic growth of urban areas. In these areas, the consequential improved life style is increasing the number of vehicles on roads. About 90 per cent of this growth is expected to take place in developing countries. The governments of these countries are less equipped and prepared to handle the new demands on infrastructure, transportation services and cope with the threats of unplanned urbanization (UN-Habitat, 2009). Cities are considered places of hope and good life since they concentrate the majority of economic activities by producing 60% of global GDP (UN-Habitat, 2013).

Cities have better transportation systems compared with their rural counterparts. However, these cities consume 60 per cent of the world's resources and energy supplies (UN-Habitat, 2015). This makes cities places where opportunities and threats to sustainable development come together (Harpham et al., 2001, UNFPA, 2007). Planned urbanization enhances cities to become places of innovation, drivers of sustainable economic growth and places where wealth and jobs are created (UNFPA, 2007). Unplanned and unmanaged urbanization leads to increased inequality, unprecedented growth of slums and disastrous impacts on urban mobility, productivity and environment (UN-Habitat, 2016). Unguided urbanization can change cities to become incubators of augmented human risks and other urban problems including limited mobility. The sustainable solutions for mobility are coherent with land use planning (WHO and UN-Habitat, 2010). The issue of unguided urbanization is also facing Tanzania's urban areas.

1.2 URBAN MOBILITY

In a global context, urban mobility is an emerging issue in the 21st Century as urban motorized transportation is expected to increase by an extra 1.0 billion by 2050. Most of these means of transport will have to squeeze into the already crowded streets of Indian, Chinese, and African cities (UN-Habitat, 2015). If no action is taken, these cars threaten to literally choke tomorrow's cities, bringing with them a host of negative consequences. Such a situation will seriously undermine the overall benefits of urbanization. Some of the negative effects of increased density of motorized transportation include lowered productivity from constant congestion; local pollution and rising carbon emissions; road traffic deaths and injuries; and rising inequity and social division. As a consequence, cities risk generating an unprecedented amount of urban traffic, from heavy goods trucks to personal or private vehicles.

Mobility is crucial for the functionality of cities as it affects their socio-economic activities and the wellbeing of their inhabitants. Alternatively, the economic development of a nation is closely linked to the efficiency of its transportation system. The hindrance of effective mobility results into road traffic congestion. According to the World Bank Report (1999), worldwide road traffic congestions constitute about 54.5% of all noticeable negative urban transport externalities. These externalities include massive delays, unpredicted travel times, increased fuel consumption, man-hour and monetary loss (Olagunju, 2015). Road traffic congestion emanates from ever growing urbanization process, human activities and the inevitable heavy dependence on road transportation. This dependence increases the number of motorized means of transport of different categories on roads. It is predicted that in both developed and developing countries' cities, the problem of road traffic congestion will continue to get worse in the future (Kiunsi, 2013).

1.3 ROAD TRAFFIC CONGESTION DEFINED

There is no single broadly agreed upon definition of traffic congestion due to the fact that it is both a physical and relative phenomenon (OECD Report, 2007). As a physical

phenomenon traffic congestion is defined as a speed, longer trip times and increased motor situation where demand for road space exceeds supply and is reflected by slower vehicular queuing (Institute of Transport Engineers, 1989). As a relative phenomenon traffic congestion is defined as a difference between road performance and road user's expectations.

Other scholars define road traffic congestion differently. Banjo (1984) defines it as a saturation of road network capacity due to regular and irregular reductions in quality of services. This situation is exemplified by increased travel times and interrupted travels. Ogunsanya (2002) on the other hand, conceptualizes road traffic congestion as a situation under which urban road network can no longer accommodate the volume of traffic on it. Yet Goodwin (1997) defines it as the impedance which vehicles impose on each other, due to speed-flow relationship, in conditions where the use of a transport system approaches its capacity. Olagunju (2011) describes road traffic congestion as a disproportion between the inflow and the outflow of vehicles into and out of a particular space.

Further, road traffic congestion is defined as recurrent (regular, occurring on a daily, weekly or annual cycle) or non-recurrent (when there are traffic incidents, such as accidents and disabled vehicles). In this regard, William Vickrey (1969) identifies six types of congestion:

(i) Simple interaction congestion on homogeneous roads: where two vehicles travelling close together, delay one another.
(ii) Multiple interaction on homogeneous roads: where several vehicles interact.
(iii) Bottlenecks: where several vehicles are trying to pass through narrowed lanes.
(iv) Trigger neck congestion: when an initial narrowing generates a line of vehicles interfering with a flow of vehicles not seeking to follow the jammed itinerary.
(v) Network control congestion: where traffic controls programmed for peak-periods inevitably delay off-peak period traffic.

(vi) Congestion due to network morphology, or polymodal/polymorphous congestion: where traffic congestion reflects the state of traffic on all itineraries and for all modes. The cost of intervention for a given segment of roadway increases through possible interventions on other segments of the road, due to the effect of triggered congestion.

While the above definitions are all valid in explaining the road traffic congestion issue, in the present consultancy study, road traffic congestion is taken to connote the phenomenon when motor vehicles are compelled to travel below reference speed for a specific road because of impedance of the vehicles ahead.

1.4 TANZANIA'S CONTEXT OF URBANIZATION AND ROAD TRAFFIC CONGESTION

Since the early mid-1980s, the fastest growing and urbanizing Tanzania's cities of Dar es Salaam and Mwanza, apart from other issues of urbanization, are increasingly facing the challenge of unprecedented growth of road traffic congestion (UN-Habitat, 2008, UN-Habitat, 2013, UN-Habitat, 2016).The urbanization process is largely attributed to rural-urban migration (UN, 2008). According to the 2012 National Population and Household Census, Tanzania's urban population growth was estimated at an annual average rate of 5.5% (NBS, 2013). During 2002 -2012 period, the population of Dar es Salaam and Mwanza cities, was growing at annual average rates of 6.45% and 6.24% respectively (NBS, 2013). Based on these growth rates, the population of these cities increased from 2.49 million inhabitants in 2002 to 4.36 million in 2012 for Dar es Salaam city and 209,806 to 706,453 for Mwanza city (NBS, 2013). By 2016, this population was estimated to have reached 5.23 million and 847,100 people for the two cities respectively.

The population growth of the two cities, is exerting enormous pressure on the urban infrastructure and services which are not growing in sync with the urbanization pace. Road, water, electricity and sanitation infrastructures are already bloated. Particularly, the supply of road infrastructure and public transport are no longer in congruence with travel demands pertaining to the movement of the urban majority especially those going

to work, schools and homes. These demands compete for space on the same roads with goods vehicles that results into considerable road traffic congestion. This congestion is threatening the urban socio-economic fabric, prosperity and the national economy at large. The road traffic congestion problem has led to reduction in vehicular speeds and flows; increased vehicle queue; and increased travel durations. Particularly, travel time is no longer predictable because of unreliable travel conditions. This situation is negatively affecting consumers of public transport services and road users in general. Overall, road congestion problem is having adverse effects on social, economic, environmental and health status of the city dwellers. The unabated growth of traffic congestion on urban roads and the consequential negative externalities is a serious concern to urban management, development and mobility professionals and policy makers.

1.5 THE ISSUE

The need for effective and efficient road traffic management on the backdrop of unabated road traffic congestion problem in Dar es Salaam and Mwanza cities, is recognized in SUMATRA's Second Strategic Plan for the period 2013/14-2017/18. In this plan a number of factors that contribute to the road traffic congestion problem are highlighted. These factors include fast urbanization; inadequate road infrastructure and public transport services; growing income levels; and the appetite for personal transport and especially private cars. In the absence of alternative means of transport, motorized road transport serves around 70% to 80% of the urban population. In urban Tanzania and particularly in the cities under reference, a multitude of cars, light goods vehicles (vans), buses, minibuses (*daladala),* heavy goods vehicles, motorcycles and tricycles, ply on the same limited road networks. The heterogenous nature of the means of transport renders road traffic congestion management complex.

In its capacity as a regulator of the road transport and pursuant to the provisions of Article 6. (1) of Act No. 9 of 2001, SUMATRA realizes the compelling need for providing quality and safer transport services for passengers and goods in urban areas. It is against this background, that SUMATRA sought the expertise of **Disnney International Consultancy** in the endeavour to establishing the causes and effects of traffic congestion

in Dar es Salaam and Mwanza cities as well as the country in general with a view to recommending traffic decongestion management interventions. The recommended traffic decongestion interventions are expected to be feasible, effective, efficient and sustainable for the urban road traffic management system. These interventions are also expected to enable SUMATRA to achieve one of its aspirations of improving the road transport subsector so that the population can have efficient and cost effective transport services with maximum safety and minimum environmental degradation as envisioned in the national transport policy.

1.6 OBJECTIVES AND SCOPE OF THE CONSULTANCY ASSIGNMENT

The broader objective of the present assignment is to establish causes, impact and mitigation strategies of road congestion in Dar es Salaam and Mwanza cities. The specific objectives and scope of the study are stated in the terms of reference (TORs) of the assignment provided in **Appendix 1.1**.

1.7 LIMITATION OF THE STUDY

The level of quantitative analysis was limited by non-availability of baseline data on various aspects of the study. For example, current data on state of roads in both Dar es Salaam and Mwanza cities were not available. Data on the number of motor vehicles in the two cities provided by TRA were doubtful as they are lower than what is pertaining in the two cities. Again, data on the impact and cost of traffic congestion on health, environment and social aspects were unavailable in both published literature and from stakeholders.

1.8 STRUCTURE OF THE STUDY ASSIGNMENT

The present study is formed by three (3) substantive parts that consists of nine chapters. Part One is formed by chapters on the introduction; methodology; and situation of traffic congestion in the two cities. Part Two consists of the study findings. That is, Chapter Five, Six, Seven and Eight present the findings on traffic management strategies; and situation of traffic congestion, causes, impacts (economic, social, health and environmental). Part Three consist of one chapter i.e., Chapter 9 that presents recommendations on the interventions to be pursued in mitigation of road traffic congestion in the two cities.

CHAPTER TWO

METHODOLOGY

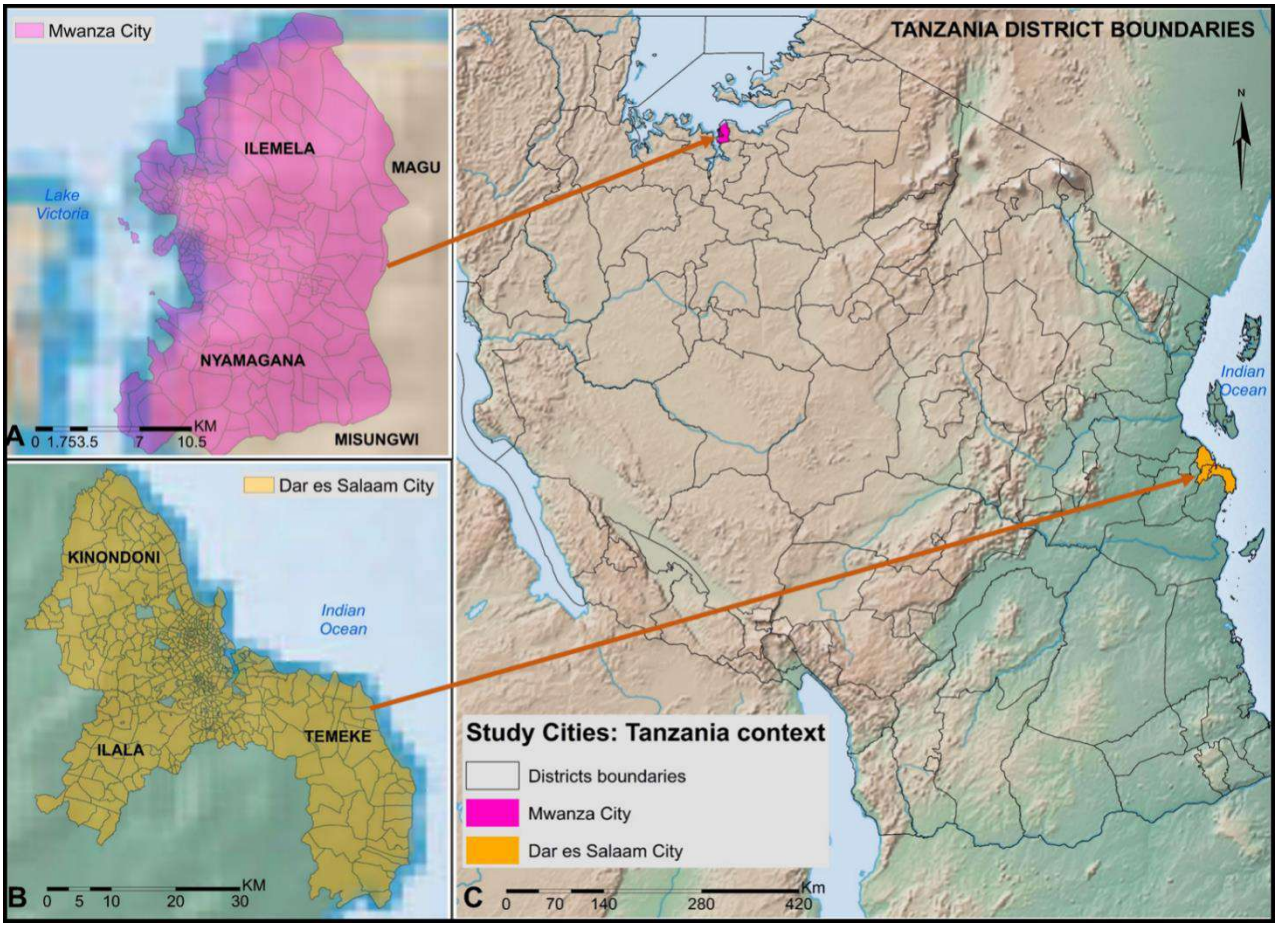
2.1 INTRODUCTION

The present methodology was developed on the basis of the Consultant's understanding of the terms of reference (TOR) and particularly the objectives and scope of the study. The methodology took into account the essence of eliciting from road users important information on the causes, effects and remedies to traffic congestion on the roads of Dar es Salaam and Mwanza cities. The road users include, among others, public transport passengers; public bus drivers and owners; private car drivers; and traffic police officers. Further, the study design took into consideration the best mechanism to obtain such information from various stakeholders including officials of private and public institutions and ministries.

2.2 STUDY AREAS

Dar es Salaam and Mwanza cities are the biggest commercial centres in the country. The location of the two cities is provided in **Map 2.1** below.

Map 2. 1: Location of Dar es Salaam and Mwanza Cities



Source: *Wards Administative Boundaries from NBS Census Data, 2012*

2.2.1 Dar es Salaam City

Dar es Salaam city is Tanzania's major commercial, business, industrial and transportation hub as well as the main sea port. Since the German colonial era during the 1880s through to the time of independence in 1961, and thereafter up to 1973, the city was the capital of the country. The city became a *de facto* seat of the Government of Tanzania from 1973 to 2016 when a decision was made to shift the national capital to Dodoma in central Tanzania.

As shown in the above map, Dar es Salaam is located on the eastern side of Tanzania and is bordered by the Indian Ocean and island of Zanzibar to the northeast. To the south, north, and west the city is cuddled by the Coast Region (RCO and NBS, 2014).

The city experiences the highest economic growth compared to others urban areas of Tanzania. Its growth largely hinges on the opportunities for employment since most of Tanzania's institutions are found in the city (RCO and NBS, 2014). These institutions include universities, colleges, hospitals, numerous businesses, international organizations, and diplomatic missions. The port serves most of eastern and central African landlocked countries that are connected by the Central and TAZARA railway lines as well as roads. These countries include Rwanda, Burundi, Uganda, Congo DRC, Zambia, and Malawi. The city is also the conduit for Tanzania's tourism destinations such as Zanzibar as well as Northern and Southern tourist sites. The city's growth is also influenced by the radial road network consisting of five main radial roads and one ring road all terminating in the Central Business District (JICA, 2008). These roads are Kilwa Road, Pugu Road, Morogoro Road and New Bagamoyo roads and the main ring road is the Mandela Road. The total length of roads based on 2005 data, was about 1,717 km of which 395 km or 23 per cent, mostly arterial roads, were paved (JICA, 2008).

As Tanzania's economic powerhouse, Dar es Salaam city has experienced the highest population growth in the country. The city with a total area of 1691.6 km^2 had a population of 769,445 in 1978 which has been almost doubling every decade to 4,364,541 by 2012 (Wenban-Smith, 2015). The 2012 population was equivalent to 10 per cent of national population. The city is a sprawling low rise which is not intensively built (Kiunsi, 2013). By 2007 the city's built-up area was only 21.7% of the total area (JICA, 2008). Administratively, until recently the city had three (3) districts that doubled as municipalities namely, Ilala, Temeke and Kinondoni. With effect from 2016, two districts namely Kigamboni curved from Temeke and Ubungo curved out of Kinondoni, were established to make the number five.

2.2.2 Mwanza City

Mwanza town was founded by German colonialists in 1892 as a regional administration and commercial centre to control mainly export products from the Lake Victoria zone. In 1978 the town was accorded municipality status in line with the local government

structure established in 1972. In 2000, Mwanza was further promoted to a city status constituted by Ilemela and Nyamagana Municipalities. The city is located on the southern shores of Lake Victoria **(Map 2.1)**. It covers an area of 1,325 km^2 of which 425 km^2 is dry land and 900 km^2 is covered by water. By 2009, approximately 86.8 km^2 equivalent to 20.45% of dry land area, was a built-up area (Mwanza City Council, 2009). The geophysical features of the city are mainly hilly and rocky land with occasional undulating plains mainly occurring in the Ilemela Municipality.

Mwanza city is the second fastest growing city after Dar es Salaam in terms of population. The City's population grew from 36,861 in 1967 to 385,810 in 2002 and 706,453 by 2012 (Wenban-Smith, 2014). The fast growth of this population has been influenced by the rural-urban migration. Particularly, the economic activities have attracted the in-migrations from the neighbouring regions of Mara, Shinyanga, Geita and Kagera. The city's economy is based on the drive to establish manufacturing industries since the 1970s. In recent years, fishing and trading of Nile perches as well as fish processing industries have been at the helm of the city's economic growth (Mwanza City Council, 2009). The city's economy has also benefited from large and small-scale gold mining within Mwanza region and other regions such as Mara, Shinyanga, Geita and Kagera.

Mwanza city's transportation infrastructure that links it with other regions of Tanzania and the world is constituted by the central railway transport (TRL), air transport, marine transport and road network. However, the city's road network is still limited in relation to demand.

2.3 STUDY APPROACHES

In conducting the study assignment, both qualitative and quantitative approaches were used. The qualitative approach involved soliciting various information on traffic congestion through questionnaires, interviews, desk-top analysis, historical data and observations. The quantitative data were obtained by using surveys and quantitative historical data. Both holistic and participatory approaches were adopted depending on the nature and type of data sought.

As required by the TOR, information relating to causes, impact and management of road traffic congestion in Dar es Salaam and Mwanza cities were collected and analyzed. The aim in this endeavour, was to enable the evolvement of dependable inferences and recommendations that were to contribute towards mitigation of the problem of road traffic congestion on the management, and supply- and demand-side measures. The management or regulatory measures focused on enforcing compliance with associated laws and instilling efficiency in traffic management. The supply side measures focus on increasing capacity and efficiency of transportation infrastructure. The demand side measures aim at restricting the use of private cars in the two cities. These measures that are complementary were expected to be feasible, effective and efficient for sustainable management of road traffic congestion. The said measures were required to be compatible with the economic, policy, legal, logistical, engineering and physical planning perspectives.

2.3.1 Sources of Data

The data used in the present study was obtained from the below explanation sources:

1. ***Documentary review method:*** The desk top documentary review was undertaken to access secondary data and information on traffic congestion in Tanzania in general and Dar es Salaam and Mwanza cities in particular from various institutions. Various reports and publications on the subject matter were widely reviewed for the purpose of complementing the collected primary data. These institutions and respective documents, among others, included the below listed:
    (i) SUMATRA**:** The Authority's statute, policy, strategic plan, commercial motor vehicle licensing and other relevant documents to the subject matter.
    (ii) Ministry of Works, Transport and Communication (MWTC): Publications which were reviewed include Road Traffic Act, National Transport Policy (NTP), 2003 and National Road Safety Policy, 2009.

(iii) Ministry of Lands, Housing and Human Settlements Developments (MLHHSD): Documents on past and future urban master plans, policies and Land Acts related to land use planning.

(iv) Energy, Water and Utilities Regulatory Authority's (EWURA) documents on petroleum importation and consumption.

(v) Tanzania Revenue Authority's (TRA) information on annual motor vehicle registration and importation.

(vi) Dar Rapid Trans Agency's (DART) documents on current and future BRT road network development in Dar es Salaam city.

(vii) Dar es Salaam and Mwanza's cities and municipal councils' documents such as strategic plans, infrastructure development plans, and land use plans and master plans.

(viii) President's Office - Regional Administration and Local Government (PO-RALG) documents on the national policy for management and administration of local authorities' infrastructure.

(ix) Chief Chemists: Statistics on the level of air pollution emanating from motor vehicle fumes in Dar es Salaam and Mwanza cities.

(x) National Environmental Management Council (NEMC): Information and statistics on motor vehicle related pollution.

(xi) Referral and Regional Hospitals: Information on respiratory ailments and stresses.

(xii) Tanzania Bureau of Statistics: Data on population growth of Dar es Salaam and Mwanza cities and any other relevant statistics.

2. *Case studies:* The Consultant also appraised the experience of other cities in the world that have experienced or are experiencing the problem of road congestion. These appraisals were mainly focused on cities that adopted traffic decongestion measures currently used or planned for adoption in Dar es Salaam and Mwanza cities. Both market-based (supply- and demand-side) and regulatory-based measures were revisited to assess their practicability in the case of the two cities. The purpose of appraising the decongestion measures of other cities was to learn

from successes and mistakes in order to propose appropriate measures that are feasible, effective, efficient, sustainable and complementary to one another.

3. Primary data: Primary data was collected from the field for the purpose of understanding the causes, implications and possible remedies of traffic congestion in the local context of the two studied cities. Different tools such as field observation, interviews and guides were used to collect the needed information.

2.3.2 Study Population and Sample Frame

1. Study population: The population from which the sample of respondents was drawn, was guided by the followingfour parameters:

(a) Population: Based on the 2012 Census, the population of Dar es Salaam and Mwanza cities were estimated at 5,166,570 and 850,000 by 2016 respectively (NBS, 2016). This population was equivalent to 86% and 14% of the combined total for the two cities respectively.

(b) Motorized transport: Nationwide number of motorized transport registered by TRA (2016), i.e., 1,010,732 motor vehicles registered between 2003 and 2011 as well as 245,180 motorcycles and 7,408 tricycles registered between 2010 and 2011. Itis estimated that 65 to 70 per cent of these means of transportation operated in Dar es Salaam City and about 10 per cent operated in Mwanza City.

(c) Stakeholders*:* These included the following categories:

(i) Public stakeholders: These were officials of the public institutions that are listed in **Appendix 2.1**.

(ii) Private stakeholders: Petroleum distributors and institutional public transporters such as UDA-RT, petroleum vendors and cargo transporters.

(d) Road users: These included the below listed:

(i) Daily commuters of public transport services who constituted over 70% to 80% of the population of the two cities.

(ii) Public transport operators and transport drivers.

(iii) Private car users that constitute about 6% to 10% of all travelers commuting to various places including the CBDs on daily basis.

2. Sample Size: From the above information, the envisaged sample was constituted by 2,233 respondents from the two cities. The sample includes 2,000 road users and 233 officials of stakeholder institutions. Selection of respondents was done through the convenience sampling method. The sample for road users took into account the fact that the selected number and composition was expected to be a fair representation of the population of these cities. The other consideration in choosing the size of this sample was its manageability in terms of time and analysis.

The 2012 census and the 2016 population estimates by NBS (2016), indicated that among the two cities, Dar es Salaam had 86% and Mwanza had 14% of the combined population. However, for the purpose of getting a fair representation of respondents, convenience of the analysis and for the dynamics of socio-economic development, the two cities were assigned the weights of 70% and 30% respectively. For the purpose of getting information from road users based on intensity of use, different weights were assigned to the categories of respondents. That is, 70% were public transport commuters; 4% were public transport owners; 2% were motorcycle drivers; 2% were tricycle drivers; 9% were public transport drivers; and 14% were private car drivers. Through this weighted population sampling method, Dar es Salaam city was assigned 1,300 respondents while Mwanza city was assigned 700 respondents.

Respondents from the institutional stakeholder group, were chosen in consideration of the need to avoid bias. In each of the institutions, the Consultant sought to obtain information from more than one respondent. The sample for the public sector stakeholders, consisted of 163 respondents. That is, 109 and 54 respondents for Dar es Salaam city and Mwanza city respectively. The sample for the private sector stakeholders consisted of 70 respondents. These included 60 and 10 respondents for Dar es Salaam and Mwanza respectively.

The sample size and sample elements for the three categories of respondents, is presented in **Appendix 2.2** and summarized in **Table 2-1** as below:

Table 2- 1: Summary of the Sample for Respondents in Dar es Salaam and Mwanza Cities

S/No.	TYPE OF RESPONDENTS	DAR ES SALAAM	MWANZA	TOTAL	%
1.	Road Users	1,300	700	2,000	**90%**
2.	Public Sector Stakeholders	109	54	163	**7%**
3.	Private Sector Stakeholders	60	10	70	**3%**
	TOTAL	**1,469**	**764**	**2,233**	**100%**
	PERCENTAGE	**67%**	**33%**	**100%**	

3. Sampling Techniques: As provided in **Appendix 2.2**, sample elements or respondents were selected by using the **random, convenience** and **purposeful sampling techniques**. The random sampling was used to obtain data from the stakeholders of the private sector namely petroleum vendors, heavy cargo transporters, passenger vehicle owners and traffic police officials. Convenience sampling was used for respondents met on roads. These respondents included the public transport drivers, commuters, public bus owners, motorcycle and tricycle drivers and private car drivers. The purposeful sampling was used to get specific

information from officials of the public sector. Respondents in this category were chosen on the basis of academic/professional qualifications and job responsibilities.

2.3.3 Data Collection Instruments

Three types of data collection instruments were used. These included **observations, structured interview guides** and **self-administered questionnaires.** The latter two are provided in **Appendix 2.3A** and **2.3B: I-XVI**. These instruments contained close- and open-ended questions for ease of collection of dependable quantitative and qualitative data. The instruments also consisted of self-rating likert scale questions with weights of 4 to 1. These questions sought to elicit qualitative information from respondents on the causes, effects and cost of road traffic congestion.

The data collection instruments also contained bio-data of respondents. These data included sex and age; sector of the economy (public, private or student); and employment status. The other sought information was on the frequencies of motor vehicle road usage, travel time of commuters, and road traffic congestion. The observations method was used to investigate the nature and extent of road traffic congestion.

The officials or experts of the public and private sector stakeholders were given self-administered questionnaires. The questions relevant to their responsibilities and businesses were in both close- and open-ended form.

The questions in both interview guides and questionnaire instruments were posed in English but also translated in Kiswahili for the purpose of easy following by the respondents and audience.

2.3.4 Quality Assurance

Prior to fully use of questionnaires, the Consultant engaged groups of 30 and 15 graduate research assistants in Dar es Salaam and Mwanza cities respectively. These research assistants who were based in the respective cities, were each trained on the purpose of

the study and the use of questionnaires for a day. The training was conducted for full day, i.e., on 8th December, 2016 for Dar es Salaam and 28th December, 2016 for Mwanza. Each of these groups were dispatched on roads for pilot studies conducted during 9th - 10th December and 29th -30th December for the respective cities. The pilot studies were meant to test the robustness, validity and sensitivity of the data collection tools and methods. The discussions that were held with these groups during the training sessions and the findings of the pilot studies, enabled the Consultant to refine the questionnaires. The research assistants were supervised by an experienced Researcher who traversed the two cities' roads on motorcycle to countercheck the correctness of the gathered data and information. His role was to distribute questionnaires and interview guides; check for completeness and authenticity of data collected; and collecting and submitting filled in questionnaires to the Consultant's office.

2.3.5 Data Collection Process

Data collection was conducted for seven (7) days in each city. That is, during 12th -28th December, 2016 for Dar es Salaam and 2nd – 8th January, 2017 for Mwanza. Three (3) control points on each of the selected roads were chosen. On each control point, the Consultant deployed a team of two research assistants. One team was stationed at the main stand where public buses started their journeys, while the other team was stationed at the end of the route. The third team was deployed on either major road intersections or midway the route. These teams gathered information from road users from Monday to Sunday between 6.00 am and 9.00 pm. The teams were further assigned with the responsibility of making observations on the daily trends of road traffic congestion. During the peak and low periods one of the research assistants was required to travel on public transport from the beginning to the end of the route in order to make observations on travel time in relation with both free and congestion flow of vehicles as well as challenges facing commuters and drivers.

For Dar es Salaam city, research assistant teams were deployed on five (5) routes as follows:

1. Mbagala – Station route: Teams were stationed at Mbagala, Mtongani and Station.
2. Gogolamboto – Mnazi Mmoja route: Teams were stationed at Gongolamboto, TAZARA and Mnazi Mmoja.
3. Kimara – Mawasiliano route: Teams were stationed at Kimara, Ubungo and Mawasiliano.
4. Bunju - Kijitonyama route: Teams were stationed at Bunju, Tegeta and Kijitonyama.
5. Africana – City Centre route: Teams were stationed at Africana, Maringo-Kawe and Ohio/Bibi Titi/A.H. Mwinyi intersection.

Each of these routes was assigned a maximum of 350 questionnaires for the seven (7) days of study. These questionnaires were required to be distrusted to 50 respondents per day.

For Mwanza city, research assistants were deployed on the three (3) routes as follows:

1. Buhongwa – KAUMA: Teams were stationed at Buhongwa, Mkuyuni and KAUMA.
2. Igoma – KAUMA: Teams were stationed at Igoma, Nyakato and KAUMA.
3. Airport – Railway Station: Teams were stationed at Airport, Pasiansi and KAUMA.

Each of these routes was assigned 240 questionnaires for one week of study. That is, these questionnaires were distributed to 34 respondents each day.

2.3.6 Data Auditing and Validation

Data auditing in this study was considered critical for the quality of the data that was collected and used for analysis. This auditing was performed at three levels as explained below:

1. ***After data collection:*** Prior to performing data analysis, the collected data was coded for the purpose grouping similar information. Thereafter the data was

audited to ascertain the completeness of questionnaires and interview guides. This step was important for the purpose of performing robust analysis. The collected data was later entered in **SPSS Version 21** for ease of management and cleaning up. This step was undertaken in order to generate reliable and error free data bases.

2. ***Data analysis and reporting:*** The data analysis was performed by using the methods described above. For robustness, the analysis was done on cleaned and complete dataset. Descriptive statistics using counts and means were conducted to reveal the pattern of the data. At this stage, all outliers were dropped. Fine scale analysis was undertaken in order to ensure that all captured information was well reported. This was achieved through staking data according to originating groups of respondents i.e., road users (public transport commuters, private car users, motor- and tricycle drivers and traffic police); public stakeholders; and private stakeholders.

3. ***Validity:*** In order to ensure validity of the results, this study designed a methodological approach which allowed collection of data from different sources for triangulation purposes. Similar questions were asked to different groups of respondents, for the purpose of ascertaining the validity of data and information originating from different sources. Importantly, the Consultant undertook extensive documentary review in order to ascertain whether or not the collected information on causes, impacts, cost and remedies of congestion was robust and supported by literature.

2.3.7 Data Analysis

The three key parameters of the assignment namely causes, impacts and management of road traffic congestion in the study cities, were quantitatively assessed. In order to achieve the study objectives, the below explained three kinds of analysis were used:

1. ***Analysis of causes, effects and remedies of traffic congestion:*** The causes, effects and remedies of road traffic congestion in this study, were quantified by using the **Likert scale** (self-rating score) with **weights of 4 to 1**. By definition, 4 stood for Highly Significant (HS); 3 – Significant (S); 2 – Insignificant (I); and 1 – Highly Insignificant (HI). The obtained scores were analyzed by using the **relative importance index (R.I.I.) mode.** The R.I.I analysis enabled the Consultant to find the contribution of a particular variable on the prediction of a criterion variable both by itself and in combination with other predictor variables. This model was used by (Popoola et al., 2013) to evaluate the causes, effects and remedies for Nigeria's highways traffic congestion. Through this model, a cross comparison of the relative importance of each of the factors as perceived by the respondents was made. This model is defined in statistical expression as below:

$$R.I.I.=(4n_1+3n_2+2n_3+1n_4)/4N \text{ and } 0.25\leq (R.I.I) \leq 1$$

Where:

n_1 = Number of respondents strongly agreeing;

n_2= Number of respondents agreeing;

n_3= Number of respondents disagreeing;

n_4 = Number of respondents strongly disagreeing; and

N = Number of respondents.

Under this analysis, the level of significance of the factor under observation was determined as follows:

1.00 – 0.750: Highly Significant

0.749 - 0.500: Significant

0.499 – 0.300: Insignificant

0.249 – 0.25: Highly Insignificant

2. ***Analysis of the economic costs to the nation:*** The calculation of cost of traffic congestion to the nation was guided by a number components contained in the

Shabbar Ali *et al* (2013) model. The model was applied to estimate the economic cost of traffic congestion for Karachi city. This model takes into account three factors namely; opportunity cost of congestion (OC), vehicle operating costs (VOC) and fuel consumption (FC) costs. These costs were calculated by using the following formulae:

$$OC = \sum_{m=1}^{m}(VOT_m \times Delay_m \times V_m \times Vocc_m) \quad (1)$$

Where:

OC = Opportunity Cost of traffic congestion.

VOT_m = Value of time for specific mode of transport *m.*

$Delay_m$ = travel delay in time units observed for mode *m* (estimated at some reference speed).

V_m = number of vehicles of type *m* per day,

$Vocc_m$= Average vehicle occupancy for specific mode m.

The VOT_m is constituted by the travel time which is in excess of the vehicle free flow time and buffer time to and from destinations by travelers using different modes of transport.

$$VOC = L * \sum_{m=1}^{m}(FC_m \times Delay_m \times V_m) \quad (2)$$

Where:

VOC = Vehicle operating Cost.

FC_m= Fuel cost in TZA/hour for specific mode *m*.

$Delay_m$ and V_m have the same meaning mentioned earlier

L = length of road in Km.

FC_m= is calculated using equation (3).

$$FC_m = \sum_{Ft=1}^{3}\left(Fcq_m{}^{Ft} \times Fp^{Ft} \times \mu^{Ft}\right) \quad (3)$$

Where:

Fcq_m^{Ft} = Fuel consumption quantity in litres/km of specific mode *m*.

Fp^{Ft} = fuel price of specific fuel types *Ft* = 1 and 2 i.e., petrol and Diesel, respectively in TZS. /litres.

μ^{Ft} = proportion of specific mode type *m* using a particular fuel type for travelling on that road stretch.

Due to the inadequacy of both primary and secondary data, some of the components of the above model were not used. The Consultant was compelled to confine the analysis to two components of the model namely, the VOT lost and extra fuel consumptions for various means of transport.

3. ***Cost-benefit analysis of the recommended strategies for managing road traffic congestion****:* Initially this analysis was to be undertaken through the **Net Present Value (NPV)** and **the benefit-cost (B/C) ratios** analytical methods. However, due to the absence of baseline data on most of the parameters and variables, the analysis was confined to explanation of potential benefits attributed to the recommended interventions for mitigation of road traffic congestion.

2.4 CONCLUSION

The foregoing discussions provide the framework and the parameters within which the study on road traffic congestion in Dar es Salaam and Mwanza cities was conducted. Particularly, the data collection tools and analytical methods that were used successfully in other countries, were deemed adequate enough to generate robust findings upon which the study recommendations were founded.

CHAPTER THREE

SITUATIONAL REVIEW OF ROAD TRAFFIC CONGESTION IN DAR ES SALAAM AND MWANZA CITIES

3.1 INTRODUCTION

Like other developing countries, Tanzania is undergoing fast urbanization process. The key characteristics of this process are the high population growth and unprecedented urban sprawl which are evident in almost all of Tanzania's urban settings. A number of urban areas in the country are increasingly facing the challenge of road traffic congestion. These urban areas include Dar es Salaam and Mwanza cities but also Arusha and Mbeya cities as well as the municipalities of Morogoro, Moshi and Dodoma. The latter municipality is more likely to face an increasing traffic congestion strain in the near future following the 2016 President's decree to shift the seat of the Government from Dar es Salaam. The other urban area experiencing the road traffic congestion pressure is Tunduma town in Songwe region which is a gateway to Zambia. In these urban areas, there is a growing imbalance between transport demand and supplyof the transport system. Particularly, the road transport which serves 70 to 80 per cent of the urban population outstrips the available road infrastructure. The objective of this chapter is to provide a situational review of road congestion in the country and specifically in Dar es Salaam in Mwanza cities as documented by other researchers.

3.2 AN OVERVIEW OF ROAD TRAFFIC CONGESTION IN TANZANIA'S URBAN AREAS

Although there are no substantive studies on the overall traffic congestion in urban areas of Tanzania, a number of interrelated factors have been identified as root causes. The key factors include but are not limited to the below listed ones:

1. ***Population growth:*** The spurt of urban population growth experienced since independence in 1961. This population increased from 685,092 equivalent to 5.7

per cent of the total population in 1967 to 12,701,238 equivalent to 29.1 per cent in 2012 (Wenban-Smith, 2015).

2. ***Urban sprawl:*** The pressure on urban land caused by population growth and the consequential urban sprawl characterized by unprecedented growth of unregulated and mainly poor informal settlements that house over 70 per cent of urban inhabitants (Wenban-Smith, 2015).

3. ***Vehicular growth:*** The overdependence on road transport and the consequential vehicular growth which is attributed to increased propensity to use motorized means of transport; liberalization of importation of motor vehicles since the mid-1980s; and liberalization of public transport (Mkalawa and Haixiao, 2014 & The Citizen News of 14th February, 2014).

4. ***Inadequacies in urban public transport:*** There has been a failure of the public transport to keep pace with urban demand and the consequential advent of the private sector and especially individuals to invest in passenger transportation business through minibuses and medium capacity buses (Msigwa, 2013).

5. ***Mono-centric structure of the urban areas:*** Most of the socio-economic services in urban Tanzania such as transport, commercial, trade, administrative, and social services are located in the inner parts of the urban areas and the consequential one direction of traffic (Kiunsi, 2013).

6. ***Inadequate infrastructure:*** Infrastructure in most of the urban areas is characterized by single lane for one direction roads; dysfunctional traffic lights and signals; poor state of maintenance of secondary roads; clogged storm water drainage; inadequate parking spaces; and dismal road infrastructure in unplanned areas.

The above factors are a manifestation of the growing imbalance between demand for and supply of, both infrastructure and transportation system in Mainland Tanzania's major urban areas.

3.3 SITUATION OF ROAD TRAFFIC CONGESTION IN DAR ES SALAAM CITY

3.3.1 Nature of Road Traffic Congestion in Dar es Salaam City

All major roads in Dar es Salaam City face the problem of traffic congestion (JICA, 2008). This problem is more pronounced on intersections of arterial roads. These roads include Morogoro, Kilwa, Nyerere, Rashid Kawawa and New Bagamoyo as well as the ring road of Mandela. Apart from the central business district (CBD) roads, the other roads and areas experiencing traffic congestion include Mwai Kibaki (formerly Old Bagamoyo), Sam Nujoma, Shekilango and Mwananyamala in Kinondoni Municipality; Uhuru, Tabata-Segerea and Kigogo in Ilala Municipality; and Chang'ombe, Temeke and Tandika in Temeke Municipality.

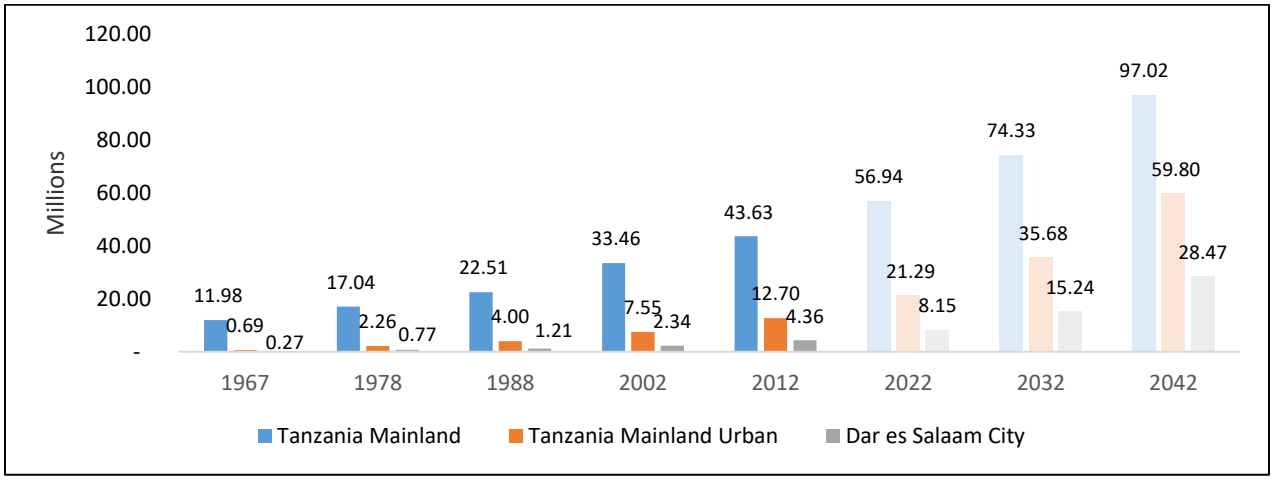
The congestion problem is more serious during mornings and evenings i.e., between 06:00am and 11:59 am as well as between 05:00pm and 8:00pm (Runyoro et al., 2014). During the morning peak periods, traffic speed is reduced to between 20 and 30 km/h at a distance of 25 to 30 km from the city centre for most of the main roads (Kiunsi, 2013). Towards approaching the city centre, traffic speed is reduced to between zero to 10 km/h within the city centre and the immediate surrounding areas. During the evening peak periods, the reverse happens. Traffic speed within the city centre is between 10 and 20 km/h. The speed decreases further to between 0 and 10 km/h just outside the boundaries of the city centre before picking up to speed of more than 60km/h in the outskirts of the City.

3.3.2 Causes of Traffic Congestion in Dar es Salaam

Road traffic congestion in Dar es Salaam City is caused by a myriad of interrelated factors. A number of documented key factors are highlighted below:

1. ***High population growth:*** As presented in **Figure 3-1** below, during the last census in 2012, Dar es Salaam City had a population of 4,364,541 which was equivalent to 10 and 29.1 percent of Tanzania Mainland and the country's urban population respectively. This population previously had increased from 0.85 million in 1978 to 1.36 million in 1988 and 2.49 million in 2002.

Figure 3-1: Population of Tanzania Mainland, Urban Areas and Dar es Salaam City for 1967-2012 and Projections for 2022-2042



Source: *Constructed from National Census from 1967 to 2012*

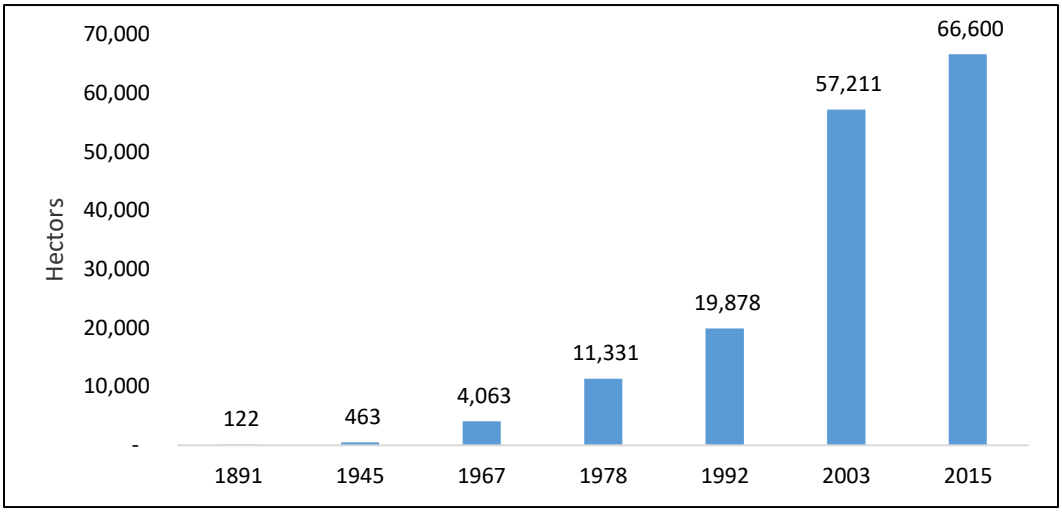
For the foreseeable future, the population of Dar es Salaam City is expected to continue growing at higher rates compared to other urban areas. Notwithstanding the recent shift of the nation's capital to Dodoma, the city commands a number of growth leverages over other urban areas. These leverages that will continue to attract in-migrations include, *inter alia,* the port that serves the upcountry and landlocked countries; the origin of the two railways and roads that connect the city with neighbouring countries; centre for international connections with the world; host of numerous institutions; and industrial and commercial growths.

At the last intercesual population growth rate of 6.45% per annum, the city is expected to become a mega city by 2026. The population will reach 15,253,000 by 2032 equivalent to 20.5% of the national population and 42.7% of the urban population. In consideration of the endemic Government budgetary constraint to invest in road infrastructure and public transport services, the city's high population growth will continue to exert tremendous demand pressure on both sub-sectors that might not correspond to supply.

2. Urban sprawl: The high growth of the urban population in Dar es salaam City is exerting pressure on urban land leading to encroachment of green fields. As

provided in **Figure 3-2** below, overtime the city with an area of 1,691.6km^2 has grown spatially from a German colonial outpost covering 122ha in 1891 to a town of 463ha in 1945 (Mng'ong'o, 2004). By 1967, the city had expanded to cover an area of 4,063ha trebling to 11,331ha by 1979. As indicated in Figure 3-2, by 2015 the City's developed area was estimated at 66,600ha (Bank of Tanzania, 2016).

Figure 3-2: Temporal Dar es Salaam City's Spatial Growth



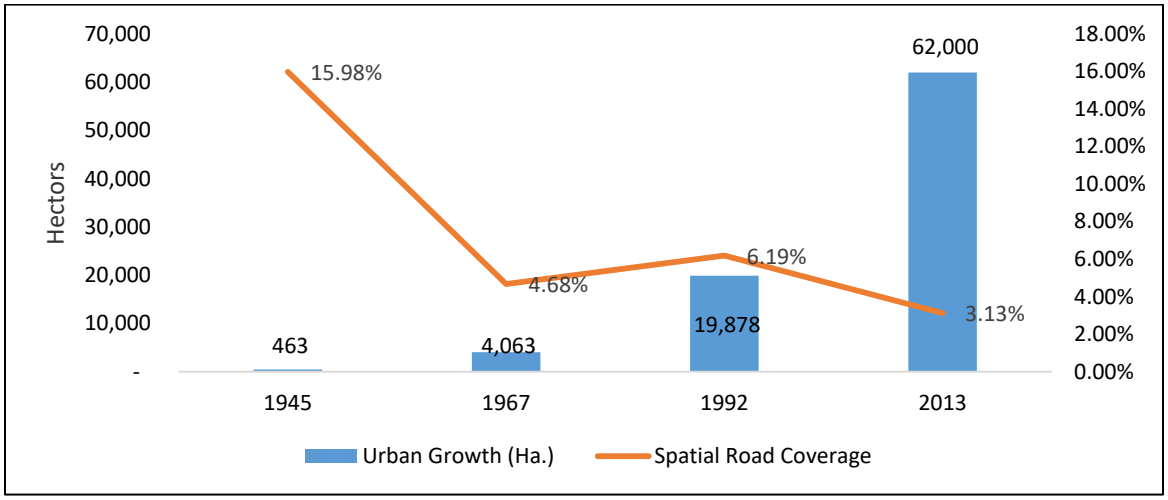
Source: *Constructed from Mng'ong'o, 2004, Dar es Salaam MasterPlan, 1979-1999 & BOT, 2015.*

On the other hand, the spatial extent of the city increased from 18 km in 1991 to 30 km in 2001 (SUMATRA, 2011). Currently, this expansion is likely to have reached over 40km as the developed areas have extended to the boundaries of Coast Region in areas such as Bunju bordering Bagamoyo District; Kwembe bordering Kibaha District; Kongowe bordering Mkuranga District; and Pugu-Kajiungeni and Chanika bordering Kisarawe. The settlement pattern is mainly along the arterial and other main roads. According to Mkalawa and Haixiao (2014), through times, the settlements have expanded from within a band of 1.0 km off roads to 6.0 km by 2012. Much of the City's sprawling growth since the mid-1970s, is in form of unregulated and unplanned/informal settlements. Such unregulated development of the city is attributed to government's inability to timely supply planned and serviced land for housing and other developments that matches demand (Kiunsi, 2013). The informally developed land lacks spaces for

standardized roads, water and electricity infrastructure as well as open spaces and other facilities.

The informal nature of the city's settlements renders it difficult to provide most areas with socio-economic amenities and access to facilities including roads and public transport (Mkalawa and Haixiao, 2014). The temporal imbalance of development of the city and growth of road infrastructure is presented in **Figure 3-3** below:

Figure 3-3: Temporal Dares Salaam Urban Spatial Growth and Road Network Coverage



Source: Constructed from Mkalawa and Haixiao, 2014 & BOT, 2015

The above statistics indicate that while in 1945 1.0 km served 6.26ha of the developed area, by 1967 this ratio had increased to 1.0 km for 21.38ha and 1.0 km for 16.16ha by 1992 before rising to 1.0 km for 31.94ha by 2012. Implicitly, the road infrastructure supply has lagged behind the pace of urbanization as indicated by the road coverage propositions. The city's road coverage is far below the recommended planning standard coverages of 15.0 to 20% (URT, 1997).

3. **Monocentric city structure:** Dar es Salaam City has got only one CBD which has three areas namely the city centre, Kariakoo and part of Upanga. The five (5) arterial roads are originating from this CBD. The City's CBD hosts almost all

key socio-economic amenities and institutions. These include, *inter alia*, major shopping areas, Government offices, educational institutions, health institutions, headquarters for most of private and public institutions; and diplomatic offices. During the past decade, the private sector has been shifting offices from the CBD northwards to Oysterbay, Masaki, Victoria and Mikocheni areas. However, the CBD and its ambiance remains a key place of employment and livelihood for most of the city's residents. Conversely, the exploding residential settlements in the peri-urban areas are devoid of socio-economic amenities and institutional facilities. The city structure has led to predominantly one directional traffic flow. That is, from residential areas to CBD during mornings and vice versa during evenings on daily basis and the consequential congestion along main roads and intersections (Kiunsi 2013).

4. ***Lack of Physical Plan and Development Controls:*** The post-independence Dar es Salaam City has been growing without a plan to guide its development (Kiunsi, 2013). The 1979-1999 master plan was neither reviewed nor earnestly implemented to the detriment of orderly city growth. Due to these inadequacies, the MLHHSD commissioned M/s Singapore Co-operation Enterprise (SCE) and Surbana International Consults Pte Limited both of Singapore to prepare a new master plan for the City.

Decades of non-implementation of the 1979-1999 Master Plan resulted into uncontrollable development and unenforceable development codes. The concept of this master plan involved the development of the city structure based on five main levels. These levels included ten cell, housing cluster, neighbourhood, community and district. At each level appropriate services and community facilities were to be provided as indicated in **Table 3-1** below.

Table 3-1: City Structure and Population Thresholds as Proposed in the 1979 Master Plan

LEVEL	SIZE	SERVICES
Ten cell unit	10 units	-
Housing cluster	10 ten cell units (100 plots)	Nursery school, 2 play grounds.
Neighbourhood	Four to eighty housing clusters (5,000 people)	Primary school with associated playing grounds. One local market and few small shops One recreation area.
Community	Eight neighborhoods (40,000 people)	One major market and shopping area. One community hall. Two religious sites. Two major recreational areas.
District	200,000 to 300,000 people	Commercial component - public and private office space. Wholesale and retail shopping facilities. Petrol service facilities. Apartment units. Institution component. District hospital. Fire protection services. Secondary school. Recreational component. A small exhibition area. A major recreational facility including playing fields, athletics tracks, practice fields, restaurants, offices, parking space and open space

Source: *Ministry of Lands, Housing and Urban Development (1979).*

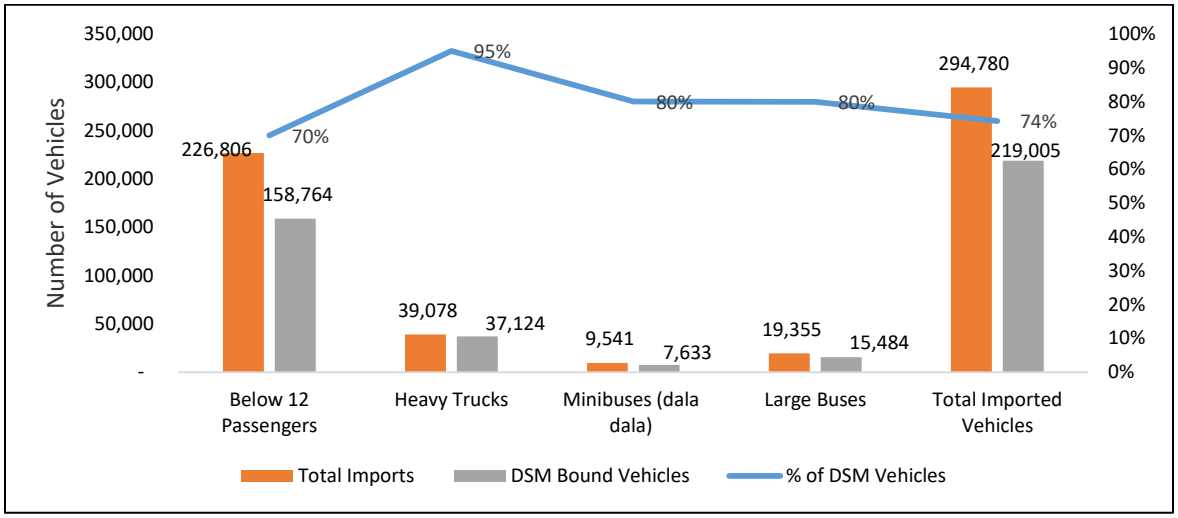
The said plan proposed an increase of types and capacities of services going up the city structure (Kiunsi, 2013). Housing clusters were constituted by 10 cells of 10 houses each, a nursery school and playing ground. The district which was the highest level, was to be provided with facilities and services such as commercial, office spaces, schools and recreational areas.

The objective of this master plan was to ensure adequate distribution of facilities within the city that were within easy reach of all residents and in accordance with population thresholds (Kiunsi, 2013). If this master plan was followed, it would have had a positive impact on the urban structure through reduction of the daily needs to travel to the CBD for services. These travels contribute to traffic congestion.

5. Insufficient Road Infrastructure and Parking Facilities: The city's road network increased from 74 km in 1945 to 230 km in 1992 and 1,717 km by 2005 (JICA, 2008). Despite the Government's efforts to invest in road construction, the network is still not enough to cope with the transport demand caused by urban sprawl. Kiunsi (2013) attributes this insufficiency to limited resources by the Government that results into low spatial road coverage which is below the recommended level as pointed above and the poor state of road maintenance. Other factors include insufficiency of road intersections and roundabouts; predominantly one lane roads per direction; and limited parking spaces especially in the city centre, Kariakoo and new commercial centres located in the city's outskirts. These outskirts include Manzese, Mbagala, Mwenge, Sinza, Tegeta, Temeke and Tandika.

6. Vehicular Growth: The number of motor vehicles in Dar es Salaam city increased from 24,600 in 1979 to between 606,439 and 707,521 by 2011 (Kiunsi, 2013). As provided in **Figure 3-4** below, statistics on various types of motor vehicle imports during 2008-2013 indicate that an average of 74% remained in Dar es Salaam.

Figure 3. 4: Number of Vehicles Imported in Tanzania Mainland during 2008-2013 Period



Source: *Constructed from AAT Report Published in the Citizen Newspaper of 14. 02. 2014*

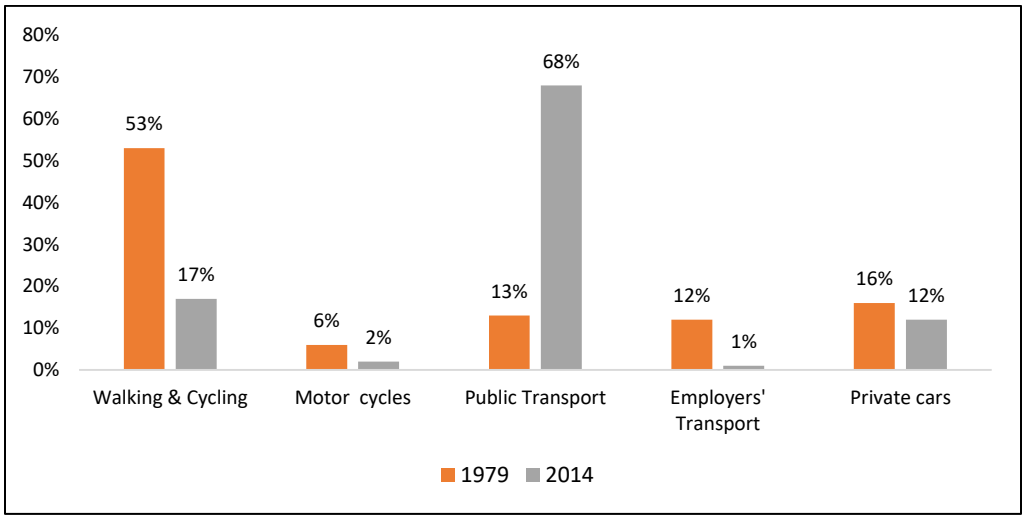
The traffic congestion problem is worsened by the increased importation of motorcycles and tricycles that compete with motor vehicles for roads. At least 50% of the 587,936 motorcycles imported in the country during 2008-2013, were licensed to operate as passenger taxies *(bodaboda)* in Dar es Salaam (AAT, 2014). Again, in 2013 a total of 8,822 tricycles *(bajaj)* were imported and over 80% were licensed as passenger taxes in Dar es Salaam.

7. Travel Demands: Travel demand entails the transportation and movement of people and freight. Key travel demands in Dar es Salaam are as follows:

(a) People transport demand: The demand for passenger services has grown over time in sync with population growth, urban sprawl (distances of residences from places of work and business) and increased income levels. In particular, the latter has increased the propensity to use private cars as means of transport. These three factors coupled with the advent of importation of cheap used cars since the early 1990s following trade liberalization, have contributed to the growth of the number of vehicles in the City. As presented in **Figure 3-5** below, the city has experienced a dramatic change in modes

of transport used by the city's population from predominantly walking and cycling (53%) in 1979 to predominantly motorized modes of transport (83%) by 2014 (Mkalawa and Haixiao,2014).

Figure 3-5: Temporal Mobility Changes by the Population of Dar es Salaam City



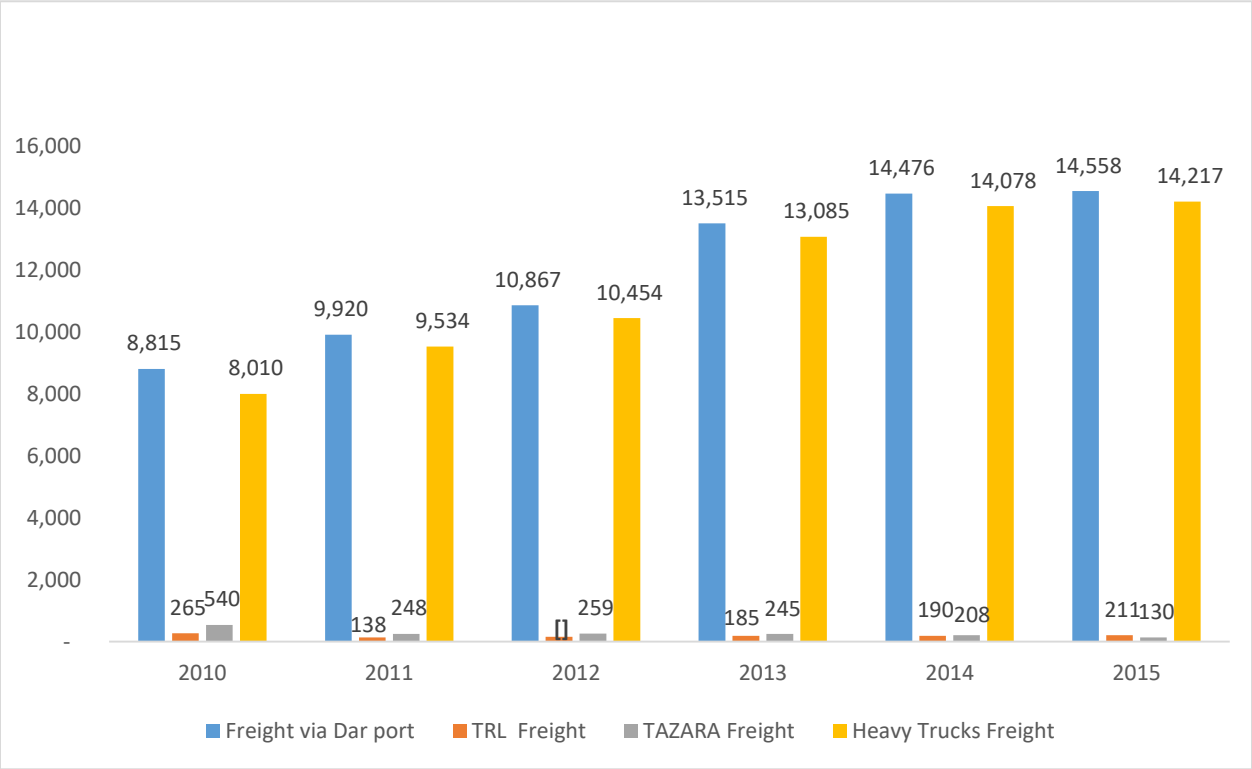
***Source**: Constructed from Mkalawa and Haixiao (2014)*

The spiked use of motorized road transport is one of the key factors contributing to traffic congestion in the city mainly during working days.

(b) Goods transport demand: There are two types of goods road transportation demand namely heavy cargo trucks and light service trucks. The cargo trucks move large heavy goods to major destinations from the port and factories to upcountry and neighboring countries and vice versa. About 80% of these vehicles which are used to transport containerized and non-containerized goods, are articulated with more than three (3) axles. Despite the absence of statistics, over years the demand for heavy cargo trucks has been on the rise. As provided in **Figure 3-4** above, 37,124 heavy goods trucks imported in the country were bound to Dar es Salaam. The Tanzania Truck Owners (TATOA) statistics indicate that their 952 members owned 15,000 trucks. The increased use of heavy goods trucks is motivated by the increase in cargo

imported via Dar es Salaam Port in the light of systematic decline of TRL and TAZARA in hauling cargo as provided in **Figure 3-6** below.

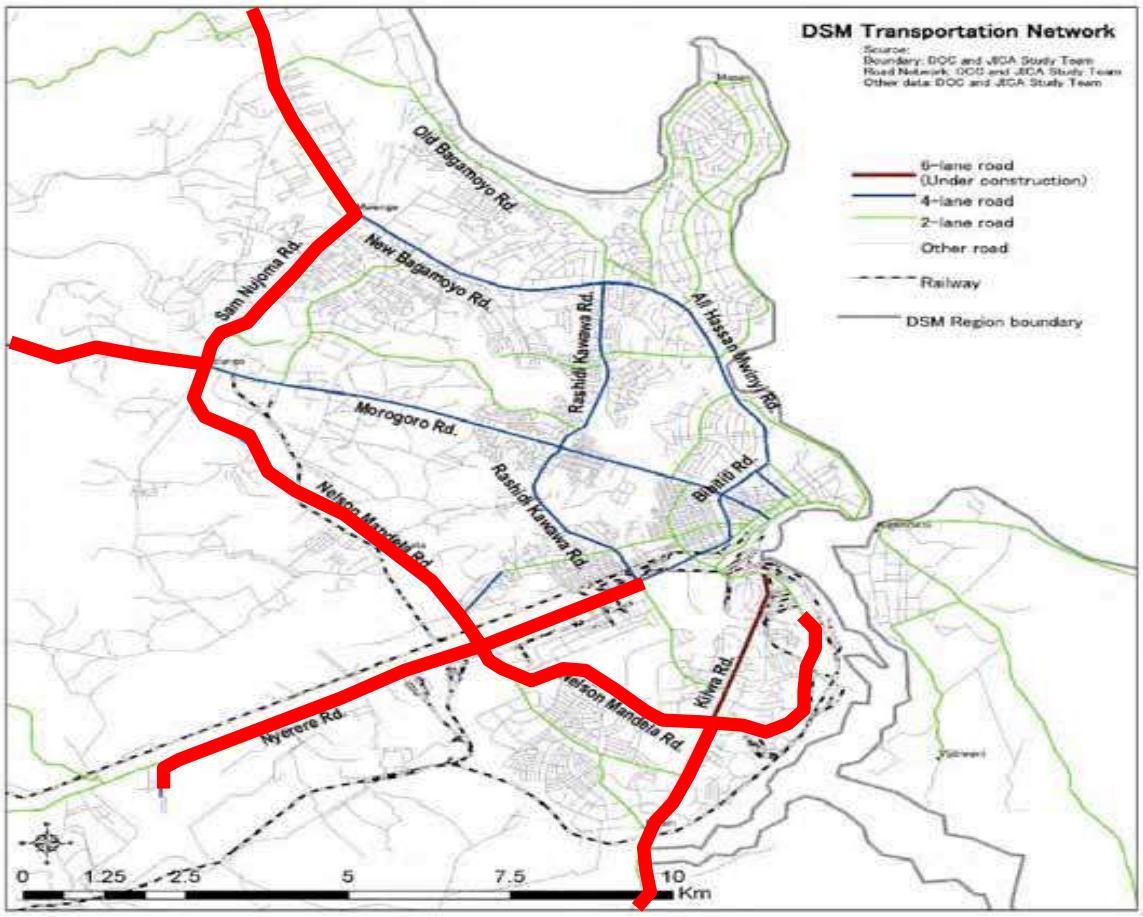
Figure 3-6: Cargo Imported via Dar es Salaam Port Hauled by Trucks, TRL and TAZARA during 2010-15 (in '000 DWT)



Source: Constructed from NBS (2006) and Tanzania in Figures (2015).

The above statistics indicate that during 2010-15 an estimated 69,378,000 tons of imported cargo, equivalent to 96% was transported by trucks. Correlatively, **Map 3.1** below indicates that heavy goods trucks mainly ply on Mandela, Morogoro Road, Sam Nujoma and New Bagamoyo roads. Unfortunately, these roads are not designated as specific roads for heavy goods trucks. Besides, these roads do not have proper parking spaces for the trucks. The sheer volume of these trucks; drivers' tendency to park on road sides; and competition for space with other types of vehicles, create congestion mayhem particularly during 17:00 to 22:00 hours.

Map 3. 1: Dar es Salaam City's Route Network for Heavy Goods Trucks



Source: *Adopted from JICA Report (2008)*

Light trucks include vehicles of not more than two (2) axles and pickups. These trucks mainly provide goods distribution services from main markets to retail markets, from port to factories, factories to wholesalers and from wholesalers to retailers. Such vehicles ply on almost all passable roads of the city. Although their number is not known, their presence on roads is significant. The increase of this type of vehicles is partly attributed to the abandonment of the use of railway sidings that used to connect factories with the port and the main central railway line. The light trucks peak periods on roads include 06:00 to 10:00 hours and 15:00 to 19:00 hours.

(c) Petroleum products transportation demand: Dar es Salaam Port remains the main entry point for petroleum product imports. During 2016, 99% of the total imported petroleum amounting to 5,486,931,146 liters entered through this port. Out of the total imported petroleum products, 3,302,298,898 liters equivalent to 60% of the total imports were destined for the local market and the remainder 40% were destined for landlocked countries of Rwanda, Burundi, Malawi, Zambia, the Democratic Republic of Congo and Uganda (EWURA, 2017). Zambia's petroleum products are mainly transported by the TAZAMA pipeline with throughput of 1,100,000,000 litres. Due to the aging state of this pipeline system, its throughput capacity has declined to 613,174,000 litres in 2015 and 502,797,000 litres by 2016.

In 2016, Dar es Salaam city consumed 845,409,043 litres equivalent to 35.4% of the 2,386,303,386 litres of petroleum products destined for Tanzania Mainland. In the absence of railway tanker wagons and a pipeline, articulated road tankers remain the main means of transport for petroleum products destined for Mainland regions and landlocked countries. During 2016, these tankers transported an estimated 1,540,894,343 litres destined for the other 25 regions of Tanzania Mainland and 1,681,835,248 litres destined for the four landlocked neighbouring countries (save for 502,797,000 litres carried by TAZAMA pipeline to Zambia). The petroleum tankers mainly ply on Mandela and Morogoro roads. The contribution of these tankers to traffic congestion in these roads is significant.

8. Defective traffic control and management system: In Dar es Salaam City, at most of the intersections, traffic lights were not working effectively due to non-maintenance while others were obsolete. That is, at least 25 of 39 road intersections, had traffic lights that were not working effectively (JICA, 2008). These lights were also not programmed to respond to traffic flow demands. Instead, they operated on fixed cycle time. In some cases, while the traffic demand exceeded the capacity of a certain approach, the allocated green light time remained the same and thus creating

congestion on relevant approaches. There were also intersections that didn't have traffic lights. While such roads were initially so designed in order to allow drivers to find an interval to manage the go-through, the vehicular growth has long overtaken this objective. Consequently, traffic at those particular intersections come to a standstill and in the process create traffic congestion on all legs of the intersections. The examples of such intersections include New Bagamoyo/Africana and New Bagamoyo/Goba roads.

The other traffic control issue is the city's roundabouts at intersections. The roundabouts are meant to provide continuous circulation of traffic and safe movement of traffic. Most of these roundabouts are of single lane design and few are of double lane design. Presently, the road capacities of both types of roundabouts are no longer in congruence with the vehicular growth. It is therefore common that, traffic on every leg of the roundabout stops or slows down before entering the roundabout. Such stoppages causes the accumulation of motor vehicle queues especially during peak periods. Due to large numbers of vehicles in downtown Dar es Salaam, every roundabout is a bottleneck for traffic flows.

9. Poor Public Transport Services: Public transport in Dar es Salaam city passed through three epochs namely, the colonial, pre and post economic liberalization. The colonial period, dates back to 1949, when a private British company known as Dar es Salaam Motor Transport Company (DMT) was formed to offer urban public transport services in the city (SUMATRA, 2011). The pre-economic liberalization started with the Arusha Declaration in 1967 when DMT was nationalized and divided into two companies namely, Usafiri Dar es Salaam (UDA) and Kampuni ya Mabasi Tanzania (KAMATA). The former was charged with the responsibility of operating public transport within Dar es Salaam and the latter was entrusted with the responsibility of operating passenger transport services in the regions.

Unfortunately, UDA's performance declined systematically with time following the economic crisis that set in since the early 1970s. Its fleet of buses declined from 257 at its peak during 1975/76 to 12 by 1998/99 (Mkalawa and Haixiao, 2014). During this

period it was not uncommon to see long queues of passengers waiting for buses at bus stands; scrambling passengers for seat on buses; and overcrowded buses. As the population increased, UDA was no longer able to meet public transport demand. By year 2000, UDA's capacity to provide public transport services had tapered to only 2% of the demand (SUMATRA, 2011).

The post economic liberalization era started during the mid-1980s when UDA's service capacity became increasingly strained. During the early 1980s, pick-up vans operated illegally as passenger carriers. In 1983 the Government sanctioned private light cargo vehicles including pick-ups to be converted into passenger carriers famously known as "*Chai Maharage*" as an intervention measure for passenger transport woos. By mid-1990s, individual owners introduced minibuses *(daladala)* to cater for public transport services while gradually phasing out the *Chai Maharage*. During the early years, the most dominant types of *daladala* buses were 15-seater microbuses. Later on, the 30-steater buses were introduced. By June, 2006, minibuses were phased out to operate in the CBD by SUMATRA.

Statistics on the number of private buses providing passenger transport services in Dar es Salaam City are sketchy. Kanyama et al. (2004) indicate that by 2003 the number of privately owned *daladala* buses operating in the city was between 6,000 and 7,500. The AAT Report (2014) put the number of buses that were imported and operated in Dar es Salaam City at 23,117. In consideration of the booming of the public transport business, currently this number might have more or less doubled. The *daladala* buses are currently operating alongside the privatized and reinvigorated UDA and the newly established DART bus fleets. The sheer number of privately owned buses adds to the already out of hand traffic congestion problem.

Despite the entry of the private sector in the passenger transport business in the City, the quality of services provided remains poor (SUMATRA, 2011 and Kiunsi, 2013). This situation is attributed to a number of factors that include, *inter alia,* limited spatial coverage by minibuses; poor maintenance state of buses; risk of accidents; lack of

fixed bus time schedules; long waiting hours at the bus stands, overcrowding; non-adherence to scheduled bus routes; lack of timetable; and unruly bus crews. The poor state of public transport compels a good proportion of city residents and especially middle income earners, to resort to using private (mainly second hand) cars instead of public transport. This situation, further worsens the problem of traffic congestion.

10. Traffic law violations and general indiscipline: In the city, it is common for motorists to violate traffic rules and regulations especially during the morning and evening peak hours. The National Road Safety Policy (NRSP) of 2009, acknowledges the problem of poor road-user behaviour by drivers. The majority of drivers do not attend formal driving training. Driver training is not adequately standardized as there is no commonly accepted curriculum, no official training manuals and no common standards for driver examination. The process of obtaining a driving license is scattered among different institutions that include training schools, traffic police and TRA. These institutions do not have a common forum to enable them to enforce discipline of drivers. Some drivers possess fake licenses. Most of the motorists and especially *daladala* drivers, are notorious for driving on wrong sides thereby introducing extra lanes. In the process, they block the oncoming vehicles due to their impatience. It is not uncommon for *daladala* drivers to assign vehicles to the so-called *deiwaka* (day-worker) drivers who lack affinity to vehicles they drive.

11. Street vendors*:* These traders famously known as *machinga*, sell their wares either on roads or to moving vehicle passengers. In the latter case, they pursue vehicles to relate with customers and in the process they slow down vehicle movements. In places like Kariakoo, Manzese and Mbagala, traders display their wares on road-sides and walkways thereby reducing the road lanes and the smooth mobility of both vehicles and pedestrians.

3.4 SITUATION OF ROAD TRAFFIC CONGESTION IN MWANZA CITY

3.4.1 Nature of Congestion in Mwanza City

Since the early 1990s, Mwanza's CBD is increasingly experiencing traffic congestion (PMO-MRALC/TOA, 2015). The city's CBD is connected with the outskirts and other regions by three arterial roads. These roads include Nyerere Road which extends into Musoma Road; Kenyatta Road which extends into Shinyanga Road; and Makongoro Road which extends into Airport road. The latter road joins the CBD with the Airport as well as Igombe and Kayenze outskirts. Mwanza city's road network is presented in **Map 3.2** below. The three (3) roads converge at the central roundabout in the city centre locally known as *Kemondo*. The city centre is served by other 23 town roads. Famous among these roads, that have turned into the City's key commercial locations include Pamba, Rwagasore, Lumumba, Kaluta, Makoroboi, Post, Bantu, Uhuru, Rufiji and Balewa.

Due to the narrowness of the CBD roads and the fact that they are basking with businesses, they are always congested with vehicles and pedestrians. The inner-city road network of about 28 km is increasingly unable to accommodate the growing volume of traffic (PMO-RALG, 2015). In the past, road traffic congestion was aggravated by heavy commercial trucks and buses weaving their way through the crowded CBD. However, the congestion situation is not getting better due to the licensing of motorcycles to operate as passenger taxes. The impact of traffic congestion in the CBD in form of long motor vehicle queues, is felt as far as the City's outskirts of Butimba, Mkolani, Mkuyuni, and Igogo along Shinyanga Road; Kisesa, Igoma, Nyakato, Mwananchi and Mabatini along Musoma Road; and Ilemela, Pasiansi, Makongoro, Ghana and Kilumba along Airport Road.

Map 3.2: Road Network in Mwanza City

<u>Note</u>: Grey colour represents built-up areas (settlements) and green clour represents city gardens, green belts and un-built areas

3.4.2 Causes of Traffic Congestion in Mwanza City

Unlike Dar es Salaam City, documented facts on road traffic congestion in Mwanza City are very limited. However, the causes in this city are not dissimilar to those of Dar es Salaam City. The key ones are as follows:

1. ***Fast population growth:*** Mwanza is the second fastest growing city in the country in terms of population. The City's population grew from 36,861 in 1967 to 385,810 in 2002 and 706,453 by 2012. The fast growth of this population is influenced by the vibrant economic growth. Particularly, the City's position as a business and commercial hub of the lake zone; manufacturing industries growth since the 1970s; fishing and fish industries since the 1990s; and the gold mining in the neighbouring regions. These economic activities have attracted in-migrants from other neighbouring regions and Mwanza's rural areas. At the City's 2002-2012 annual inter- censusal population growth rate of 6.24 per cent, *ceteris paribus*, the population is expected to reach 1,375,000 by 2022, 2,519,000 by 2032 and 4,614,000 by 2042. The fast growth of the city's population will continue to exert tremendous demand pressure on land for settlements, road infrastructure and public transport services that might not correspond to respective supplies. This situation is expected to add on the already existing traffic congestion in the city.

2. ***Urban growth:*** Mwanza City has also experienced fast urbanization as a consequence of fast population growth. The city has gone through an unprecedented urban sprawl which has grown parallel to unplanned settlements. During the 1970s these settlements were confined to the hilly and rocky areas of Mabatini, Mkuyuni and Igogo. Consequent to the Government limited capacity to deliver planned, surveyed and serviced land, by 1980s the informal settlements had expanded to both other hilly and rural-agricultural areas. Some of these areas include Sangabuye, Buhongwa, Ilemela, Nyakato, Buswelu and Kitangiri in Ilemela Municipality; and Nyashana, Mbugani, Bugarika and Maina in Nyamagana Municipality. The City's population living in informal settlements increased from 34 per cent during the late 1990s (URT,

2000) to 40 per cent by 2008 (UN-Habitat, 2010) and 60 per cent by 2014 (Rincon, 2014).

The fast urbanization process is evidenced by the urbanized area of the city. In 2005, of the city's total dry land measuring 425km^2, 86.8 km^2 equivalent to 20.4% was urbanized (Amani, 2010, Mwanza City Council, 2009). By 2014 the proportion of the City that was urbanized had reached approximately 173.0 km^2 equivalent to 40.7 per cent of the total area (JICA, 2015). The geographical expansion of the city has increased the demand for transport services as the livelihood and residential places of the majority of City's population are increasingly becoming further apart.

3. ***Monocentric city structure:*** Like most of the regional headquarters in Tanzania, the structure of Mwanza city is also monocentric. The implication of this structure is that, most of the socio-economic amenities are located in the overcrowded CBD. These services include major shopping areas located along Rwagasore, Nyerere, Pamba and Kenyatta Roads; administrative offices located in the Regional Block and City Council areas; central market enclosed by Rwagasore, Nyerere and Pamba Roads; and manufacturing industries located along Kenyatta Road in Nofa, Igogo and Mkuyuni areas. The CBD continues to pull in a big proportion of the city's population daily despite that Nyakato and Ilemela areas which have evolved into manufacturing industry hubs as well as Kilumba market that has become a key trading place. In this regard, most of the motor vehicles troop in or through the City's CBD.

4. ***Lack of Physical Plan and Development Control:*** Mwanza city has been growing uncontrollably into informal settlements. This growth is attributed to poor enforcement of land planning policy, codes and standards especially in peri-urban and hazardous areas. The last Mwanza Municipality Master Plan of 1984 was neither reviewed nor fully implemented. Notwithstanding the financial constraints of the Councils and the Central Government to provide the

infrastructural services in sync with demand, the growth of the unplanned settlements is rendering it difficult to provide such services including roads. In recognition of the essence of having in place guidelines for physical planning and enforcement of development conditions, the City Council in collaboration with the MLHHSD is finalizing the city's Master Plan, 2035. This plan is being undertaken by the Singapore based M/s Singapore Co-operation Enterprise (SCE) and Surbana International Consults Pte Limited. Under the envisaged plan, satellite towns are expected to be developed in the outskirt areas of Luchelele, Kishili and Bugarika. The objective is to decongest the CBD by establishing new business centres in these areas.

5. ***Inadequate Road Infrastructure and Parking Facilities:*** Mwanza city's road network in relation to urbanization and population, is still limited. As presented in **Table 3-2** below, the city's total road network increased by 48% from 584.0 km in 2002 to 866.2 km by 2012. This road network growth translates into an annual rate of 3.7% per annum which is below the annual population growth rate of 6.24% and the annual urbanization rate of 5.0% recorded during 2005-2015 period. By 2015 the spatial road coverage of Mwanza City was better than that of Dar es Salaam City at 20.0%. However, 92.5% of the total length of the road network was surfaced with gravel and earth. This network which is under the administration of the City and Municipal Councils is prone to damages especially during the rainy seasons. Due to the fact that these Councils are financially constrained, the gravel and earth roads are not regularly maintained. Besides, the hilly and rocky geophysical features of the city as well as the overcrowded informal settlements render it difficult and expensive to provide roads. Implicitly, motor vehicles are competing on few better roads and in the process causing road traffic congestion.

Table 3- 2: Mwanza City's Road Network by Type of Surface

Year	Type of Surface/Km.					
	Tarmac	**Gravel**	**Earth**	**Concrete**	**Stones**	**Total**
2002	14.0	97.7	475.3	-	-	**584.0**
2015	61.1	101.6	699.7	1.3	2.5	**866.2**
% Increase	**336%**	**4%**	**47%**	**-**	**-**	**48%**

Source: *Constructed from MCC (2008) and PMO-MRALC/TOA (2015)*

The traffic congestion in Mwanza city and particularly the CBD, is worsened by narrow roads network of about 28 km. This network is unable to accommodate the motor vehicles that troop the city centre each day. Most of the private vehicles spend the majority of the time parked on narrow CBD streets that had a capacity of 1,396 parking spaces during 2013/14 (JICA, 2015). The situation is worsened by the fact that all roads that could have had double or more lanes, have single lanes. These roads are squeezed by buildings and unplanned vehicle parking on both road sides (JICA, 2015 and Olagunju, 2015). The cost of widening the roads is too high as the buildings along the roads will have to be demolished and owners compensated. The combination of these challenges are plunging the city into further problems of traffic congestion.

6. ***Vehicular growth:*** By comparison, Mwanza City has fewer motor vehicles than Dar es Salaam City. Although statistics on vehicular growth are not available, JICA (2015) suggests that traffic volumes traversing the roads of the city in a single day surged from 200 vehicles per day in 1990 to about 2,300 vehicles by 2014. During the same year, the City had 965 *daladala* buses (PMO-MRALC/TOA, 2015). Each of these vehicles made on average eight (8) trips to and from the city and thus a total of 7,720 trips per day. There were also about 430 heavy duty vehicles (HDV) entering the city per day. Since the 1990s, traffic congestion was increasingly felt particularly in consideration of the narrowness of CBD roads and limited tarmac and concreate roads. In recent years, traffic congestion in the city has been

exacerbated by rapid growth of motorcycles taxis (b*odaboda)* which to a greater extent are driven recklessly. The *daladala, bodaboda*, private cars and small carts competed for passage with about 430 heavy trucks that entered the city each day.

7. ***Poor Public Transport Services:*** Following the Arusha Declaration in 1967, the Government established business and development venture corporations that were entrusted to the district councils. The Mwanza Development Corporation (MWADECO) was established under this line. MWADECO owned a fleet of buses that operated as public buses within Mwanza district. During the 1970s through to the 1980s, MWADECO's public transport services operated parallel with commuter minibuses of 12 to 15 passengers (famously known as *Mbilimbili* as they charged a fare of Shs. 2.00/=) as well as pick-up vans. The minibuses were operating on shorter distances compared to MWADECO buses. These minibuses operated from the town centres to places such as Kilumba, Ilemela, Pasiansi, Nyakato, Mabatini, Igogo and Mkuyuni.

   The entry of minibuses and vans in the public transport business was an indication that MWADECO was no longer capable of providing these services in sync with demand. By mid-1980s, MWADECO had run bankrupt mainly due to mismanagement and waned Government funding. Consequently, there was a surge of private commuter minibuses of 15 to 34 passengers (*daladala)* that entered the public transport business. Since then, the number of these buses has increased tremendously given that this business is attractive to individual investors. Most of these buses either ply to or pass through the CBD daily and thus creating a mayhem of traffic congestion. Besides, the quality of services provided by the *daladala,* is poor as exhibited by overcrowded buses and lack of defined schedules, among others. Consequently, the middle-income earners decide to use private cars the fact which strains further the already bloated city roads.

8. ***Traffic law violations and general indiscipline:*** In Mwanza City, violation of rules and especially traffic rules by motor vehicle and motorcycle drivers is also

rampant. Particularly, traffic rules are violated during morning and evening peak hours. The main culprits of traffic rules violation are *daladala* bus drivers. The creation of extra motor vehicle lanes and taking shortcuts by drivers in a bid to avoid traffic congestion, blocks roads and other motor vehicles.

3.5 IMPACTS OF ROAD TRAFFIC CONGESTION

3.5.1 Economic Impacts

The key negative economic impacts or externalities of road traffic congestion as explained by researchers such as Katala(2012), Kiunsi (2013) and Thwala et al. (2012) are discussed below:

1. ***Longer commuting time:*** On par with congestion, both motorists and passengers spend longer non-productive time caught in traffic ques (Katala, 2012). The non-productive time include wasted time on roads by employees, business people and students. An important factor underlying longer commuting time is related to residential affordability. Housing located further away from CBDs (where most of the employment is located) is more affordable as compared to housing close to the CBD (Thwala et al, 2012). In Dar es Salaam City, people who commute to the CBD daily live as far as Bunju, Madale, Boko, Goba, Mbezi Mwisho and Kibamba in Kinondoni Municipality; Gongo la Mboto, Pugu Kajiungeni, Mwakanga and Chanika in Ilala Municipality; and Mbagala, Kongowe, Charambe, Chamazi and Mbande in Temeke Municipality. These areas are within the perimeter of 25 to 40 km from the city centre. In Mwanza City, a substantial proportion of the population lives in areas that are further away from the CBD. These areas include Igombe, Ilemela, Sangabuye, Buhongwa, and Buswelu in Ilemela Municipality as well as Igoma, Buhongwa, Usagara, Nyegezi and Mkolani in Nyamagana Municipality. These areas are located within the radius of 15 to 25 km from the CBD.

   Katala (2012) estimated time lost on commuting in Dar es Salaam City basing on the wasted time for a given trip relative to the time needed to make the trip at free flow. He postulates that private car, truck and bus drivers each spend an extra one

(1) labour hour on roads due to traffic congestion. This extra hour is counted on the city's motor vehicles plying the roads and daily commuters constituting 82% of the city's the population.The lost time is a tremendous cost on labour productivity and GDP.

2. ***Inability to forecast travel time accurately:*** Due to the unpredictability of the traffic congestions, commuters and motor vehicle drivers allocate more buffer time to travel i.e. "just in case time", and less time on productive activities (Katala, 2012). In both Dar es Salaam and Mwanza cities, residents are compelled to wake-up earlier than normal and leave work either much earlier or late in order to avoid long hours in traffic jams.

3. ***Increased travel costs:*** In both Dar es Salaam and Mwanza cities, commuters of public transport are often forced to disembark from buses to take alternative means of transport namely motorcycle or tricycle taxes in order to arrive at their destinations in time. Although there are no studies that have examined these expenses, they exert a strain on urban residents and especially low income earners. It was estimated by Dias Olvera et al (2008) that such extra expenditure in Dar es Salaam averaged around 9.1% of the household income. These researchers established further that 90% of low income households spend as much as 41.9% of their incomes on transport. The latter expenditure compares with the case of Lagos where commuters spend an average of 40% of their incomes on transportation (Mobereola, 2012).

4. ***Increased fuel consumption:*** Due to increased idling in traffic congestions, motor vehicle drivers are forced to accelerate and brake at very short distances (Katala, 2012). These tendencies lead to increased motor vehicles fuel consumption and the consequential rise in the fuel costs. Particularly, the fuel cost burden is worsen by the fact that most of the imported motor vehicles plying the roads of Dar es Salaam and Mwanza cities are not new but used or second-hand aged over five (5) years. Katala (2012) suggests that in Dar es Salaam a motor

vehicle spends an extra one (1) litre of petrol or diesel fuel a day due to road traffic congestion.

5. ***Wear and tear of vehicles:*** It is suggested further by Katala (2012) that a significant proportion of the cost of wear and tear of vehicles is attributable to idling in traffic jams; frequent acceleration and braking; and damages to motor vehicles due to increased accidents. This situation leads to frequent repairs and replacement of vehicle parts and the consequential increase in vehicle running costs.

6. ***Damage on infrastructure:*** Traffic congestions exert pressure on road infrastructure (Olagunju, 2015). This pressure occurs during peak hours when extra lanes are created by rushing vehicles driven on the road sidelines or when HGV disregarding road weight restrictions. Such violations are common in both Dar es Salaam and Mwanza cities.

7. ***Reduced labour productivity*****:** This cost is in form of stress and fatigue of road users that impact negatively on the working time especially for employees.

8. ***Delay in service delivery:*** Whenever there are traffic congestions, delivery of various services is impaired. For example, perishable food staff from rural areas might rot prior to reaching market places and the consequential loss of business to individuals and the nation at large.

3.5.2 Social Impacts

The negative social peals of traffic congestion are explained as follows:

1. ***Reduced quality of life:*** This social cost of traffic congestion is in form of reduced personal incomes for both public transport commuters and private car users due to increased transportation costs as well as loss of time that could have otherwise been spent on social activities (Kiunsi, 2013). Although in Tanzania this social cost is as yet to be quantified, it could be correctly asserted that it affects the livelihood of almost all households in Dar es Salaam and Mwanza cities.

2. ***Family disintegration:*** It is apparent in both Dar es Salaam and Mwanza cities that there is a growing mistrust of infidelity among couples because of late arrival from places of work caused by traffic congestion. In some cases, such mistrusts have led to separation and divorce (Nelson, 2013).

3. ***Declining parenthood:*** A study conducted by Nelson (2013) in Dar es Salaam, found out that traffic congestions have a high toll on parentage. He establishes that parents had no adequate time for children during week days. In most cases parents were forced to get up early in the morning when children were still asleep, but also they return home very late to find their children already asleep. Consequently, parents lacked time to make follow-ups of children regarding their progress at school and behaviour. Equally, children lacked parental care and guidance and the consequential deterioration of ethics and morals. Similar findings were established by the MRC (2011) in Mauritius.

4. ***Students' performance:*** Day scholar children and students travelling by either public transport or school buses, normally get-up early and arrive home late after school as most of such schools are located far from their places of domicile. These children and students arrive at school and back home tired and sleepy because for long, they are caught in traffic congestions. This situation impacts negatively on their study performance.

5. ***Difficulties for non-motorized transport:*** Due to competition for road space by private cars, commuter buses, motorcycles and tricycles, the mobility of pedestrians and bicycle riders is impaired. Thwala et al (2012) apportions part of the blame on lack of consideration for pedestrians and bicycles in the physical design of infrastructures and facilities. In Dar es Salaam and Mwanza cities and especially in unplanned settlements, most of the roads lack pedestrian walkways. As such, pedestrians and bicycle riders feel unsafe to use roads.

6. ***Spillover effect of congestion:*** This effect occurs when motorists avoid trunk roads to drive on secondary roads and side or informal streets as alternative routes during traffic congestion times. This behaviour which Katala (2012) calls "**rat running"** negatively affects the ambiance and amenities of neighborhoods through which such vehicles pass.

7. ***Diminished social relation:*** At a community level, Nelson (2013) found out that in Dar es Salaam city close social relations among residents are increasingly diminishing due to traffic congestion. He argues that friends, neighbours and relatives do not get enough time to socialize as it used to be in the past.

3.5.3 Health Impacts

The health impacts of traffic congestion primarily occur due to extended exposure to polluted air and unnecessarily long periods spent on roads (Kiunsi, 2013) as well as accidents. These impacts are explained further as follows:

1. ***Diseases****:* Consequent to traffic congestion both motorists and commuters are susceptible to commutable and non-communicable diseases. The two groups of travelers usually experience mental fatigue, stress, rage and frustrations due to prolonged stay in traffic congestion (MRC, 2011 and Katala, 2012). These daily behaviours of travelers turn into health problems such as high blood pressure stress and diabetes.

   Besides, vehicles emit noxious gases such as carbon dioxide, carbon monoxide, nitrogen dioxide and sulphur dioxide that cause respiratory diseases. Such diseases include airway inflammations, bronchitis, bronchial asthma, infections and lung cancer. Again, contagious diseases such as tuberculosis (TB), HIV and skin diseases spread due to long hours in crowed buses. Olagunju (2015) notes that travelers are also exposed to lead poisoning from vehicle emissions occurring due to traffic congestion. The symptoms of such poisoning include, among others, vomiting, constipation, headache, body and weakness. Insomnia which is caused

by early waking and late arrival at home is another health problem related to congestion (Nelson, 2013). Again, long hours on the road and lack of time for exercise for the majority of motor vehicle users also contribute to the problem of obesity. These maladies are on an increase in Dar es Salaam (Nelson, 2013) and probably Mwanza cities.

2. Accidents and safety: Historical statistics on road accidents are not readily available. Data published by the Tanzania Police Force (TPF) in collaboration with NBS in 2016 are presented in **Table 3-3** below:

Table 3- 3: Number of Traffic Offences in Dar es Salaam and Mwanza Police Regions during 2015

Region	Traffic Offences		Road Accidents		Fatalities		Injuries	
	Number	%	Number	%	Number	%	Number	%
Dar es Salaam Zone	410,367	30%	3,574	43%	316	11%	2,167	54%
Mwanza	69,900	5%	206	2%	154	5%	440	11%
Tanzania Mainland	**1,374,518**	**100%**	**8,337**	**100%**	**2,806**	**100%**	**4,006**	**100%**

Source: TPF and NBS (2016)

The above statistics indicate that during the year under reference, Dar es salaam City experienced the highest number of traffic offences, road accidents, fatalities and injuries as compared to Mwanza region. These statistics vindicate Nelson's (2013) assertion that Dar es Salaam City experiences more than a third of road accidents that happen countrywide. This situation is attributed to the fact that about 70% of all motor vehicles in the country operate in Dar es Salaam.

In Dar es Salaam and Mwanza cities, there is a growing number of accidents that are attributed to traffic congestion. Apart from causing traffic delays, accidents cause permanent disabilities and fatalities. In a study undertaken on Mwanza City, (Ngallaba et al., 2014) established that between 2009 and 2012 a total of 3,450 road traffic accident cases were recorded by Sekou Toure and Bugando hospitals. About 2,809 cases equivalent to 87% were caused by motorcycles. The fatality

rate for motorcycle accidents was 5 per cent higher than that of motor vehicle accidents which stood at 24%. These accidents were attributed to reasons of overloading, lack of road signs and posters, poor road conditions, poor vehicle conditions, poor status of the drivers and corruption by Traffic Officers. The other reason was identified as over-speeding of the majority of the drivers in compensation of the lost time in traffic congestion (Nelson, 2013).

In Dar es Salaam City, (Barengo et al., 2006) suggest that between 1999 and 2001 the city recorded a total of 5,985 accidents that caused injuries to 11,234 people and 947 fatalities. Over this period, accidents, injuries and fatalities were increasing in tandem with increase in the number of motor vehicles and road congestion. Injuries and loss of lives cause difficulties for the livelihood of families as well as loss of human resources for the nation.

3. ***Hindrance to emergency services:*** ` Traffic congestions interfere with the passage of emergency vehicles such as medical ambulances with patients and fire tender services.

3.5.4 Environmental Impacts

The documented environmental effects of road traffic congestion in Dar es Salaam and Mwanza cities are provided below:

1. ***Air pollution:*** Motor vehicles are a major source of air pollution (Kamukala, 2011 and ESRF, 2015). In cities of the developing countries, the air pollution problem attributed to motorized modes of transportation is influenced by a number of factors identied by Gorham (2002) as follows:

    (i) Excessive use of motor vehicles.
    (ii) Age of motor vehicles and the technology used.
    (iii) Poor maintenance of motor vehicles.
    (iv) Unavailability and improper use of appropriate fuel.
    (v) Limited use of emission control technologies.

(vi) Near absence of regulation measures.

When motor vehicles, motorcycles and tricycles burn petrol and diesel fuels, they emit pollutants that include lead aerosol, carbon dioxide (CO_2), carbon monoxide, sulfur dioxide, nitrogen dioxidecarcinogens (benzene, butadiene, aldehydes, and polynuclear aromatic) and hydrocarbons gases. Air pollution occurs when these gases are unable to mix into the atmosphere due to heating and light winds. Air pollution leads to the increase of **greenhouse gases** (GHG) in the atmosphere and thus contributing to respiratory related ailments and climate change (Kiunsi, 2013, Thwala et al, 2012 and Olagunju, 2015). The problem of air pollution attributed to traffic congestion is more serious in Dar es Salaam city as compared to Mwanza. In the former city, the sheer numbers of vehicles coupled with overdependence on motorized transport as residences are increasingly becoming far apart from places of work, are raising GHG emission levels. The problem is worsened by the fact that most of the vehicles on roads including *daladala* buses, private cars and heavy goods trucks, are over 5 years old.

In 2013, it was estimated thatTanzania generated greenhouse gas emissions of 1.55 tonnes of carbon dioxide (CO_2) per person annually which were mainly from vehicles (ESRF, 2015). Although, this level was far below the emissions produced by the Group of 7 countries that averaged 11.82 tonnes CO_2 per person annually, it was higher than that of the sub-Saharan Africa that averaged 0.80 tCO_2 per person (ESRF, 2015). As provided in **Table 3-4** below, the GHG emissions in both Dar es Salaam and Mwanza cities are expected to increase *peri pasu* with the growth of GDP and population.

Table 3- 4: Estimated Absolute GDP, GHG Emissions and Population in Dar es Salaam and Mwanza Cities for 2013 and 2030

City	GDP (USD bil.)		Population (million)		Emissions (in mil. tonnes of CO_2)	
	2013	2030	2013	2030	2013	2030
Dar es Salaam	12.6	48.7	3.0	6.8	4.3	9.3
Mwanza	1.2	4.8	0.3	0.7	0.7	1.5

Source: *ESRF (2015)*

Further evidence on air pollution in the two cities is provided through a worldwide survey conducted by the NUMBEO website which monitors the air quality index (AQI) and air pollution index (API) on daily basis. The indices of the two parameters are measured within the range of 0.00: Very low and 100.00: Very high. The recorded indices for the two cities are presented in **Table 3-5** below:

Table 3- 5: Air Quality Surveys for Dar es Salaam and Mwanza Cities

City	Date of Survey	Air Quality	Air Pollution
Dar es Salaam	August, 2017	33.94 (Low)	67.04 (High)
Mwanza	March, 2017	66.67 (High)	33.33 (Low)

Source: *https//www.numbero.co/pollution/in/Dar-Es-Salaam and https//www.numbero.co/pollution/in/Mwanza*

Despite that the way the survey is undertaken might raise some questions of subjectivity, it is apparent that the air quality in Mwanza city is far better as compared to that of Dar es Salaam city. The latter city has far a bigger number of motor vehicles. The problem of unlimited motor vehicle emission levels in Tanzania, is likely to stay longer. Currently, the country has not put in place a mechanism to enforce the regulations that require every vehicle on the road to be tested regularly for emission levels after TBS has inspected them on entry (Haule, 2015).

2. Noise pollution: This type of pollution is generated by speeding and defective motor vehicles. Noise pollution is increasingly becoming a serious nuisance to the quality of life and even to the health of urban population in Dar es Salaam and Mwanza cities and especially those living along major roads (Nelson, 2013). If unabated, these nuisances will continue to have negative long-term ramifications on the quality of the inhabitants of the two cities.

3.6 Cost of Road Traffic Congestion for Dar es Salaam City

Although in Tanzania the problem of traffic congestion facing the fast growing cities is widely acknowledged, there have been few attempts to estimate its costs. In the recent past some congestion costing attempts were undertaken by Katala (2012) and Mfinanga & Fungo, 2013) for Dar es Salaam City. However, for Mwanza City, such attempts are still lacking. In view of this limitation, the congestion costs presented in this section are for Dar es Salaam City only.

Researchers who attempted to measure the cost of road traffic congestion used a number of parameters and models to estimate both internal and external costs of traffic congestion. The internal costs are considered to be borne by motorists. These costs include **vehicle operating cost, travel time**, and **crash cost**. The external costs that are taken to be more important than the internal ones, involve costs which vehicles impose on other motorists and commuters. It is worth noting that, traffic congestion costs incurred are both tangible and intangible to individual road users as well as the society at large.

According to (Grant-Muller and James Laird, 2006), economists measure the cost of traffic congestion through three approaches. First, the **marginal cost** of congestion approach which internalizes both the short- and long-run marginal costs of a single additional vehicle trip (or vehicle-km) on total transport costs. Second, **total cost of congestion** approach which involves the calculation of the cost of congestion in reference from a state of zero congestion. Third, the **excess burden of congestion** which involves the comparison of the cost of congestion in the current traffic state with

the state of traffic that would be expected with optimal prices in place (optimal to maximizing economic output). These three approaches are expected to lead to obtaining more or less similar costs of congestion.

Katala (2012) while estimating the cost of congestion in Dar es Salaam City, seems to have employed the Grant-Muller and Laird's total cost of congestion approach. According to Katala (2012), the measurement and pricing of congestion costs on cross-town link roads are based on two key components that are outlined below:

1. ***Economic costs and welfare losses:*** The calculation of these costs is based on the following variables:
    (i) Value of the time (VOT) lost due to reductions in traffic speed caused by current congestion;
    (ii) Value of increased depreciation of vehicles and additional fuel consumption;
    (iii) Comparative disadvantage for location of economic activities; and
    (iv) Valuation of material damage arising from congestion-related accidents.

2. ***Environmental costs and loss of welfare:*** The calculation of these costs is based on the following variables:

    (i) Costs and welfare losses arising from noise associated with traffic congestion on cross-town link roads;
    (ii) Costs and welfare losses from noxious gas emissions associated with traffic congestion on urban roads;
    (iii) Costs and welfare losses inherent in exposure to risks from the transportation of hazardous goods; and
    (iv) Costs and welfare losses arising from the barrier effect caused by heavy traffic on roads.

On the basis of foregoing cost elements, Katala (2012) calculated the cost of traffic congestion as follows:

1. ***Cost of VOT lost:*** The cost of VOT lost was calculated on the basis of the following assumptions:
    (i) Private car waste one (1) hour per day due to traffic congestion.
    (ii) An employee spends 50% of average cost for one (1) labor hour and leisure time equivalent to 10% of average cost for one (1) labor hour.
    (iii) Truck and bus spend one (1) hour i.e. 50% of average cost of daily revenue divided by average daily vehicle operating hours.
    (iv) There were 150,000 private cars and 10,000 trucks and buses plying the roads of Dar es Salaam City per day.
    (v) One (1) average labor hour for a person in a private car was worth TAS.4,000/= and for a commercial vehicles it was worth TAS.15,000/=.
    (vi) Active days were assumed to be 300 days in a year.

    The one (1) hour labour time lost while traveling established by Katala (2012) is not far from the average passenger travel time on Dar es Salaam routes of 61.7 minutes and average passenger waiting time of 18.44 minutes established by SUMATRA (2011). From the above assertion, Katala (2012) suggested that the total cost for the VOT lost through traffic congestion in the year was about TAS. 360.0 billion for private cars and TAS. 90.0 billion for commercial vehicles. That is, the total cost for the VOT lost in traffic congestion was **TAS. 450.0 billion** per year.

2. ***Cost of fuel consumption:*** In estimating the cost of fuel consumption, Katala assumed that each vehicle uses an extra 1.0 litre of fuel per day due to traffic congestion. He assumes further that, in a year a total of approximately 100 liters of fuel is wasted. At a price of fuel of TAS. 2,050.00 per litre; an active year of 300 days; and 150,000 private cars and 10,000 trucks and buses, the total cost of fuel attributed to traffic congestion was estimated at **TAS. 205.0 billion** per year.

3. Cost of road accidents: In estimating the cost of road accidents Katala (3012) used the **human capital (HC) approach** rather than the **willingness to pay (WTP) approach** and **insurance company (IC) approach.** The adopted approach involves calculation of what an accident costs to those involved. The general cost elements used in this approach were as follows:

(i) Loss of future economic productivity due to death or injury in a road accident.

(ii) Cost of medical treatment and rehabilitation in all stages during and after the accident.

(iii) Property damage caused by the accident to vehicles, personal property and external damages.

(iv) Cost of services related to the accident: Insurance, emergency services, police and judicial costs, social care, etc.

(v) Cost in money terms for "grief, pain and suffering" to the persons and relatives involved.

Katala (2012) further categorized the average cost of accident by severity (all costs inclusive) into four groups as outlined below:

(i) Fatal accident;

(ii) Severe injury accident;

(iii) Slight injury accident; and

(iv) Property damage only accident.

The resultant countrywide costs of accidents during the year under review were as presented in **Table3-6** below:

Table 3- 6: Cost of Accidents in Tanzania during 2011 (in TAS.)

Type of Accident	Cost per Accident	Number of Accidents	Total Cost
Fatal Accidents	100,000,000	3,582	358,200,000,000
Injury accidents	5,000,000	21,000	105,000,000,000
Property damage only accidents	100,000	15,000	1,500,000,000
Total			464,700,000,000

Source: Adopted from Katala (2012)

Since Dar es Salaam City experiences about a third of the accidents countrywide, Katala (2012) asserts that during the year under reference, the city recorded the loss of around **TAS. 150 billion**. The grand total financial and welfare costs attributed to road traffic for Dar es Salaam City, was estimated at **TAS. 805.0 billion.** Katala (2012) argues that if such lost resources could be saved, they could be deployed to develop the infrastructure. While Katala (2012) didn't include cost attributable to environment pollution, he identified hidden economic costs of traffic congestion. These costs include negative externalities on production and consumption of products and services; trade and development; and economic growth and efficiency.

The other study on the cost of road traffic congestion in Dar es Salaam City was undertaken by Mfinanga and Fungo (2013). These researchers used the **deterministic queuing analysis** and **shock wave analysis** to estimate the excess time spent by motor vehicles on arterial roads due to traffic congestion during morning and evening peak periods. The analysis focused on incidences of traffic delays namely, vehicle accidents and vehicle breakdowns. These researchers divided the city in three zones as follows:

Zone 1: The southern part of the city which covers most of Temeke District. It includes Mbagala, Vingunguti, Airport, Chan'gombe, TAZARA and nearby areas. The major roads in this zone include parts of Nelson Mandela, Nyerere and Kilwa Roads.

Zone 2: The central part of the city covering most of the Ilala District. It includes the city centre, Tabata, Kariakoo, Ubungo, Manzese, Magomeni and neighboring areas. The major roads in this zone include parts of Nelson Mandela, Nyerere Road, Kawawa and Morogoro Roads.

Zone 3: The northern part of the city that covers mostly the Kinondoni District. The zone includes Mwenge, Kawawa, Kawe, Msasani, Upanga, University of Dar es Salaam and neighbouring areas. The major roads in this zone include Sam Nujoma, Ali Hassan Mwinyi, Old and New Bagamoyo Roads and part of Kawawa Road.

In the analysis, Mfinanga and Fungo (2013) established that along roads in zone 1, 2 and 3, motor vehicles delayed for an average of 10, 9 and 7 minutes respectively for each trip made. In other words, roads in zone 1 which were found to be traversed by 2,599 vehicles and incidences lasting for a total of 45 minutes, had an average of 446 vehicle-hours delays. Zone 2 with an average of 2,934 vehicles and a total 52 minutes incidents, was found to have an average delay of 433 of vehicle-hours. Zone 3 with an average of 3,264 vehicles and 40 minutes delay incidents, had an average total delay of 375 vehicle hours. The total average delay time due to incidents that cause traffic congestion on the City's investigated major roads, was a walloping 1,272 vehicle-hours a day. However, these delays did not involve district, feeder and urban roads that feed the major roads with vehicles.

3.7 CONCLUSION

This chapter has provided other researchers' empirical evidences on the nature of road traffic congestion in Tanzania's urban areas in general and Dar es Salaam and Mwanza cities in particular. The situational analysis of traffic congestion is well documented for the former city as compared to the latter. The analysis on the context of traffic congestion in the two cities that follows in respect of causes, effects and economic costs of congestion, builds on the findings of other researchers.

CHAPTER FOUR

TRAFFIC MANAGEMENT INSTITUTIONAL SET-UP AND GOVERNMENT EFFORTS TO ADDRESS ROAD CONGESTION IN DAR ES SALAAM AND MWANZA CITIES

4.1 INTRODUCTION

The role of road traffic control, management and safety in Tanzania is divided among different stakeholders that are guided by different legislations and policies. These stakeholders and respective legislations are presented in the following discussion.

4.2 INSTITUTIONAL SET-UP OF TRAFFIC MANAGEMENT, CONTROL AND SAFETY

4.2.1 Ministry of Home Affairs (MHA)

This Ministry is charged with the role of administering the Road Traffic Act (Amended) No. 30 of 1973. This Act confers the power to Traffic Police Department (TPD) which is under the MHA to oversee issues related to road safety, control and management (JICA, 2008 and SUMATRA, 2011). The major regulatory instruments in this respect include vehicle inspection (Section 82); certification of drivers (Section 19); registration of motor vehicles (Section 3); and attending to road accidents (Section 40). Other roles of the TPD under this Act include setting of traffic signals and signs; traffic markings; restriction of traffic on roads; making regulations of temporary speed restrictions; closure of roads; restriction of use of one-way traffic; and setting aside parts of a road as special parking areas.

4.2.2 Ministry of Works, Transport and Communication (MWTC)

This Ministry undertakes the role of road traffic management, control and safety through the Road Act No. 30, 2007. The legislation is a tool for the road authority to regulate traffic in case of construction works, maintenance works, and for preserving road structures. Besides, this Act confers the road authority powers to control and manage traffic. As regards to road safety, Part 5 of the Road Act requires the road

authority to undertake the installation of road signs by relevant authorities; provide specification of road speed limits as determined by the responsible Minister; and ensure safety of road users during design, construction, upgrading and use of roads.

The MWCT has two departments that deal with traffic management namely, the Department of Road Safety and the Department of Transport. The former department oversees the execution of the National Road Safety Policy (NRSP) of 2009 by making plans for the traffic management and road safety. Particularly, through this policy government sought to address weaknesses in road use by establishing a Driver and Vehicle Examination and Licensing Agency (DVELA) with legal mandate to oversee the certification system for drivers and vehicle roadworthiness. The latter department oversees the execution of the National Transport Policy (NTP) of 2003 which is concerned with the regulation on transport services.

The MWTC's key role player institutions are as follows:

1. Roads Fund Board: This Board is responsible for enforcing the Road Tolls Act (Amendment) No. 2 of 1988 through which the road maintenance and construction financial resources are garnered. The source of these resources include, roads tolls imposed on diesel and petrol; transit fees; heavy vehicle licensing; vehicle overloading penalties; and other sources as may be determined by the Parliament. It is noteworthy that the fuel levy accounts for over 95% of the road funds.

2. TANROADS: The Tanzania National Roads Agency (TANROADS) established in 2000 is charged with the responsibility of managing the countrywide trunk and regional road network. Currently, this network has a total length of 33,012 km. In execution of this responsibility, TANROADS is guided by the Road Act No. 30 of 2007. As a road administrative body, TANROADS prepares guidelines, standards and specifications for road works and performance. Regarding the road management role, the Agency is responsible for traffic control and management through the activities of controlling overloading of trucks; temporary regulation of

traffic during road works and disasters; and regulation of traffic to protect the road structures and surfaces (JICA, 2008).

3. SUMATRA: The role of SUMATRA in respect of road traffic management is provided under the SUMATRA Act No 9 of 2001.Under this role the Authority is responsible for promoting, facilitating and ensuring availability of efficient, safe, fair, reliable and environmentally friendly transportation services in the surface and maritime transport sub-sectors. Section 6 (1) of the Act and the Transport Licensing Act No 1, 1973 convey SUMATRA with powers relating to traffic management as a licenser of passenger service vehicles (PSV) or buses with the carrying capacity of seven persons and above. Under this role SUMATRA has to ensure that legitimate buses are in service; loading and offloading of passengers are efficiently conducted at designated bus bays without hindrance to other traffic; drivers of buses especially *daladala* follow established road rules; and buses are well maintained and are clean (JICA, 2008). SUMATRA is also authorized to license goods carrying vehicles.

4.2.3 President's Office - Regional Administration and Local Government (PO-RALG)

The RALG ministry which was formerly under the Prime Minister's Office (PMO) is currently under the President's Office. The Ministry is involved in the activities of road management through Local Government (Urban Authorities) Act No. 8 of 1982. Section 55 (1) (h) (n) of this Act stipulates the duties of local governments with respect to provision of public transport. Section 75 of the same legislation spells out that local government can provide urban transport services. The key role players are the City, Municipal, Town and District Councils. These Councils are charged with the responsibility of advising the central government and its institutions on short and long term plans related to road transport as well as the physical (land) planning in areas of their jurisdiction. The other key roles bestowed on the councils include construction and maintenance of urban road infrastructure; construction and operations of bus

terminals; issuance of licenses to taxi and parking spaces; and provision of ferry services.

Currently, Dar es Salaam City Council (DCC) has five (5) municipalities namely Temeke, Ilala, Kinondoni, Ubungo and Kigamboni. Mwanza City Council (MCC) has two municipalities namely Nyamagana and Ilemela. The city councils' Works, Fire and Rescue Service Departments are responsible for the management of road rescue operations. Save for the Nyamagana Municipal Council, since 2000 the functions of road management are undertaken by the municipalities.

4.2.4 Ministry of Finance and Economic Affairs (MFEA)

This ministry is responsible for tax policies. Through TRA, the ministry undertakes the role of collecting revenues from vehicle registration fees; registration of vehicles through its central motor vehicle registration system; collection of driver licensing fees; regulating insurance matters; renewal of driving licenses; and collection of driver license renewal fees.

4.2.5 Ministry of Trade, Industry and Marketing (MTIM)

The MTIM is responsible for setting and enforcing standards for all imports including motor vehicles. The ministry undertakes this role through the **Tanzania Bureau of Standards (TBS)** which was initially established through the repealed Standards Act No. 3 of 1975. The present Standards Act No. 2 of 2009 confers powers to TBS to set, modify and nullify standards including those of motor vehicles. Through Tanzania Standards Nos. TZS 983:2007, TZS 698:2007 and TZS 698:2012 the Bureau is empowered to limit the noxious gases emitted by motor vehicles.

4.2.6 Vice President's Office (VPO)

The VPO through the Ministry of State for Environment is responsible for environment management matters. Also NEMC which was established by the Environmental Management Act (EMA), 2004 that replaced the National Environment Management Act No. 19 of 1983 reports to this Office. This Council is responsible for overseeing the

environmental management issues. In its role, it is guided by the National Environmental Management Policy (NEMP) of 1997 and the Environmental Management Regulations (EMR) of 2007. Through Section 141 and 142 of the EMA, 2007, NEMC is mandated to enforce environmental quality standards including levels of air pollution generated by motor vehicles.

4.2.7 Dar Rapid Transit (DART) Agency

DART Agency was established through GN No. 120 of 2007 under the Executive Agency Act No. 30 of 1997 for the purpose of prompting modern and efficient urban transport system in Dar es Salaam City. The key role of the DART Agency is to establish and operate the Bus Rapid Transit (BRT) system for Dar es Salaam in order to ensure orderly flow of traffic on urban streets and roads. Under this role, the Agency successfully oversaw the construction of BRT Kimara-Kivukoni, Kawawa-Magomeni and Fire-Gerezani roads under Phase I of the project. This phase was completed at the cost of TAS.403.5 billion co-funded by the Government of Tanzania (TAS.86.5 billion) and the World Bank's soft loan (TAS.317.0 billion).

4.2.8 Usafiri Dar es Salaam Rapid Transit (UDA-RT)

UDA-RT is a consortium formed by the Simon Group that owns UDA and Dar es Salaam Commuter Bus Owners Association (DARCOBOA). This consortium operates the BRT routes of Kimara- Kivukoni, Kimara-Gerezani, Kawawa-Kivukoni and Kawawa-Gerezani as an interim service provider (ISP). While Simon Group invested in purchasing buses and running the logistics, the Government through DART invested in road infrastructure development. UDA-RT is currently operating a fleet of 148 articulated buses with a capacity of 140 passengers each and 100 large buses with capacities of 60 passengers.

4.3 Level of Coordination among Key Traffic Management Actors

As presented above, road traffic planning, management and control responsibilities are undertaken by a multiplicity of actors that are guided by different legal mandates and policy frameworks. As such, these responsibilities are scattered among the

Ministries responsible for Transport and Works, Home Affairs, Finance and PO-RALC, among others. These actors lack a coherent policy to guide them towards a common goal. Some of the disadvantages of the current institutional arrangement include overlapping or duplication of roles, responsibilities, efforts, authorities, and lines of accountability (URT, 2003). The effects of these inadequacies include malpractices especially in design and construction of roads; traffic and road crash management; erosion of accountability in respect of road safety; erosion of efficiency in traffic management and safety; and inability to reduce road crashes, fatalities and injuries (URT, 2003 and URT, 2009).

The present institutional set-up, is indicative of lack of formal coordination of efforts that would bring about coordinated and integrated traffic control and management for greater effectiveness and efficiency. Efforts devoted to traffic decongestion of the two cities are still disjointed and to a large extent uncoordinated. Therefore, there is a need to streamline functions and increase coordination among these actors through a formal legal forum and a coherent policy that can link diverse traffic management roles, policies and legislations. Such a forum could be able to improve the overlapping and often ineffective organizational approach to traffic control and management as well as public transport.

4.4 INITIATIVES TO REDUCE TRAFFIC CONGESTION

The Government through its institutions such as Municipal Councils, TANROADS, Police Department and DART Agency has been pursuing various avenues in order to ease traffic congestion on Dar es Salaam and Mwanza Cities' roads. Some of the initiatives in each of the two cities are explained below.

4.4.1 Dar es Salaam City

The Government through the DCC and the three (now five) municipal councils has been investing in both infrastructure development and traffic management. The efforts taken this far are as follows:

1. ***The improvement of road network:*** This network includes trunk, regional and urban roads improved through maintenance and construction; notably, the

upgrading of one-lane for one-direction to two-lanes one-direction roads. Such roads include Kilwa Road (Port-Mbagala Rangi Tatu section), New Bagamoyo Road (Mwenge-Tegeta section and Mwenge-Kawawa Road section). Resurfacing of the four lane Mandela Road (Port-Ubungo section) and extra lane expansion of New Bagamoyo Road on Mwenge-Kawawa section.

2. ***Construction of the ring roads:*** The roads include Jangwani-Kigogo-Tabata Dampo to join the Tabata-Segerea and the outer road of Majumba Sita-Segerea-Mbezi Mwisho-Tangi Bovu Road and the Tangi Bovu-Rainbow road section that complete the ring by joining Mwai Kibaki and New Bagamoyo roads.

3. ***Bus Rapid Transit (BRT) Project:*** The project involves the development of the Bus Rapid Transit (BRT) project in line with the JICA's Dar es Salaam City Transport Master Plan, 2030. The project is implemented under six (6) phases consisting of 130.3 km of segregated bus-ways that run in the middle of the road corridors, 18 terminals and 228 stations. The project's objective is to ensure orderly flow of traffic on the city streets and roads by increasing the level of mobility, improving public urban transport, promoting the use of non-motorized transport, and meet the ever increasing travel demand of the city residents. The ultimate aim of this project is to increase comfort and quality of life for the city residents as well as fostering orderly urban development. At completion, the project is planned to cover over 90% of the city's population. The coverage of the six (6) phases is provided in **Map 4.1** below:

Map 4.1: Coverage of Dar Rapid Transit (DART) Project

Source: *Adopted from JICA Report (2008)*

Phase 1 of the project involved the construction of 20.9 kilometres of segregated bus-ways, 27 stations, 5 terminals, 6 feeder stations and 2 bus depots along Morogoro, Kawawa North, Msimbazi Street, Kivukoni Front roads. The phase was commissioned for implementation in April, 2016, having been completed in December, 2015 and launched into operation during May, 2016. This phase was funded by the World Bank and the government of the URT at a cost of USD. 290.0 million.

The completed phase has a capacity of transporting between 350,000 and 406,000 passengers per day. The system uses articulated high occupancy buses with a capacity of 140 passengers and large buses with a capacity of 60 passengers. Currently, the entire system is operated by Usafiri Dar es Salaam Rapid Transit (UDA-RT) through an interim license under the regulation of SUMATRA. UDA-RT is a special purpose company formed by UDA (owned by Simon Group) and the daladala associations namely, Dar es Salaam Commuter Bus Owners Association (DARCOBOA). The system provides express and normal services for 18 hours daily

from 05:00 am to 11:00 pm. During peak hours BRT system operates at 200% to 250% carrying capacity. This system has considerably eased traffic congestion on the respective roads and neighbouring roads and substantially reduced travelling time for commuters by 40-70%.

4. ***Enhancement of the railway systems:*** This involves the construction of standard gauge railway (SGR) on the central corridor, planned rehabilitation of the existing railway systems (TAZARA and TRL) and construction of Kwala Dry Port for the purpose of improving cargo transport from and to the Dar es Salaam port.

5. ***Improvement of traffic lights and signals:*** The improvement of the traffic lights and signals on roads is in line with the recommendations provided in the JICA Report (2008).

6. ***Introduction of one way roads in the CBD:*** The pertinent roads include Samora Avenue, Sokoine Drive and Makunganya Road.

7. ***Restriction of microbuses from CBD:*** In 2006 SUMATRA prohibited low capacity minibuses (*daladalas)* from entering the CBD.

8. ***Provision of new daladala terminals:*** Relocation of public bus terminals from Ubungo to Mawasiliano and Mbezi Mwisho areas.

9. ***Construction of flyovers:*** The under way construction of a flyover at TAZARA (Mandela-Nyerere roads intersection) and Ubungo interchange (Mandela-Morogoro-Sam Nujoma intersection). Other flyovers are planned for Magomeni, Fire, Chang'ombe and KAMATA junctions.

10. ***Deployment of Traffic Police:*** Increased presence of Traffic Police officers to regulate traffic flows especially during peak periods and enforce road traffic laws and regulations.

11. ***Dar es Salaam Metropolitan Development Project (DMDP*)*:*** The DMDP, 2013-25 is being implemented under the PO-MRALG. This project which is financed by a USD.331.0 million World Bank loan, is aimed at supporting the City in addressing its key urbanization challenges. The project components include institutional capacity building; development of infrastructure in unplanned settlements; storm water drainage improvements; improvement of local roads; solid waste management; rail and marine transport; and public private partnership initiatives.

12. ***JICA (2008) Transport Master Plan for Dar es Salaam City, 2030:*** This plan prepared in collaboration with DCC is aimed at identifying short term, medium term and long term solutions to transportation problems in the City. Phase II of this plan that will include non-road transport services is underway.

13. ***Dar es Salaam City Master Plan, 2035:*** This plan is currently being prepared by Singapore based M/s Singapore Co-operation Enterprise (SCE) and Surbana International Consults Pte Limited.

14. ***Satellite towns:*** These towns are currently being developed in the City's outskirts. Such satellites include the ongoing Luguruni, Kawe and Kigamboni that are developed by the National Housing Corporation (NHC).

4.4.2 Mwanza City

The MCC and its two municipal councils, has also been taking a number of steps in order to decongest traffic on its roads through planning and implementation initiatives. According to PMO-MRALG/TOA (2015) some of the initiatives are as follows:

1. ***Stakeholders' cooperation:*** The cooperation between the TANROADS and the City Council in implementing the road improvement efforts.

2. ***Formation of City Transportation Committee:*** Effective cooperation between the Councils and the Regional Traffic Police Office resulted into the formation of the City Transportation Committee. This Committee meets monthly to appraise road traffic and transportation issues.

3. ***Effective road funds management:*** Prudent utilization of funds from World Bank and DANIDA that facilitated effective and efficient construction of tarmac roads within and outside the CBD thereby reducing motor vehicle travel time.

4. ***Provision of traffic information to travelers:*** There have been collaborative initiatives among MCC, City Radio FM 90.2 and Barmedas Television to monitor and announce vehicular movements and problems in the City especially during traffic congestion periods and accidents as well as alerting commuters on alternative routes to take. The TV station has cameras and screens in various locations that are used to monitor traffic movements and provide traffic information.

5. ***New parking spaces for trucks:*** The MCC established new cargo trucks parking lots at Buhongwa and Nyamhongolo for the purpose of limiting trucks of above 10 tonnes to ply on CBD roads.

6. ***Road network improvements:*** The City embarked on construction of more roads including ring roads at asphalt concrete standard and upgrading feeder roads. Such roads include a 23.7 km Mkuyuni–Maina–Nyakato, Isamilo–Mji Mwema Road that connects the CBD with Ilemela Municipality as well as Sanga–Kilolelí Road, Bugando–Bugarika–Mwananchi Road. Other roads with bus parking stands that were improved include Sukuma Road, Boma Road, Pamba Road, Uzinza Road, Temple Street, Vijana Road, Rwagasore–

Lumumba Connection Road, Kamanga Bypass and Capri Point Road, Mabatini–Nyamuge–Nyasaka (at the junction of Pansiansi–Buzuruga Road). These roads constructed under the Tanzania Strategic Cities Programme (TSCP) during 2014/2015, costed USD. 27.0 million. The other roads constructed under this programme during 2012/13 are Liberty Road, Karuta Road, Pepsi Loop, Mkuyuni–Butimba Roads and Tunza-Airport Loop. The Mwanza–Musoma Road between City Centre and Buzuruga was widened from two to three lanes.

7. ***Other infrastructure development initiatives:*** These initiatives include creation of new *daladala* routes, bus stands, establishment of new workshop sites, parking areas and business centres outside the CBD. The other initiative involved theconstruction of stone-paved roads in unplanned settlements toopen up motor vehicle transportation especially the Bugando- Igogo road.

8. ***Law enforcement:*** The MCC has been enforcing the 2002 bylaws for effective use of city road network by all types of moving vehicles, parked vehicles and other road users.

9. ***New terminals for regional buses:*** The MCC established two terminals outside the CBD zone for buses from other regions at Buzuruga and Nyegezi.

10. ***Construction of pedestrian flyovers:*** These flyovers were constructed at Mabatini and Ghana areas for the purpose of improving the safety of pedestrians and traffic flows on respective roads. .

11. ***Introduction of one way roads:*** The one way designated roads include Rwagasore, Lumumba, Regional Drive and Sheik Amin Roads. This initiative was aimed at allowing for parking spaces and smoother vehicle flows.

12. ***Vehicle parking fees:*** The introduction of the motor vehicle parking fees was meant to discourage long time parking by motorists.

13. ***Satellite towns:*** The MCC is planning to develop non-residential satellite towns in the outskirts of the city at Buhongwa, Nyamhongolo and Luchelele areas.

14. ***Mwanza City Master Plan, 2035:*** This plan is currently under preparation by Singapore based M/s Singapore Co-operation Enterprise (SCE) and Surbana International Consults Pte Limited.

While the above initiatives are a step towards the right direction, they have been unable to ease the pressure of traffic congestion on Mwanza City roads. This inadequacy is mainly attributed to the fact that the road infrastructure is still insufficient in the light of unrelenting population and vehicular growth. The underway Mwanza City Master Plan, 2035 is expected to address the bottlenecks that cause traffic congestion.

4.5 CONCLUSION

The review of the traffic management institutional set-up and government initiatives to mitigate traffic congestion in Dar es Salaam and Mwanza cities, is meant to provide an understanding on the views of other researchers. This chapter therefore, sets the platform for analysis of the information and data on the subject matter obtained from the residents of the two cities as presented in Part Two of this report.

PART TWO: ANALYSES AND FINDINGS

CHAPTER FIVE

NATURE AND CAUSES OF ROAD TRAFFIC CONGESTION IN DAR ES SALAAM AND MWANZA CITIES

5.1 INTRODUCTION

This chapter presents the findings on surveys conducted on the general public in Dar es Salaam and Mwanza cities for the purpose of investigating, among others, the nature of traffic congestion; causes of road traffic congestion; and its impact. The data was gathered from diverse groups of respondents sampled in the five municipal councils in Dar es Salaam and two in Mwanza cities. These groups were constituted by road users and both public and private institutional stakeholders. Public stakeholders included a number of Ministries and government agencies. The later institutions included TPD, TANROADS, SUMATRA and EWURA, TAZARA, NEMC, TPA, TRL, RAHCO and TEMESA. Private institutions, among others, included UDA/Simon Group and AZAM Marine in Dar es Salaam as well as Kamanga Ferry Ltd, Songoro MarineTransport Ltd and Nyahonge Marine Xpress in Mwanza city.

As indicated in Section 2.3.4 above, during the process of data collection, a total 2,044 questionnaires and interview guides for road users were distributed in the two study cities. That is 1,330 and 714 for Dar es Salaam and Mwanza respectively. Out of these interview guides a total of 1,884 equivalent to 94.2% of the target sample size of 2,000 were completed and returned by road users. Of these interviews, 692 (36.9%) were from Mwanza city and 1,182 (63.1%) were from Dar es Salaam city.

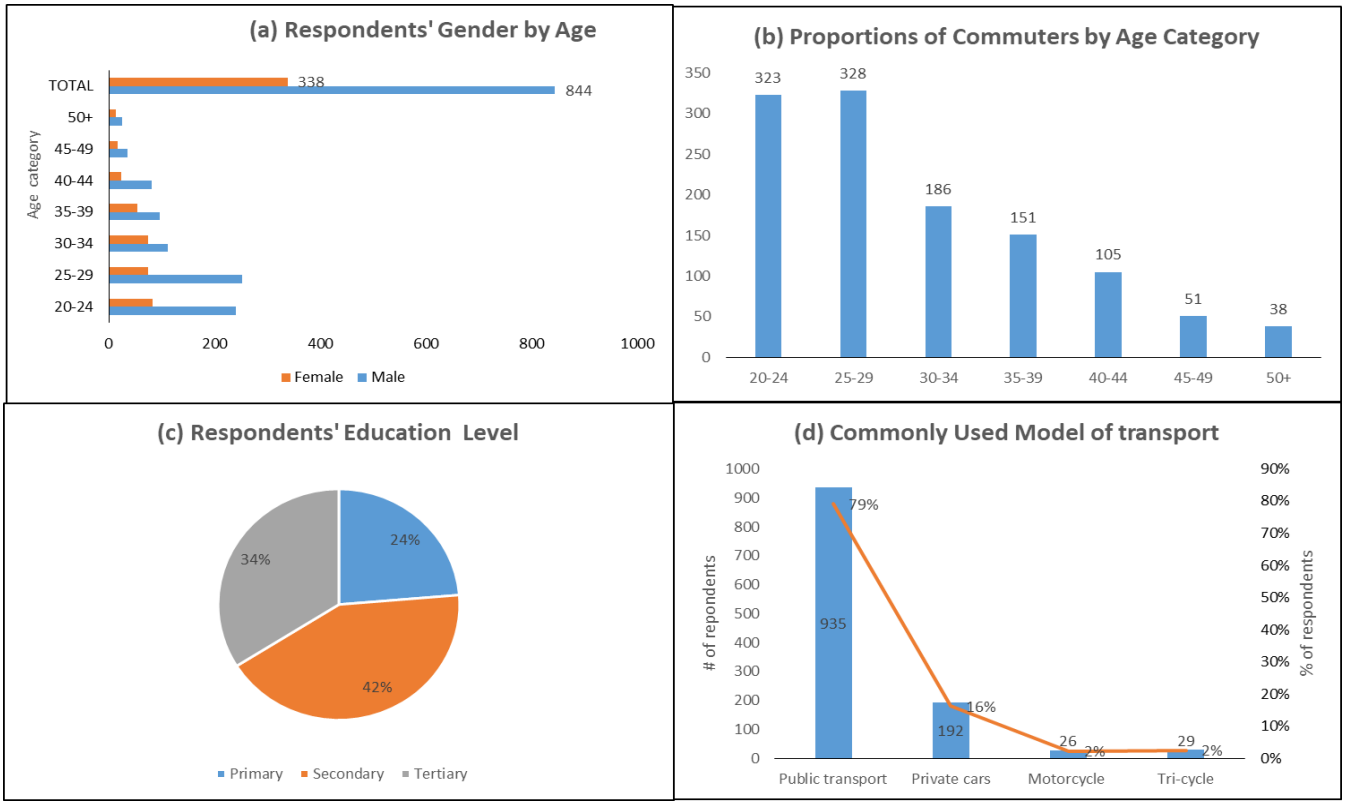
In accordance with the TOR, the data collection tools was structured in such a way that they were to capture both the general and city - specific causes of road traffic congestion. Relevant to this chapter, are the findings on profile of respondents; nature of traffic congestion; general or common causes of road traffic congestion; and causes of congestion that are specific to Dar es Salaam and Mwanza cities.

5.2 DAR ES SALAAM CITY

5.2.1 General Profile of the Respondents in Dar es Salaam City

Road users were classified in accordance with sex, age, occupation, marital status, levels of education and commonly used modes of transport. This information was deemed useful for backing-up proposals on policy interventions. The statistics on the respondents' characteristics in Dar es Salaam city are presented in **Appendix 5.1** while the key results are graphically presented in **Figure 5-1** below:

Figure 5-1(a-d)-: Profile of Dar es Salaam City Respondents



Source: Road Users' Survey data, 2017

The key characteristics of Dar es Salaam city's 1,182 respondents presented in the above Figure were as follows:

- The majority of respondents (71%) were males who were mainly young falling within the age band of 20-34 years. Female respondents were few as they were not forthcoming in respect of responding to questionnaires and interviews.
- About 76% of respondents had attained a minimum of secondary school education and thus were enlightened enough to provide dependable answers.

- 53% of respondents were single, 45% were married while 2% were divorced.
- 33% respondents were employed, 47% were self-employed and 20% were students.
- The majority of respondents (79%) used public transport (daladala) while 16% used private cars and the rest used either motorcycles or tricycles.
- The biggest commuting group was constituted by young respondents aged 20-39 years (71%).

5.2.2 Public and Private Sector Stakeholders Consulted in Dar es Salaam City

A total of 91 public and private sector stakeholders were consulted as provided in **Table 5-1** below:

Table 5-1: Categories of Interviewees from Public and Private Sectors in Dar es SalaamCity

S/NO	Stakeholder's Affiliation	Number	Percentage
1.	Ministries	4	4%
2.	TAMISEMI (PO-RALG)	2	2%
3.	Municipal Councils	3	3%
4.	TRA	1	1%
5.	Traffic Police	45	50%
6.	SUMATRA	2	2%
7.	TEMESA	1	1%
8.	EWURA	1	1%
9.	TAZARA	1	1%
10.	TRL/RAHCO	2	2%
11.	Temeke Hospital	1	1%
12.	NEMC	1	1%
13.	Government Chemist & Laboratory Agency	1	1%
14.	Private sector	26	28%
	Total	**91**	**100%**

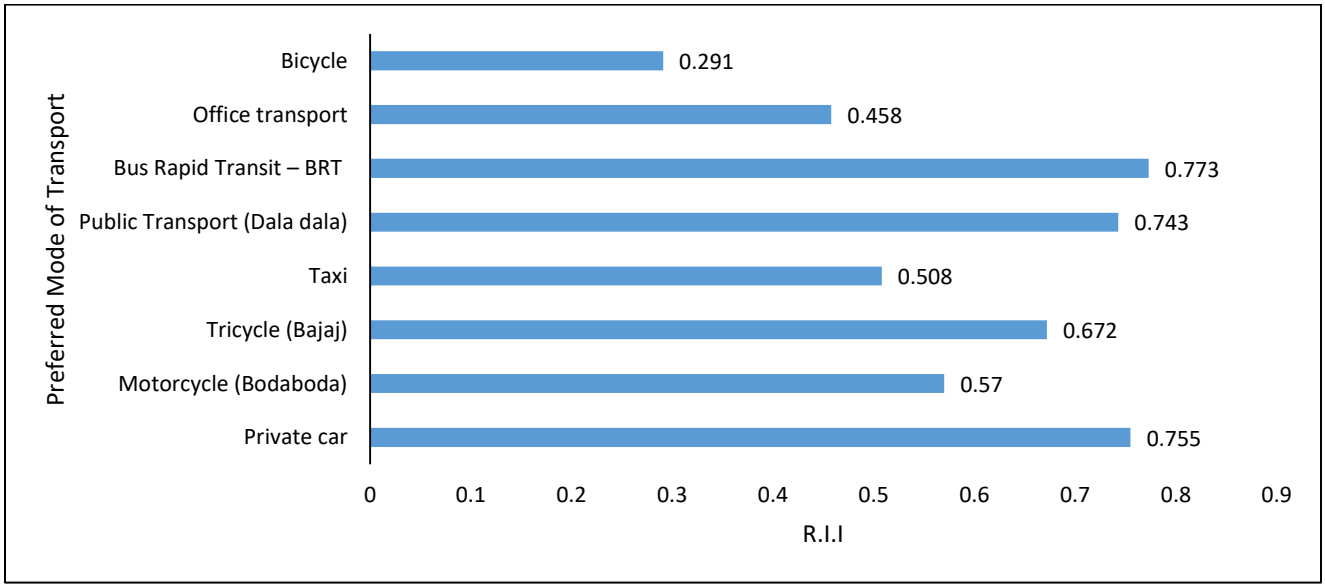
Source: *Official Interviews, 2017*

The information obtained through interviews of various stakeholder officials was useful in supplementing the findings on road traffic congestion. This information was also used to substantiate the views of other road users. Importantly, these stakeholders provided varying opinions which were used in the triangulation and validation of the information collected from road users and secondary sources (Carter et al., 2014).

5.2.3 Nature of Road Congestion in Dar es Salaam City

1. Preferred modes of transport: Commuters in Dar es Salaam city responded on the question on the preferred mode of transport. The results obtained by calculating the relative importance index (R.I.I) are presented in **Appendix 5.2** and graphically in **Figure 5-2** below:

Figure 5-2: Commuters' Preferred Mode of Transport in Dar e Salaam City



Source: *Survey data, 2017*

As presented in Section 2.3.7 above, the significance threshold on the R.I.I scale is 0.500. This significance level is equivalent to the mean of the highest score on the likert scale. The levels of significance are determined as follows:

1.000 – 0.750: Highly Significant

0.749 - 0.500: Significant

0.499 – 0.300: Insignificant

0.299 – 0.250: Highly Insignificant

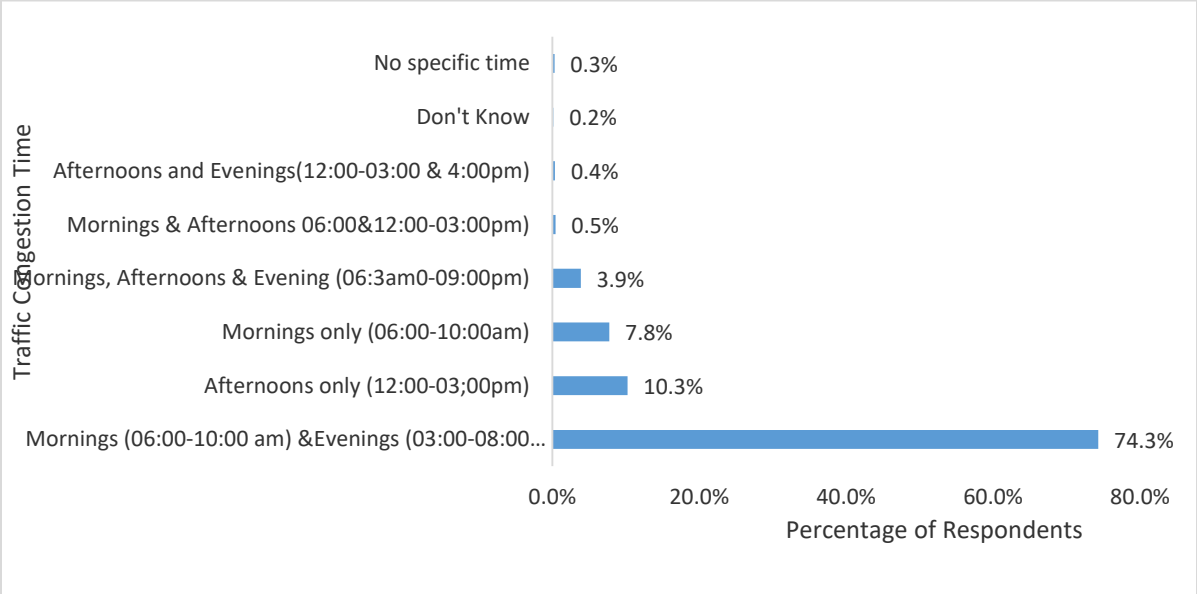
From the results presented in the above figure, the most preferred modes of transport for the city residents that are also highly significant on the R.I.I scale by obtaining above 0.750, were BRT system and private cars. The second tier of preferred modes of transport that scored between 0.749 and 0.500 include *daladala*, tricycles *(bajaj),* motorcycles *(boda boda)* and taxis in the descending order. The preference for the BRT is based on the fact that it is the fastest mode of transport. Road users who were interviewed indicated that these buses have reduced travel time by between 50% and 75%. The private cars ranked second due to the fact that they are the most convenient and flexible despite that they are the most expensive mode of transport. The public transport (*daladala)* is the third most preferred probably because it is the most commonly used and the cheapest mode of transport. The last most preferred mode of transport was tricycles. Its preference may be influenced by the fact that it is faster and relatively safer. The motorcycle and taxi cabs were just significant for obvious reasons. Motorcycles though fast, they are unsafe while taxis are expensive and out of reach of the majority of inhabitants. Office transport and bicycling were the least preferred by scoring below 0.499. It is noteworthy that, most employers ceased to provide transport to their employees and bicycles are no longer preferred because of unsafe roads.

The preference of private cars as the second-best mode of transport has an implication on the road traffic congestion in the city. According to the data provided by TRA, private cars and vans constitute 71.0% of the 228,700 motor vehicles that were issued with annual motor vehicle licenses during 2016. Lorries and buses constitute 24.6% and 4.4% of the licensed motor vehicles respectively. Apparently, the high proportion of private cars that transport an average of one to two passengers or about 8.0% of city's population, significantly add on the traffic congestion experienced on Dar es Salaam

roads. The bulk of commuters are transported by buses which are mainly minibuses that constitute 4.4% of all vehicles licensed during 2016.

2. ***Traffic congestion periods:*** Regarding the times of congestion, both road users and other stakeholders including traffic police reported the peak hours to be during the mornings and evenings that is, from 6.00 am to 10.00 am and from 3.00 pm to 7.00 pm respectively. These peak periods were reported by 74.3% of the respondents. The two peak periods are reflective of the times when almost all the active population is commuting from homes in the morning to various places such as schools, places of social services, work and business places that are mainly located in the city and vice versa during the evening. The statistical results of the identified peak periods for Dar es Salaam are presented in **Appendix 5.3.** These results which are also presented graphically in **Figure 5-3** below, are important in the endeavour to devising appropriate traffic congestion interventions.

Figure 5-3: Road Traffic Congestion Periods in Dar es Salaam City



Source: *Survey Data, 2017*

The above results indicate that at least 74.3% of respondents constituted by public bus commuters (69.5%), traffic police (96%), public bus drivers (84.3%) and private car users (82.8%), were of the view that mornings and evenings are the most congested

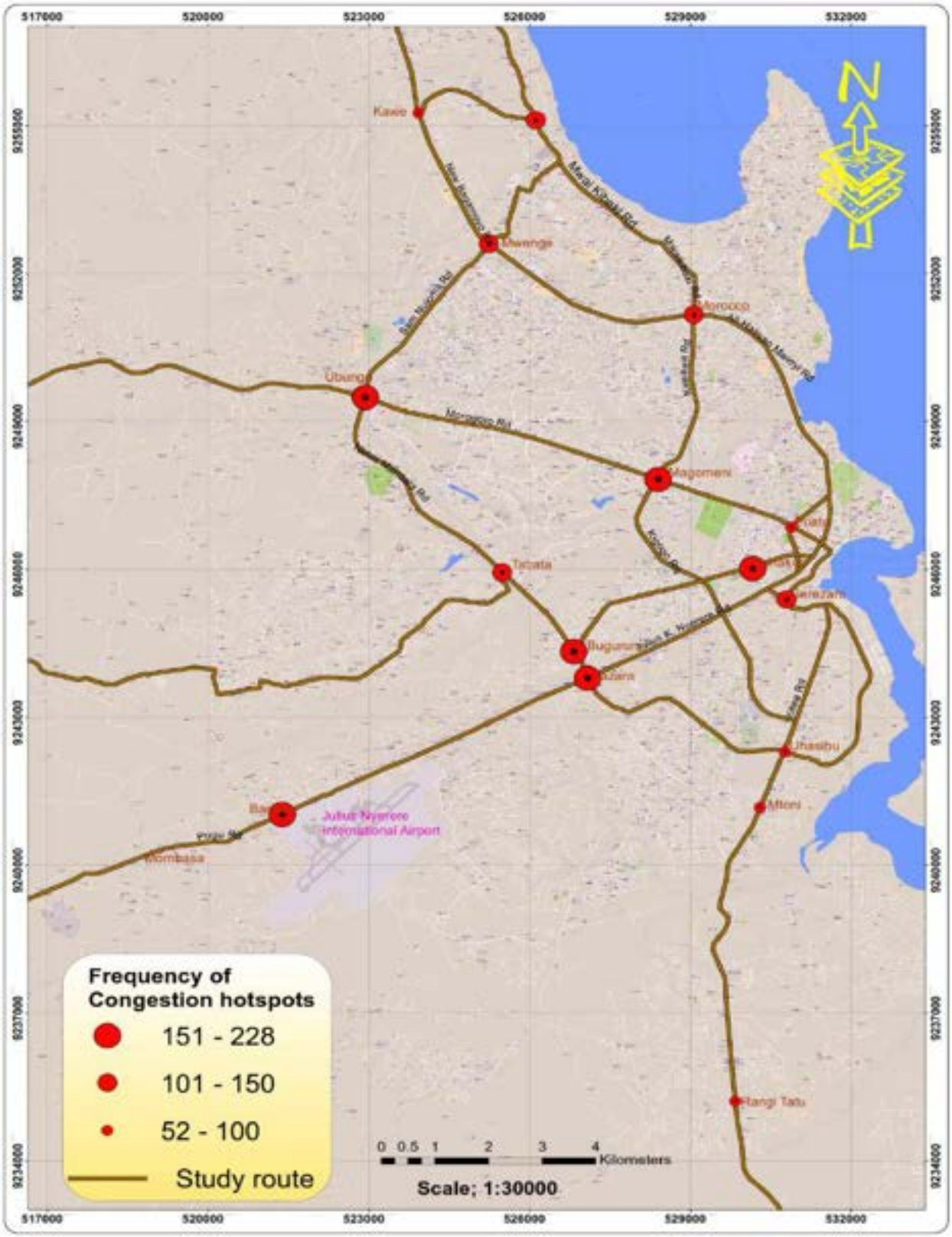
periods of the day. On a number of arterial roads such Kilwa, Mandela, Nyerere and Bagamoyo roads, the evening traffic congestion extended up to 09:00 pm. However, few respondents from each group consistently reported other times of the day as the highest congested periods. For example, afternoon only period was reported by 14% of road users, 5% of traffic police, 7% of public bus drivers and 10% of private car drivers. Overall, these proportions counted to an insignificant 10.3% of all respondents. Interestingly, follow-up question to these groups revealed that the reported afternoon congestion mainly occurred on Fridays at the time the Muslims are going to and coming from mosques to attend Friday prayers.

5.2.4 Road Traffic Congestion Hotspots in Dar es Salaam City

In Dar es Salaam, a total of 11 areas were identified through 1,530 multiple responses as notorious spots for traffic congestion. As shown in **Appendix 5.4**, the top five spots were road intersections. These intersections and the corresponding proportions of respondents include Pugu Road at Mombasa/Ukonga Junction (15.9%); Nyerere and Mandela roads at TAZARA (14.9%); Morogoro/Mandela roads at Ubungo (13.5%); Uhuru/Msimbazi roads in Kariakoo (11.5%); Mandela/Uhuru roads at Buguruni (10.4%); Kilwa/Gerezani Road (8.6%); Kawawa/New Bagamoyo Road (7.1%); Mandela/Tabata Road (6.8%); Azikiwe -Posta (4.8); Morogoro/Kawawa Road (4.0%); and Mbagala Rangi Tatu (3.5%).

The traffic congestion experienced on road intersections has a spillover effect to other trunk and secondary roads that terminate in the city centre as well as the neighbouring areas. According to the interviewed respondents, this effect is felt as far as the whole of Kariakoo area, Gerezani, Bibi Titi Mohamed Road, Chang'ombe Road, Fire area, Kigogo Road, Jamhuri Street, Posta area, Kilwa Road, Africana, Tangi Bovu, Sinza, Jangwani, Goldstar, Ilala, Kamara, Kijitonyama and Kimara, among others. The city's traffic congestion hotspots and other areas affected by the traffic congestion are provided in **Map 5.1** below:

Map 5.1 Hotspots of Road Traffic Congestion in Dar es Salaam City

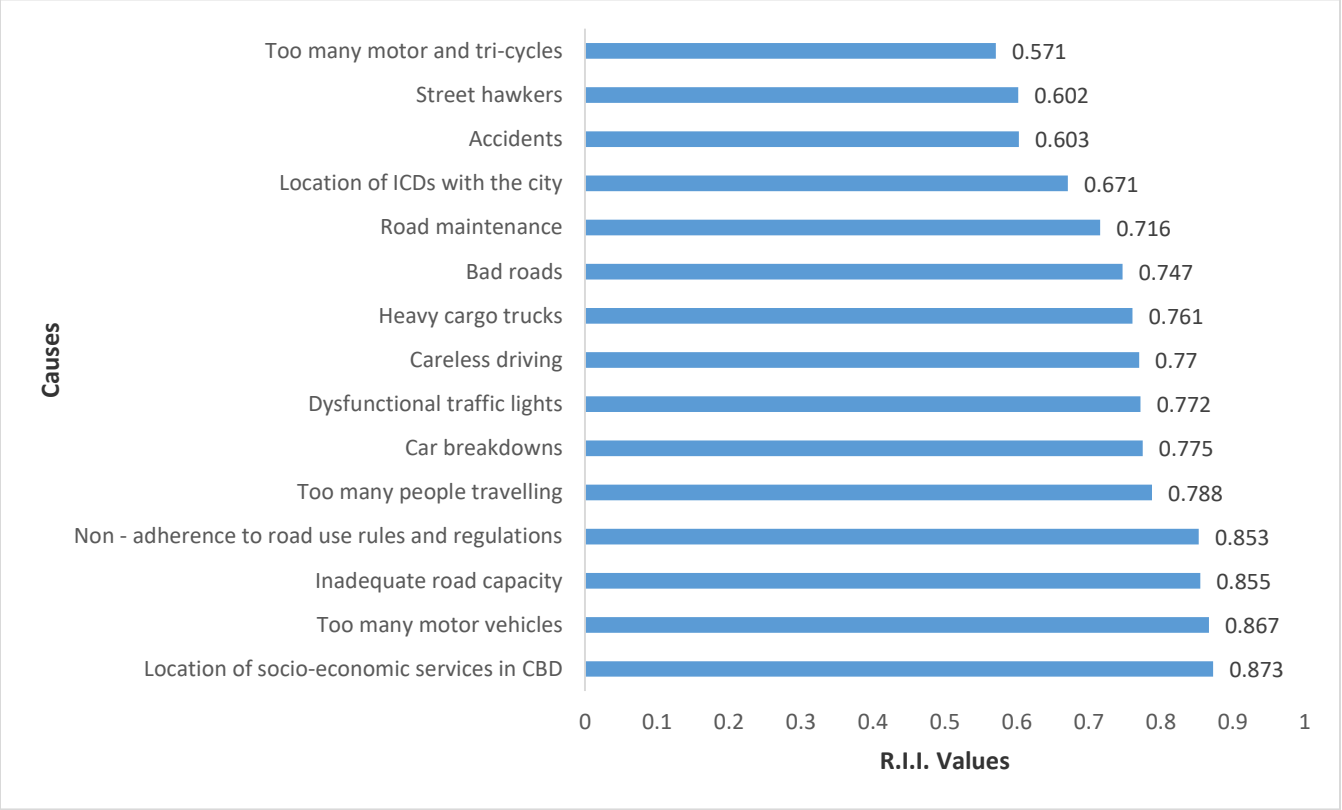


Source: *Field Survey, 2017*

5.2.5 General Causes of Road Traffic Congestion

The analysis on the general causes of traffic congestion in Dar es Salaam city has a bearing on the findings on causes of traffic congestion in cities elsewhere in the world (Ogunsanya, 2002, Mahmud et al., 2012, Popoola et al., 2013 and Olagunju, 2015) and in Tanzania's cities in particular (JICA, 2008, Kiunsi, 2013, Mfinanga & Fungo, 2013 and Mkalawa & Haixiao, 2014). Through the likert scale scores, the Consultant sought to elicit the views of different categories of road users on the causes of traffic congestion in the city. The findings on the respondents' views in Dar es Salaam city, indicate that 15 causes were found to be significant by scoring above the 0.500 threshold on the R.I.I scale. These results are presented in **Figure 5-4** below:

Figure 5-4: General Causes of Traffic Congestion in Dar es Salaam City as Measured by R.I.I



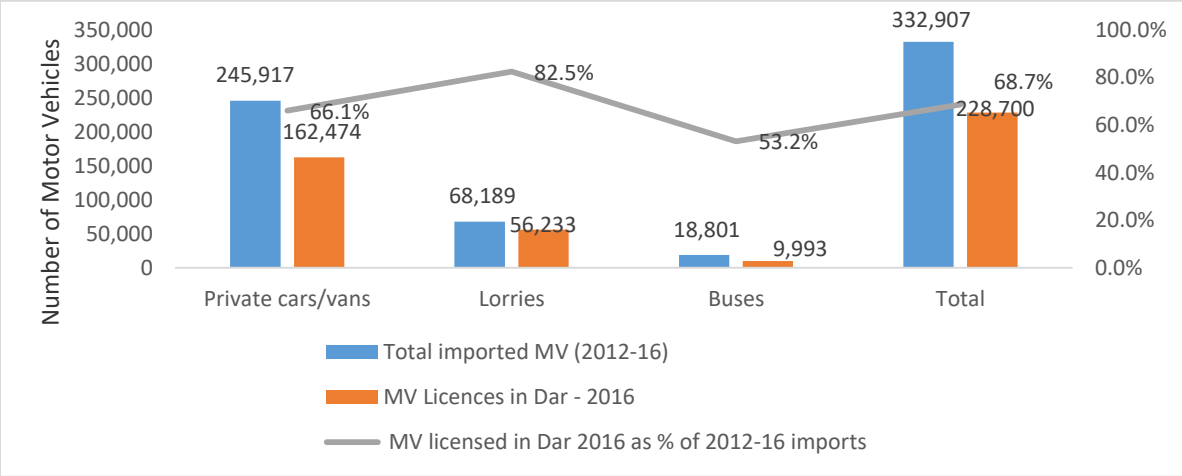
Source: *Survey data, 2017*

The explanation on these causes is provided below:

1. ***Monocentric structure of the cities:*** Road users in Dar es Salaam city were of the view that the location of socio-economic amenities in the CBD that exhibits the monocentric structure, was highly significant and ranked foremost among the cause of traffic congestion through scores of 0.873 on the R.I.I scale. This significant level highlights the importance of the CBD as a place of livelihood of most of city's residents. These residents, commute on a daily basis to and from their homes to CBDs during mornings and vice versa during evenings. The ensuing dominance of one directional flow of traffic contributes to congestion during these periods along the main roads, intersections and secondary roads (Kiunsi, 2013).

2. ***Vehicular growth:*** Respondents in Dar es Salaam city were of the view that the increase in the volume of vehicles on city roads was the second most significant cause of traffic congestion by scoring 0.867 on the R.I.I scale. This perception is attributed to the fact that Dar es Salaam city experiences the highest vehicular growth in country. The city retains about 70% per annum of all vehicles imported in the country. Similarly, the number of different types of vehicles issued with licenses by TRA in the city, increased more than threefold from 64,382 in 2012 to 228,700 by 2016 (TRA, 2017). These statistics do not include government-owned vehicles, donor-funded project vehicles, police and military vehicles. The level of vehicular growth is provided in **Figure 5-5** below:

Figure 5-5: Motor Vehicles Licensed in Dar es Salaam in 2016 as a Proportion of Motor Vehicle Imports during 2012-16



Source: *TRA, 2017.*

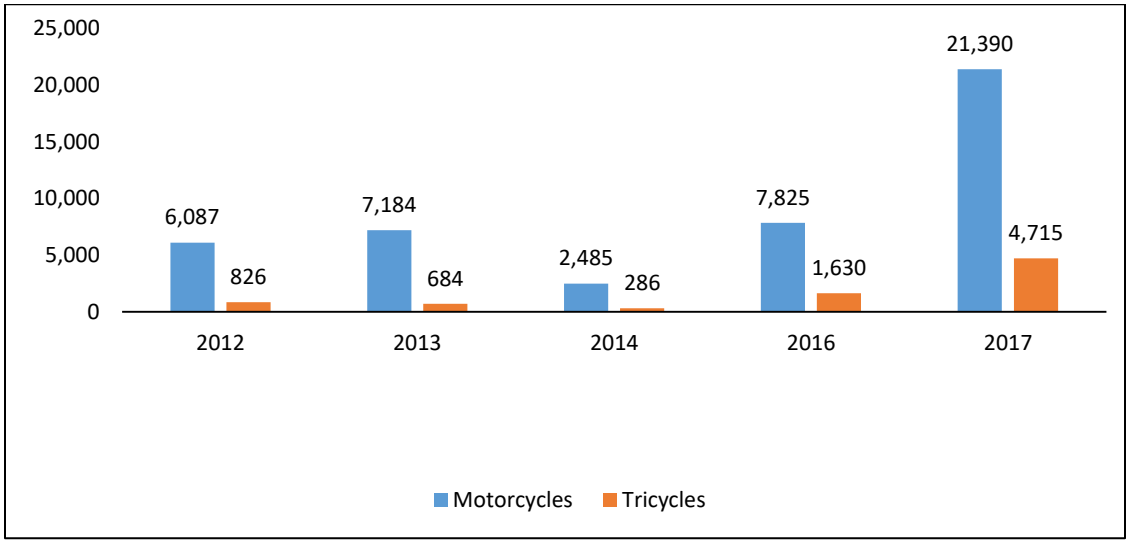
Statistics presented in the above Figure, indicate that the number of motor vehicles issued with annual licenses during 2016 were equivalent to 68.7% of all types of motor vehicles imported in the country during 2012-2016 period (TRA, 2017). Interestingly, during 2016 private cars and vans that carry a limited number of passengers constituted 71.0% of all motor vehicles issued with annual licenses. Again, interviews with the officials of companies managing parking spaces in Dar es Salaam, indicated that an estimated 30,000 motor vehicles enter the CBD each of the working day. These vehicles exclude those belonging to public institutions, buses providing public transport services *(daladala)* and taxis.

3. ***Inadequate road infrastructure capacity:*** In Dar es Salaam city, respondents acknowledged the inadequacy of road infrastructure as the third most significant cause of traffic congestion by the score of 0.855 on the R.I.I scale. There are five (5) arterial roads in this city that carry motor vehicles to the CBD. These are Kilwa, Nyerere, Uhuru, Morogoro and New Bagamoyo roads. Road users were increasingly realizing that the city's road network capacity is no longer congruent with the demand. That is, the roads were deemed to be in bad state and not adequately maintained by scoring a statistically significant 0.761 and 0.716. The other noted road inadequacies include inadequate parking spaces; lack of room

for expansion; lack of modern bus terminals; and inadequate facilities for non-motorized traffic and pedestrian lanes (URT, 2003).

4. ***Non-adherence to road safety and traffic laws and regulations:*** The violation of road traffic laws and regulations was found by Dar es Salaam respondents to be the fourth most significant cause of traffic congestion by scoring an R.I.I value of 0.853. Key violators of road use regulations included motor vehicle, motorcycle and tricycle drivers. In this respect, careless driving scored a significant 0.770. Besides, the increase in volume of motorcycle and tricycle taxes that are driven by mainly unruly youth, was identified as another significant cause of traffic congestion by scoring 0.571. The number of licensed motorcycles and tricycles respectively increased from 6,087 and 826 in 2012 to 21,390 and 4,715 by 2017 as provided in **Figure 5-6** below:

Figure 5-6: Motorcycles and Tricycles issued with Licenses in Dar es Salaam during 2012-17



Source: *TRA (2017)*

The other road use law violators are the street vendors who either spread their merchandise along roads or obstruct traffic flows by chasing motorists. As a cause of traffic congestion, street vendors scored the R.I.I value of 0.602.

5. ***Increase in commuting population:*** The increase in the number of people travelling in Dar es Salaam scored 0.788 as a cause of traffic congestion. It is estimated that between 70% and 80% of the city's population commute on daily basis. This increase coupled with the insufficiency of the public transport, compels the middle and upper classes to depend on private cars for commuting.

6. ***Delays in attending traffic incidents and accidents****:* Respondents in Dar es Salaam city indicated that car breakdowns were the sixth significant causes of traffic congestion by scoring 0.775. Besides, road accidents were indicated as a significant thirteenth traffic congestion cause by scoring 0.603. Both breakdowns and accidents when they occur, they are likely to cause relatively prolonged traffic congestions. These responses are indicative of the fact that, in most cases traffic police and rescue services such as towering vehicles do not arrive in time to attend traffic accidents some of which are minor.

7. ***Dysfunctional traffic lights and inadequate roundabouts:*** These two causes of traffic congestion are symptomatic of defective traffic control and management. Respondents in Dar es Salaam scored a significant 0.722 on the R.I.I scale. Dysfunctional traffic lights appear at three levels namely, nonfunctioning lights; absence of traffic lights at key road intersections; and fixed cycle traffic lights that are nonresponsive to traffic flows or demand. Roundabouts at road intersections are either single lane or no longer adequate for the increased traffic and particularly during peak periods.

8. ***Heavy goods trucks and petroleum tankers:*** The presence of such trucks on roads that compete with other modes of transport was ranked ninth by respondents of Dar es Salaam by scoring 0.761. The number of cargo trucks or lorries issued with annual vehicle licenses in Dar es Salaam, increased by almost fivefold from 14,511 in 2012 to 56,233 in 2016 (TRA, 2017). This increase has added pressure on already limited capacity of road infrastructure and especially on Mandela Expressway, Morogoro and Sam Nujoma roads.

9. ***Location of inland container depots (ICDs):*** The effect of the location of ICDs within or in the outskirts of the city on traffic congestion is severe in Dar es Salaam. Respondent ranked this issue as a significant cause of congestion by scoring 0.671. The ICDs that are located along Chan'gombe, Mandela and Nyerere roads, impinge on traffic flows in these areas particularly at the time when cargo trucks are either entering or exiting in such places.

10. ***Quality of public transport services:*** The quality of public transport buses *(daladala)* services is influencing travel demand. These buses are overcrowded; they don't have specific travel schedule; they are highly unreliable; and in most cases they are defective. This situation compels a section of the population to travel by private cars thereby generating substantive traffic congestion.

5.2.6 Dar es Salaam City Specific Causes for Road Traffic Congestion

Specific causes for road congestion in Dar es Salaam city are either location specific or event specific. The key specific causes that were established through observations; open-ended questions contained in questionnaires; and interviews with road users and officials of various public and private institutions, are as explained below:

1. ***Absence of parking space along Sokoine Drive:*** The section of Sokoine Drive which is off AZAM Marine jetty, experiences severe traffic congestion during the periods when passengers are either arriving on vessels from Zanzibar or boarding to that destination. On daily basis, these vessels load passengers for departure at 9:00 am, 11:15 am, and 11:30 am and offload arrivals at 2:30 pm and 3:00 pm. AZAM Marine Company transports an estimated 8,000 passengers daily on the Dar es Salaam–Zanzibar route. Its vessels carry between 540 and 620 passengers on each of the inward and outward trip. On arrival, these passengers struggle to board public transport *(daladala),* private cars, taxis or *bodaboda.* Other passengers cross Sokoine Drive to the nearest locations where they can get convenient means of transport. Formerly, taxis and private cars dropping or waiting for passengers travelling to and from Zanzibar, used to park on the space

which is infront of Avalon Cinema area. This place is now under construction with the multistory Mwalimu J.K. Nyerere Tower. The City Council BRT station located in the proximity of the jetty has also added a new dimeson in respect of the challenges of passengers travelling to and from Zanzibar.

The ensuing traffic congestion along Sokoine Drive, spills over to other roads such as Azikiwe, Samora Avenue, Uhuru and Railway roads. In mitigation of this problem, Azam Marine officials indicated the company's willingness to construct a multistory car pack that will also serve as a passenger lounge. These officials also cherish an idea of extending the company's marine services to Mtoni Kijichi through the Magogoni Creek. The officials indicated that about 70 .0% of their passengers live in Temeke, Tandika, Mtoni and Mbagala areas. The two projects could be executed through PPP with TPA.

2. ***Road design at Mbagala Rangi Tatu:*** This area on Kilwa Road, is a terminal point for public buses plying to and from various destinations such as Ferry, Gerezani, Tandika, Buguruni, Gongo la Mboto, Mawasiliano, Kimara, Kawe and Kijitonyama, among others. About 250 meters from this terminal southwards, there is a roundabout which is a very busy junction for numerous private, public *(daladala)* and cargo vehicles. These vehicles traverse to and from Mbande, Charambe, Kigamboni, Toangoma, Vikindu, Mkuranga, Temeke, Tandika and City centre as well as different destinations of the city and other regions such as Coast, Lindi, Mtwara and Ruvuma. The bus terminal, roundabout and a roadside public bus bay for buses plying southwards, are in proxmity of each other. This road situation coupled with big number of motor vehicles operating in the area and a multitude of road side vendors, renders the Rangi Tatu area always congested and almost impassable for most part of every day. Notwithstanding the presence of traffic police who struggle to regulate motor vehicles, traffic congestion rarely eases in this area.

3. ***Storm water drainage system:*** Through observations and interviews with road users, it was established that in Dar es Salaam and especially in the CBD, storm water drainage system is mostly clogged. During rainy seasons, the roads are flooded. These floods render the roads either impassable by vehicles or passable with considerable difficulties. During rainy seasons, it is a nightmare for motorists who spend long hours caught in traffic jams. These jams impact adversely on the traffic flows on neighbouring roads as far as Chang'ombe, Ilala, Magomeni and Kinondoni areas.

4. ***Inadequacies of public transport services:*** The open-ended questions and interviews with road users, revealed three negative features on public transport services. These features are as follows:

   (i) *Unutilized sections of feeder roads:* A number of road users complained that there were some roads that didn't have public transport which would have otherwise relieved congestion pressure on trunk roads carrying numerous vehicles. The example of such roads includes Tandika-Buza and Mtongani-Tandika off Kilwa Road, among others.

   (ii) *Overcrowding of Mandela Road with public transport routes:* This road is a passage of public buses travelling to and from various destinations via Buguruni, Tabata and Ubungo. These destinations include Mnazi Mmoja, Gerezani, Mbagala, Tandika, Gongo la Mboto, Segerea, Mbezi Mwisho, Kimara and Mawasiliano, among others. Commuters were of the opinion that part of the traffic congestion on Mandela Road is caused by too many buses that are plying to various destinations.

5. ***Regulation of motor vehicles by traffic police:*** There were mixed feelings with regards to the performance of traffic police who regulate traffic flows and especially during peak hours. Interviewees using the New Bagamoyo and Mwai Kibaki roads, suggested that the increased presence of traffic police, has eased

traffic jams and considerably reduced the travel time by between 30 and 50 per cent. However, interviewees using Kilwa, Nyerere and Chang'ombe roads as well as those passing through Mandela/Morogoro/Sam Nujoma junction, were of the opinion that these police were causing serious traffic congestion. These interviewees contended that police normally favour motor vehicles traveling to one of the directions oblivious of congestions building up on unattended roads.

6. ***Low speed on highways:*** Observations and interviews with road users indicated that in Dar es Salaam, low speed by motorists on highway has become a culture. Speed of 30 km to 50 km per hour were noted on roads such as Nyerere, Mandela, Morogoro and New Bagamoyo even during non-peak periods.

7. ***VIP entourages:*** *Road* users in Dar es Salaam were of the view that motorcades of local and foreign dignitaries arriving or leaving the J.K. Nyerere International Airport or travelling to other parts of the city trigger considerable traffic jams. For example, when these dignitaries are travelling to or from the airport, most of the CBD roads are blocked. Other roads that are blocked include Vingunguti, Mandela, Chang'ombe, Kawawa and Kilwa. The shut-down of these roads has telling effects on almost all parts of the regional city. In most of the time, such congestions are prolonged between some minutes and some hours.

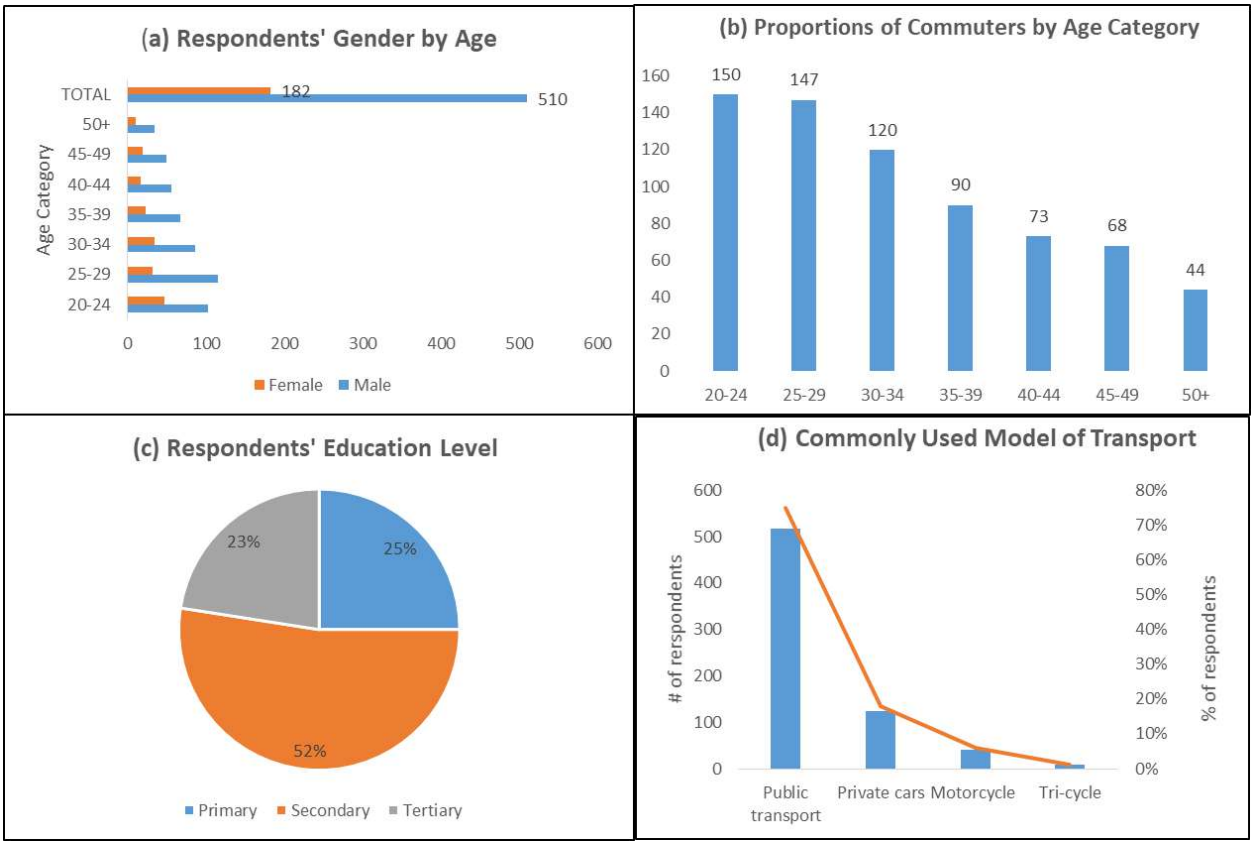
8. ***Insufficient bus bays:*** On most of the roads including the newly constructed Morogoro Road, bus bays are too short to accommodate more than four buses. As a result, buses that are peaking or dropping passengers, are compelled to pack on roads for the purpose. In the process, these buses obstruct the movement of other vehicles resulting into serious traffic congestions especially during peak periods.

5.3 MWANZA CITY

5.3.1 General Profile of the Respondents in Mwanza City

The general profile of the 692 respondents of Mwanza city are presented in **Appendix 5.5** and the key characteristics are provided in **Figure 5-7 (a-d)** below:

Figure 5.7 (a-d)-: Profile of Mwanza City Respondents



Source: *Survey Data, 2017*

In Mwanza, 73.7% of respondents were males and 26.3% were females. Like in the case of Dar es Salaam, females were not forthcoming in answering questions and being interviewed. Regarding the level of education, the majority of the respondents (75.0%) had secondary school education or above. As regards to occupation, 47.5% of respondents were self-employed and 28.6% were employed while students constituted 23.9%. Implicitly, the sample was representative and sufficient to provide robust information regarding road traffic congestion in the city.

Public transport was the commonly used modal of transport as it attracted 74.8% of respondents. Other type of transport namely, private car, motor cycle and tri-cycle were being used by 25.2% of respondents. The majority of respondents i.e. 60.3% were generally young of age 20-39 years.

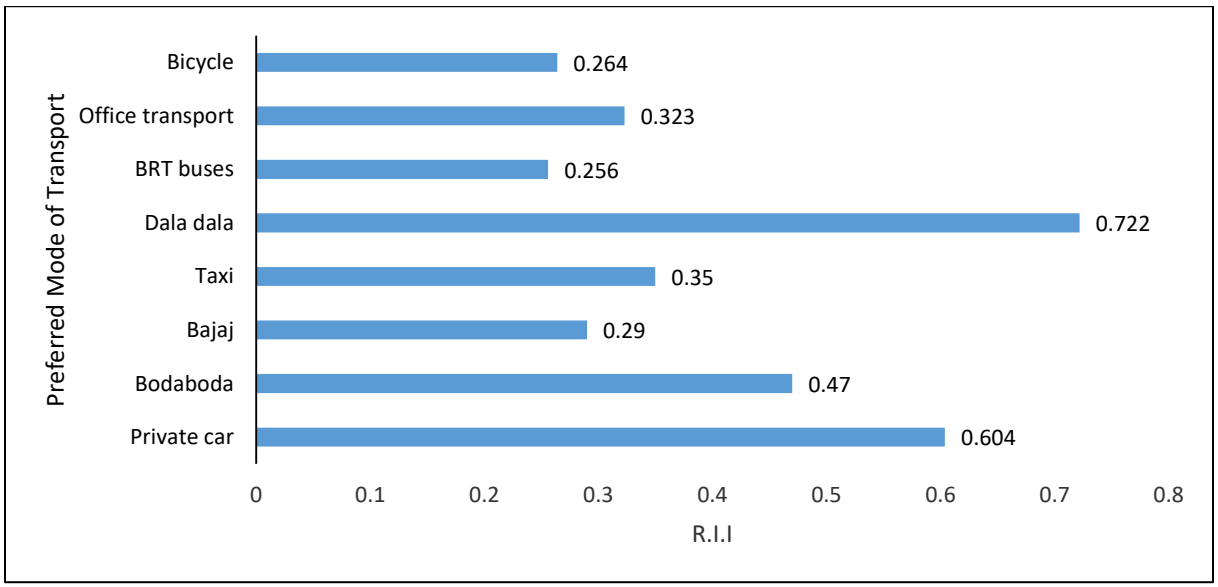
5.3.2 Public and Private Sector Stakeholders Consulted in Mwanza City

A total of 50 officials belonging to the stakeholder public and private sectors were either interviewed or requested to fill-in the relevant questionnaires regarding causes, impacts and measures to curb the problem of traffic congestion in the city. These officials were from TRA (1); Municipal Councils (2); Traffic police (27); and private sector respondents (21). The information elicited from these officials was useful in providing supplementary information on road traffic congestion in Mwanza city.

5.3.3 Nature of Road Congestion in Mwanza City

1. Preferred modes of transport: A total of 125 commuters responded on the question of choice of mode of transport. The results on responses to this question as measured by the R.I.I are presented in **Appendix 5.6** and are graphically shown in **Figure 5-8** below:

Figure 5-8: Commuters' Preferred Mode of Transport in Mwanza City



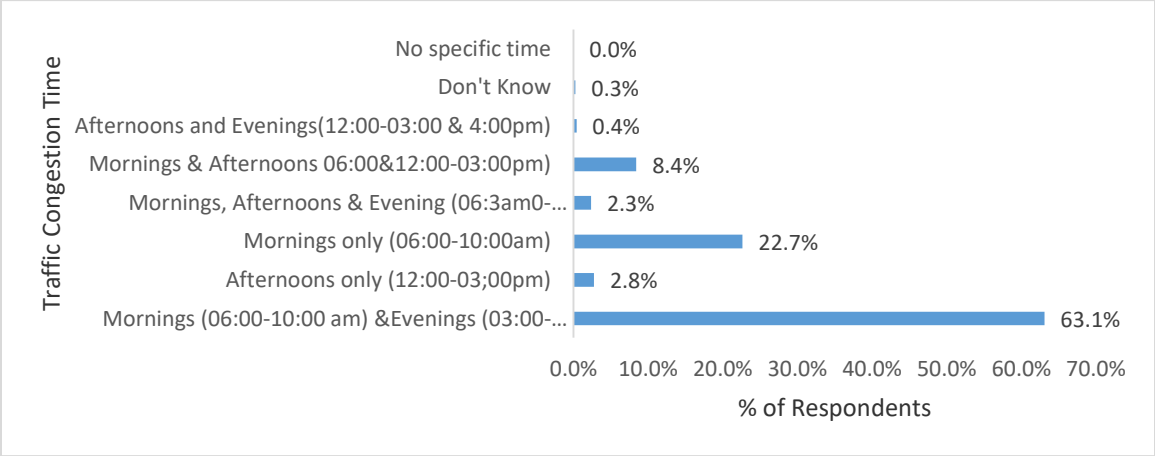
Source: *Survey Data, 2017*

From the above Figure, the most preferred modes that scored above the 0.500 R.I.I significance threshold in Mwanza city were public transport (*daladala)* followed by private cars. The other five modes namely motorcycles, taxis, office transport, tricycles, bicycles and BRT were less preferred in descending order as they fell below the significance threshold.

In Mwanza, *daladala* are the most commonly used and the cheapest means of transport. Like in Dar es Salaam city, the choice of private car/vans as the second preferred mode of transport in Mwanza that could be attributed to their convenience and flexibility has significant implication on traffic congestion. These cars constitute 66.4% of the 25,859 motor vehicles that were issued with annual road licenses during 2016. Buses that transport 70% to 80% of the city's population accounted for only 8.3% of all vehicles. Implicitly, the multitude of private cars with low passenger occupancy capacity compared to buses, has significant ramifications on traffic congestion pressure given the limited road capacity.

2. Traffic congestion periods: A total of 724 Mwanza city's road users that include commuters, traffic police, public transport drivers and private car users, reported on the periods of traffic congestion during the day. As provided in **Appendix 5.7** and **Figure 5-9** below, 63.1% of all respondents identified mornings (07:00-9:00 am) and evenings (03:30-07:00 pm) to be periods of high traffic congestion as compared to other periods of the day.

Figure 5-9: Road Traffic Congestion Periods in Mwanza City



Source: Survey data, 2017

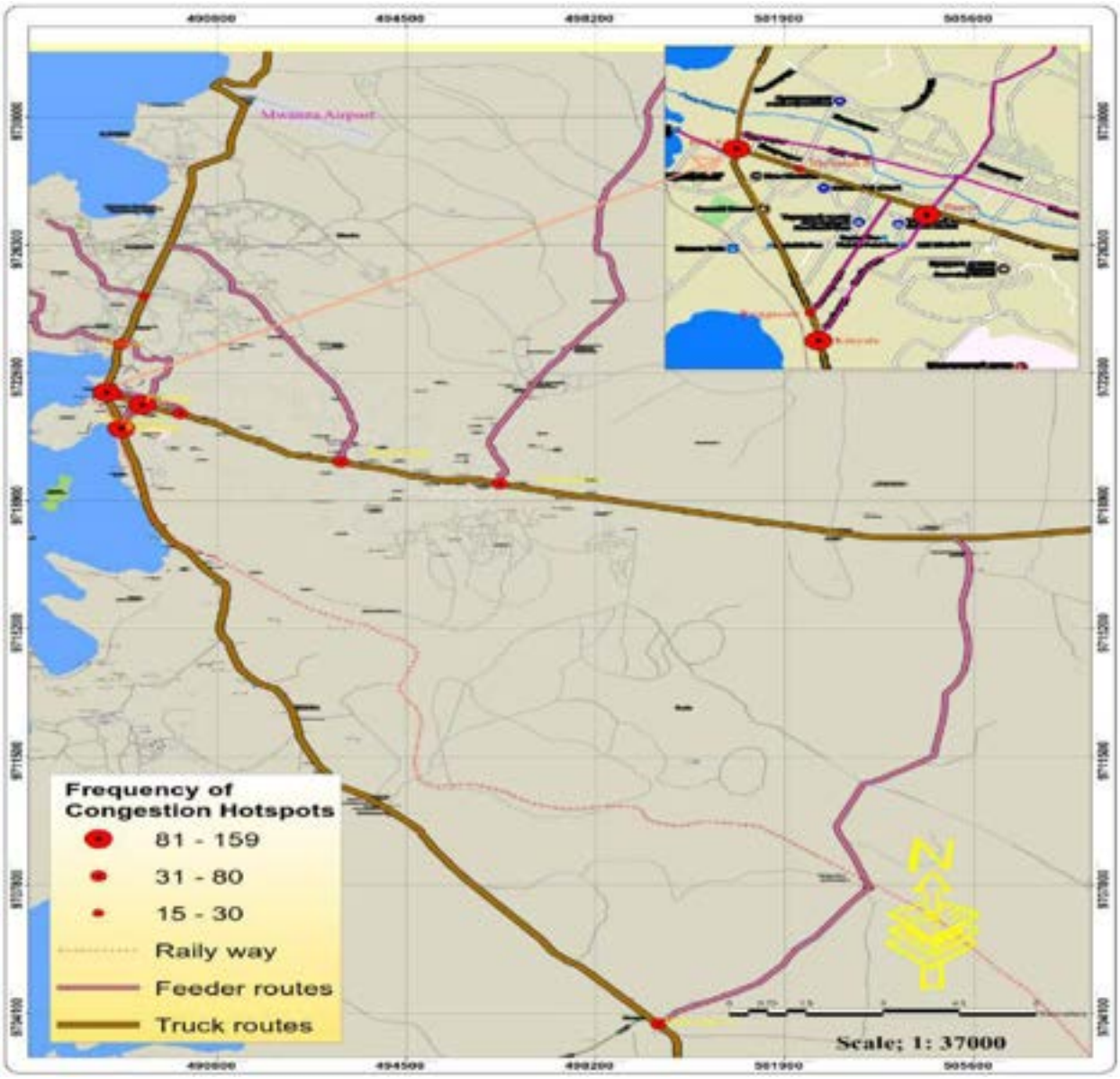
The above peak periods were reported by 58.2% of commuters, 95.0% of traffic police, 68.7% of public bus drivers and 91.0% of private car users. Except for the morning only period that was supported by 22.7% of the respondents, other periods of the day seemed not to experience significant traffic congestion. Interestingly, as compared to Dar es Salaam city, the traffic congestion peak periods in Mwanza city start at least one hour later and last an hour earlier. This observation could be explained by the fact that Dar es Salaam city has a far bigger number of motor vehicles and sprawl as compared to Mwanza city.

The inadequate road capacity, i.e., the three arterial roads and a single ring road coupled with vehicular growth contribute to the serious traffic congestion the city is currently experiencing during the rush periods of mornings and evenings.

5.3.4 Road Traffic Congestion Hotspots

In Mwanza City, nine (9) areas, were identified through 565 responses as traffic congestion hotspots as presented in **Appendix 5.8** and **Map 5.2** below:

Map 5.2: Hotspots of road traffic congestion in Mwanza City



Source: *Field Survey, 2017*

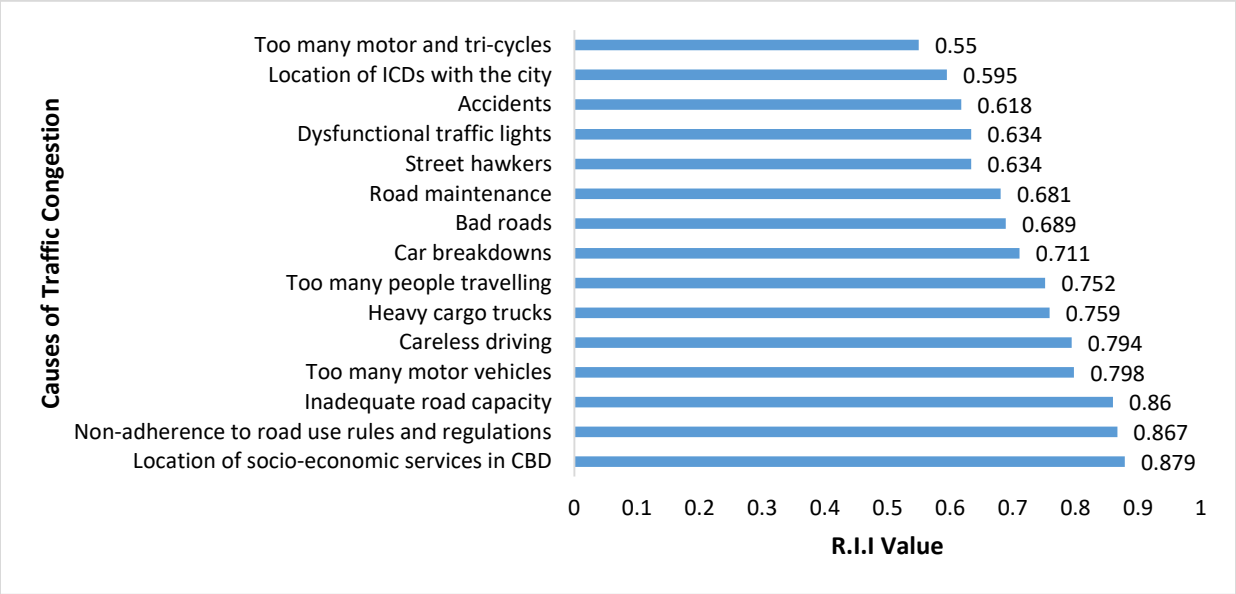
The hotspots include Nyerere Road which was reported by 28.1% of all responses as the highly congested road in Mwanza city. This road was closely followed by Kenyatta Road that was identified through 25.1% of responses. Pamba Road ranked third as it was reported it garnered 18.2 % of all responses. The other congestion hotspots in the descending order, that were identified by between 6.4% and 2.7% of all responses include Buzuruga, Mission Road; Mabatini, Sahara and Buhongwa Road; Specifically, Kenyatta, Nyerere, Makongoro and Port roads converge at the roundabout located in

front of Nyanza and CCM building. This roundabout which is locally known as *Kemondo,* is the highly congested spot in Mwanza city. The traffic congestion in these hotspots also spillover to other areas and roads such as Rwagasore, Kaluta and Lumumba roads in the CBD and as far as Igogo, Mabatini, Ghana and Kilumba areas.

5.3.5 General Causes of Road Congestion and Ranking in Mwanza city

The general causes of road traffic congestion in Mwanza City that were identified by various groups of 438 respondents through a 4-point likert scale and analyzed by using a R.I.I. model are presented in **Figure 5-10** below:

Figure 5-10: General Causes of Road Traffic Congestion in Mwanza City as Measured by R.I.I



Source: *Survey data, 2017*

The explanation of the Mwanza city's respondents on the above causes is as follows:

1. ***Monocentric structure of the cities:*** Mwanza's road users supported the view that the location of socio-economic amenities in CBD that exhibits the monocentric structure, was highly significant and ranked first among the 15 causes of traffic congestion through scores of 0.879 on the R.I.I scale. These results affirm those obtained from Dar es Salaam city that the CBD remains a place of livelihood for

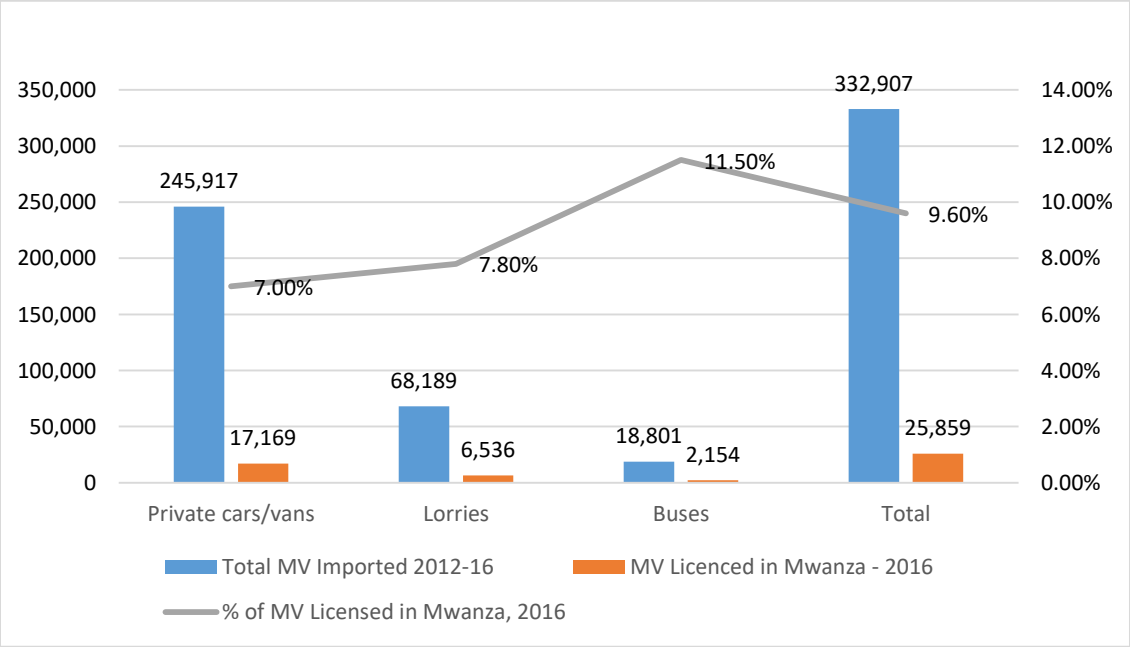
most of city inhabitants. This situation results into one directional flow of traffic that significantly contributes to road congestion in the mornings and evenings.

2. ***Non-adherence to road safety and traffic laws and regulations:*** The violation of road traffic laws and regulations was found by Mwanza city respondents to be the second most significant cause of traffic congestion by scoring an R.I.I value of 0.867. The key violators of road use rules included motor vehicle, motorcycle and tricycle drivers. Careless driving scored a significant 0.794 for Mwanza city. The increase in volume of motorcycle taxis that are driven by mainly unruly youth, scored 0.550. This score is above the significance threshold. The increase in motorcycles as common means of transport from 1,679 in 2012 to 2,242 in 2016 (TRA, 2017), had a significant impact on violation of road safety laws and the resultant traffic congestion. The other category identified as law violators were street vendors who were scored at 0.634.

3. ***Inadequate road infrastructure capacity:*** In Mwanza city, the inadequacy of infrastructure scored 0.860 as one of the major causes of traffic congestion. Like Dar es Salaam city, Mwanza city's road network is still limited. In the latter city, there are three (3) arterial roads that carry motor vehicles to the CBD. These roads include Kenyatta that opens into Shinyanga Road, Nyerere that opens into Musoma Road and Makongoro that opens into Airport Road. These roads are relieved by few ring and secondary roads that limit greater connectivity. Correlatively, respondents were of the view that most of city roads were not in a good passable state by scoring a significant R.I.I value of 0.689. Equally, road maintenance was deemed inadequate by scoring 0.681.

4. ***Vehicular growth:*** In Mwanza city, the increase in motor vehicles was identified as the fourth significant cause of traffic congestion by scoring 0.798. As provided in **Figure 5-11** below, by 2016 only 25,859 motor vehicles equivalent to 9.6% of the total motor vehicles imported in Tanzania Mainland, were licensed in Mwanza city.

Figure 5-11: Number of Motor Vehicles Imported in Tanzania Mainland and Those Licensed in Mwanza City



Source: *TRA, 2017*

While the number of motor vehicles in this city was not as significant as the case of Dar es Salaam city, two issues are apparent in respect of traffic congestion. First, private cars and vans that carry fewer passengers compared to buses were a significant 66.4% of all vehicles licensed during 2016. Second, given the small area of the city and the limited road network, the total number of vehicles easily saturated the city resulting into significant road congestion.

5. ***Heavy cargo trucks and petroleum tankers:*** The presence of such trucks on roads that compete with other modes of transport was among the highly significant contributors to traffic congestion in Mwanza by scoring 0.759. These results are worrisome particularly in consideration of the fact that the Mwanza South Port is currently operating under capacity due to the poor performance of the central railway line. The seriousness of the trucks predicament on Mwanza city road, is depicted by growth statistics presented in **Figure 5-11** above. The number of cargo trucks issued with annual vehicle licenses increased by 3.5 folds from 1,877 to 6,536

during 2012-2016 period. This increase has certainly added pressure on already limited capacity of road infrastructure.

6. ***Increase in commuting population:*** The increase in the number of people travelling in Mwanza city was also a highly significant cause of congestion by scoring 0.753 on the R.I.I scale. This cause has bearing with the increase in population and the insufficiency of the public transport system. These factors have also raised the propensity to own private cars by residents in the middle and upper income group.

7. ***Car breakdowns and accidents****:* Respondents in Mwanza city indicated that car breakdowns were also a significant cause of traffic congestion by scoring 0.711. Road accidents were indicated as a significant cause by scoring 0.618. Implicitly, both breakdowns and accidents when they occur, were likely to cause prolonged traffic congestions.

8. ***Dysfunctional traffic lights and inadequate roundabouts:*** Respondents in Mwanza city scored 0.634 on the R.I.I scale regarding this inadequacy. The city lacks traffic lights at almost all road intersections. Presently, these lights are at two intersections namely Nyerere/Nkrumah roads and at Buzurugwa. Equally, roundabouts at road intersections are either single lane or no longer adequate for the increased traffic especially during peak periods.
9. ***Location of inland container depots (ICDs) within the city:*** The effect of the location of ICDs within or in the outskirts of the city though marginally significant in Mwanza by scoring 0.595, ranked among the causes of traffic congestion. Implicitly, the location of ICDs may be outside the CBD or non-existent.

5.3.6 Mwanza City Specific Causes for Road Traffic Congestion

The open-ended questions contained in questionnaires, interviews and observations, enabled the Consultant to establish the causes of traffic congestion that are specific to Mwanza city. These causes are explained below:

1. ***Geophysical conditions:*** About 68% of the city area of 1325km^2 is covered by waters of Lake Victoria and only 32% of this area is dry land. Most of the dry areas, and especially those surrounding the CBD, are mainly hilly and rocky with occasional undulating plains on the outer areas of Ilemela and Nyamagana Municipalities. For long, people settled on the hilly and rocky unplanned areas that are close to the CBD. These areas include Mabatini, Igogo, Mkuyuni, Maina, Bugarika, Bugando and Kitangiri. The areas that lack sufficient road infrastructure experience high population densities. Due to the geophysical nature of these areas, it is rather difficult or extremely expensive to provide roads that can link other outer areas with the CBD. Consequently, road users are compelled to ply on the three arterial roads that join the outer of the city with the CBD.

2. ***Location of Piers for Waterways at North Port and Kamanga Ferry:*** The two jetties are in proximity of each other. They serve travelers to and from Ukerewe, Kigoma, Geita and Kagera. On arrival, marine vessels offload passengers and motor vehicles on city roads via Port and Reginal roads and vice versa on departure. That is, motor vehicles that are arriving and departing or picking and dropping travelers, converge with other city vehicles at the main *Kemondo* roundabout. This roundabout is a convergence point for Kenyatta, Nyerere and Makongoro roads. Consequently, this convergence not only clogs these roads but also other secondary roads such as Nkrumah, Liberty, Uhuru, Posta, Lumumba, Karuta and Rwagasore.
3. ***Location of manufacturing industries, godowns and petrol depots within CBD:*** These facilities are mainly located in Nofa, Igogo, Mwanza South and Mkuyuni areas along Kenyatta Road. These industrial areas were outskirts of Mwanza Town during the yesteryears. However, the population growth has compelled people to settle beyond these areas to places as far as Mkuyuni, Maina, Nyegezi, Buhongwa, Malimbe and Usagara. Since the structure of the city hasn't changed, these industrial facilities are presently situated within the CBD. Heavy and light cargo trucks that offload and load materials and products, compete with other motor vehicles on Kenyatta Road causing serious traffic congestion.

4. ***Inadequate parking for public buses at KAUMA area:*** Public buses to the city centre that come from various destinations load and offload passengers at KAUMU area along Kenyatta Road. These buses ply to places such as Kayenze, Igombe, Ilemela, Airport, Bwiru, Buhongwa, Butimba, Nyegezi, Malimbe, and Maina. The parking area is no longer adequate for buses going to these destinations. The bus drivers are therefore compelled to park their vehicles along Kenyatta Road while waiting for their turns to load passengers. As a result, these buses obstruct other vehicles plying on Kenyatta Road resulting into traffic congestion.

5. ***Lack of public transport services for sections of Pasiasi – Usagara via Nyasaka, Buzuruga and Kisesa ring road:*** This route is an important ring road that could ease traffic congestion pressure on the city's arterial road. However, some sections of the roads forming this ring lack public transport services. There is public transport service from Kona ya Bwiru in Pasiansi to Maduka Tisa in Nyasaka. The Nyasa – Buzuruga section though paved with tarmac, currently doesn't have public transport services. This section is served by motorcycles *(bodaboda)* and taxis that charge TAS. 500.00 per passenger. Again, the Kisesa – Usagara section is also currently lacking public transport services.

5.4 CONCLUSION

The suggestions by Dar es Salaam and Mwanza cities' respondents on the nature and both general and city-specific causes of road traffic congestion, are not dissimilar from those established by various researchers for cities of other countries and Tanzania. These findings underlay the subsequent analyses on the impacts of traffic congestion and proposals on possible mitigation measures.

CHAPTER SIX

ECONOMIC COSTS OF ROAD TRAFFIC CONGESTION

6.1 INTRODUCTION

Studies on road congestion elsewhere in the world and Tanzania, have come out with findings that show enormous internal costs that are borne by motorists and external costs that are borne by the society at large. These costs include economic, social, environmental and health aspects. This chapter presents the findings on the direct economic costs pertaining to Dar es Salaam and Mwanza cities that were derived on the basis of the facts that were obtained during the field studies.

6.2 APPROACHES AND ASSUMPTIONS ON ECONOMIC COSTS OF TRAFFIC CONGESTION

6.2.1 Approaches for Estimating Direct Economic Costs of Road Congestion

The direct economic costs of traffic congestion are calculated on the basis of the internal costs that are borne by the individual commuters as opposed to the cost imposed on the larger society (externalities). Shabbar et al. (2014) identifies the economic costs as a composite of **opportunity, vehicle operating** and **extra fuel consumption costs** that result from excessive delays attributed to traffic congestion.

Traffic congestion result into costs to motorists and commuters in form of extra time spent on travelling. This extra time is referred to as an 'opportunity cost' because it is equated to the value of productive/social active time foregone. The opportunity cost of traffic congestion is the value of time (VOT) lost when assigned monetary value. The VOT is constituted by the actual extra time spent on traveling and the buffer or just in case time due to unpredictability of travel. The buffer time is a composite of early waking-up time and early or late knocking out of work.

In calculating the direct economic cost of congestion, the Consultant adopted three approaches that were modified to suite the Tanzanian context. The first approach is the **'total cost of congestion approach'** employed by Grant-Muller and Laird (2006) and later Katala (2012) who estimated the cost of congestion for Dar es Salaam. The second

approach is the **'zoning approach'** used by Mfinanga and Fungo (2013) for investigating traffic congestion in Dar es Salaam city. The third approach is the **opportunity cost of time model** that was employed by Shabbar et al. (2014) to estimate the cost of congestion on Karachi roads in Pakistan.

From Grant-Muller and Laird (2006) and Katala's (2012) total cost approach, the Consultant adopted the 2016 per capita income to calculate the monetary worth of the VOT lost due to congestion for the daily commuting population in both Dar es Salaam and Mwanza cities. The Mfinanga and Fungo's (2013) zoning approach, enabled the Consultant to use the spatial accessibility approach to obtain the extra time spent by commuters and motorists occasioned by congestion in the context of the mono-centric nature of Dar es Salaam and Mwanza cities. The Shabbar et al. (2014) approach was used to calculate the extra fuel consumption costs by vehicles.

The combination of the above approaches enabled the Consultant to capture the heterogeneity nature of the monocentric settings of the two cities in terms of modes of transport and spatial qualities (location, land use types and densities of population). Particularly, the zoning approach that starts from the CBDs, is an attempt to homogenize the time of travel by road users residing in different parts of the cities. Travel in the two cities is mainly one directional as per Kiunsi (2013). Correlatively, road users residing in CBDs spend less time and fuel compared to those residing in peri urban areas.

6.2.2 Assumptions on Estimation of the Direct Economic Costs of Road Congestion

In calculating the direct cost of traffic congestion in both Dar es Salaam and Mwanza cities a number of assumptions were made. These assumptions hinge on the respondents' answers on the questions contained in the questionnaires and interview guides. The key assumptions are as follows:

1. ***Per capital income as a proxy for VOT lost:*** Tanzania's 2016 per capita income of USD 960.00 is used as a measure of opportunity cost of congestion in terms of VOT lost. The hourly cost is based on the 365 days per year and 8 hours per day. The ensuing cost is USD 0.33 per hour. This proxy is used to capture the costs

incurred by every traveler including motorists irrespective of age, economic and social status.

2. ***Travelling population:*** As established through literature review, the daily commuting population which uses motorized transport is 81% of the total population of both Dar es Salaam and Mwanza cities. That is, 68% are public transport commuters, 1% employees transport commuters and 12% private car users. The population used in calculations, is projected from the 2012 census i.e. 4,364,541 for Dar es Salaam and 706,453 for Mwanza. In the absence of ward specific population growth rates, the 2002-2012 intercensal annual rates of 6.45 and 6.24 per cent respectively are used.

3. ***Seasonality of traffic congestion:*** The severity of congestion during the year in both Dar es Salaam cities is seasonal. In a year, there are nine (9) active months of 234 days (excluding Sundays) and l three (3) less active months of 78 days (excluding Sundays). The latter months include school and annual holiday months of June, July and December. The active and less active periods are equivalent to 75 and 25 per cent of the year.

4. ***Commuting behaviour:*** While a section of the population undertake multiple journeys per day, the calculations are based on home to place of work and home journeys.

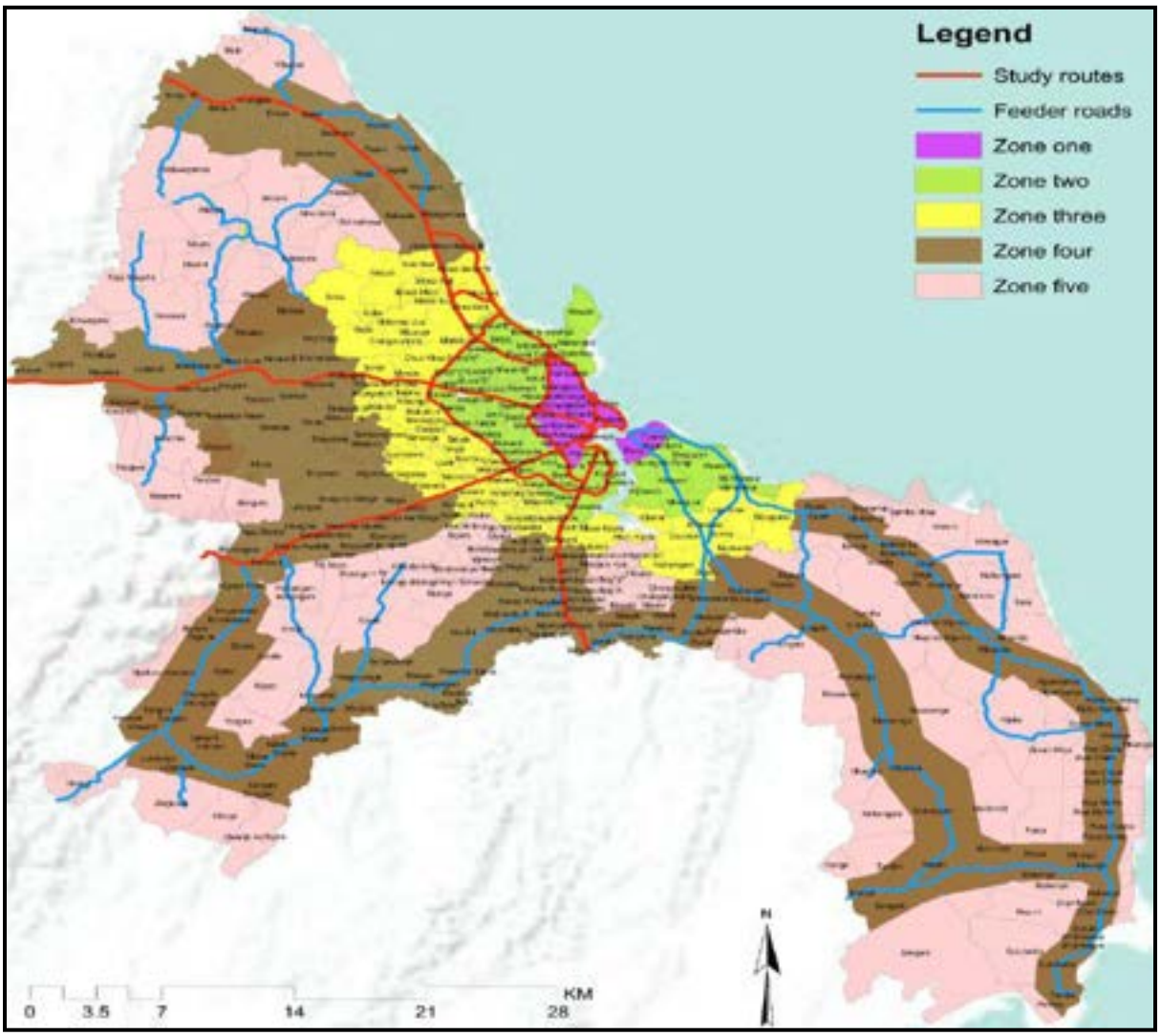
6.3 DIRECT ECONOMIC COST ESTIMATES OF TRAFFIC CONGESTION FOR DAR ES SALAAM CITY

6.3.1 Travel Time Zoning

For the purpose of calculating the opportunity cost or VOT lost due to traffic congestion in this city, five (5) zones were created starting with the CBD and radiating outwards. Zone demarcation was guided by the following criteria:

1. Zones were created on the basis of sub-wards in densely populated areas that are closer to CBD and wards in spatially populated outskirts.
2. Zones followed the band of between 0 and 3.0 km on both sides of the arterial and major feeder roads that are served by public transport or used by big volume of vehicles.
3. In order to avoid overlapping of the population in the sub-wards and wards, the administrative boundaries of these constituents that are recognized by PO-RALG, were followed. The generated travel zone settlements are presented in **Map 6.1** below:

Map 6.1: **Travel Zone Settlements of Dar es Salaam City as per Spatial Accessibility to CBD, Main and Feeder Road**



Source: *Generated Through Consultant's Survey*

The locations and constituents of the wards in each zone are as below:

- **Zone 1:** This zone covers sub-ward and wards in the city's CBD and parts of Ilala, Kinondoni and Temeke Municipalities. The 17 wards constituting this zone, are within a range of 0 km to 4.9 km from the city centre. These wards include Kisutu, Kivukoni, Mchafukoge, Mchikichini, Mzimuni, Upanga West, Upanga East, Kariakoo, Gerezani, Hananasifu, Ilala, Jangwani, Keko, Kigamboni, parts of Magomeni and Kinondoni. These wards are formed by 48 sub-wards. The zone has the highest density of road network that include the five (5) arterial roads that start in the CBD. Most of these wards are within a walkable distance to the city centre. However, a good number of their residents use motor vehicles to commute to either places of work or other destinations outside the CBD.

- **Zone 2**: This zone covers the secondary part of the city immediately after the CBD. The zone is located within the band of 4.9 km to 10.63 km. The 27 wards forming this zone with a total of 111 sub-wards, include Magomeni, Makurumla, Ndugumbi, Tandale, Mwananyamala, Msasani, Mzimuni, Kigogo, Mabibo, Manzese, Ubungo, Mburahati, Makumbusho, Sinza, Kijitonyama, Mikocheni, Tabata, Ilala, Buguruni, Temeke, Kurasini, Chang'ombe, Miburani, Vijibweni, Mtoni, Mjimwema and Tungi. The zone has a high road network and consequently the high traffic volume. Due to longer distance from the CBD, residents of this zone use motorised transport for travel.

- **Zone 3:** This zone is located within a distance of 10.63 km from the CBD up to 19.21 km northwards; 14.06 km westwards; and 12.44 km southwards. The zone is constituted by residential, industrial, commercial and institutional developments. The 27 wards with a total of 98 sub-wards constituting this zone include Goba, Kawe, Makuburi, Kimara, Mbezi Juu, Makongo, Vingunguti, Kipawa, Kiwalani, Segerea, Kimanga, Yombo Vituka, Azimio, Tandika, Sandali, Makangarawe, Kilakala, Kibada, Mbagala, Kijichi, part of Ubungo, Mjimwema, Vijibweni, Temeke, Mtoni, Buguruni, and Tabata. A number of distant sub-wards

of these wards form Zone 2. Due to increased distance from the CBD, residents travel by using motorized transport.

- **Zone 4:** This zone is constituted by the fast growing peri-urban areas that are hosting new housing developments and the highest population. The zone is formed by 38 wards consisting of 162 sub-wards. This zone starts at the distance of some 19.0 km from the CBD. It radiates to distances of 34.07 km northwards; 32.19 km westwards; 34.76 km south-westwards; and 45.84 km south-eastwards. The zone includes Kibamba, Kawe, Kunduchi, Bunju, Kimara, Mbezi, Saranga, Kwembe, Msigani, Mbezi Juu, Mabwepande, Wazo, Ukonga, Pugu, Kipawa, Segerea, Gongolamboto, Mbagala, Kijichi, Buza, Chamazi, Charambe, Mianzini, Kiburugwa, Kimara, Kinyerezi, Kimanga, Goba, Toangoma, Mbagala Kuu, Somangila, Pemba Mnazi, Kisarawe II, Msongola, Kimbiji, Pugu, Chanika and Majohe.

- **Zone 5**: This is also a peri-urban zone constituted by 21 wards with a total of 107 sub-wards. The zone is either wedged between areas of Zone 4, sharing boarders with Zone 3 or on the fringes of the city. The wards forming this include Buza, Chanika, Goba, Kibamba, Kiburugwa, Kijichi, Kimbiji, Kisarawe II, Kitunda, Kwembe, Mabwepande, Majohe, Makangarawe, Mbagala Kuu, Mbezi, Mbweni, Msongola, Pemba Mnazi, Pugu Somangila, Toangoma, Wazo and Yombo Vituka. The distances of this zone from the CBD are beyond 31.44 km to 32.19 km north-westwards; 34.23 km north-eastwards; 36.36 km south-westwards; and 45.97 south-east. This zone is the least serviced in terms of road network. Its residents spend longer time connecting to major roads for the purpose of accessing public transport. The use of private cars by residents of this zone is higher compared to the other four zones.

6.3.2 Extra Time Spend on Travels Due to Traffic Congestion for Dar es Salaam City

The extra time was obtained from the city's road user respondents by using questionnaires on the five (5) routes that were surveyed. These respondents included public transport commuters; private car drivers; public bus drivers; traffic police; motor- and tricycle drivers and motorcycle drivers. The estimated average extra travel time spent by commuters and motorists from and to their homes in the five zones are presented in **Table 6-1** below:

Table 6-1: Dar es Salaam City's Weighted Daily Extra Travel Time Occasioned by Traffic Congestion per Traveler during 2016 (in Hours)

Zone	Level Of Congestion Severity During Year		Weighted Average of Extra Time
	Severe – 234 days (75%)	Less Severe 78 days (25%)	
Zone 1	30 minutes	18 minutes	27 minutes
Zone 2	1:35 hours	45 minutes	1:22 hours
Zone 3	3:00 hours	45 minutes	3:11 hours
Zone 4	5:00 hours	3:45 hours	4:41 hours
Zone 5	6:30 hours	4:00 hours	5:53 hours

Source: *Field Survey, 2017*

6.3.3 Opportunity Cost of Congestion on Residents of Dar es Salaam City

On the basis of the assumptions made in Section 6.2.2 above; weighted daily extra travel time attributed to traffic congestion; and population projections for 2016, the estimated opportunity cost or VOT spent in traffic jams in Dar es Salaam is presented in **Table 6-2** below:

Table 6-2: Dar es Salaam City's Estimated Annual Value of Time Lost Due to Traffic Congestion in Dar es Salaam City during 2016 (in USD)

Zone	Population Projection (6.45% p.a.)			Traveling Days in a Year	Per Capita Hourly Rate	Daily Time Lost (Hours)	Value of Time Lost
	2012	2016	Traveling Population				
(1)	(2)	(3)	(4)=(3)X81%	(5)	(6)	(7)	(8)=[(4)x(5)x(6)x(7)]
Zone 1	269,812	319,393	258,708	312	0.33	0:27	11,986,474
Zone2	969,346	1,147,473	929,453	312	0.33	1:22	131,104,197
Zone 3	1,051,576	1,244,813	1,008,299	312	0.33	3:11	330,129,845
Zone 4	1,404,884	1,663,046	1,347,067	312	0.33	4:41	649,088,131
Zone 5	668,923	791,845	641,394	312	0.33	5:53	388,303,279
Total	**4,364,541**	**5,166,570**	**4,184,922**				**1,510,611,926**

***Source**: Field Survey, 2017.*

From the above table, the estimated VOT lost due to traffic congestion during 2016, was a walloping **USD 1,510,611,926** equivalent to **TAS. 3,389,813,161,944** at the December, 2016 exchange rate**.** In terms of Dar es Salaam city's per capita income at USD 292.38 this amount is equivalent to 30.5% of the national GDP per capital income.

6.3.4 Estimation of Extra Vehicle Fuel Consumption Costs Attributed to Congestion

The estimation of the extra vehicle fuel consumption costs attributable to traffic congestion in Dar es Salaam city is premised on the following considerations:

1. ***Fuel consumptions:*** Vehicles' petrol and diesel consumptions per day constitute the average estimates gathered through questionnaires administered to drivers of private cars/vans (192), public buses (78), trucks/lories (42), tricycles (17) and motorcycles (21).
2. ***Number of vehicles, motorcycles and tricycles:*** The number of motor vehicles motorcycles and tricycles used in calculating fuel consumption, are those

issued with annual licenses by TRA during 2016. These vehicles are presented in **Figures 5-5 and 5-6 above.**

3. ***Fuel Prices:*** Prices of fuel are the December, 2016 average prices provided by EWURA, i.e. TAS. 2, 060.00 and TAS.1913.00 per litre for petrol and diesel.

4. ***Fuel Usage:*** Cargo trucks and buses are assumed to use diesel while private cars/vans, tricycles and motorcycles are assumed to use petrol.

5. ***Traffic congestion days:*** The annual traffic congestion days are taken to constitute 234 active days and 78 less active days i.e. a total of 312 days.

From the above factors, the 2016 daily weighted average for the cost of extra fuel consumption per vehicle during active and less active days is presented in **Table 6-3** below:

Table 6-3: Weighted Average for Daily Extra Vehicle Fuel Consumption Attributable to Traffic Congestion in Dar es Salaam during 2016 (in Litres)

Type of Vehicle	Type of Fuel	Level of Congestion Severity/Daily Fuel Consumption During the Year		Weighted Average of Extra Fuel
		Severe 234 days (75%)	Less Severe 78 days (25%)	
Private cars/vans	Petrol	5.0	2.5	4.4
Lorries	Diesel	18.0	12.0	16.5
Buses	Diesel	25.0	17.0	23.0
Motorcycles	Petrol	1.25	0.5	1.1
Tricycles	Petrol	3.0	1.5	2.9

Source: *Field Survey, 2017*

On the basis of the above estimates, the 2016 vehicles' cost of extra fuel consumptions caused by traffic congestion in Dar es Salaam city is presented in **Table 6-4** below:

Table 6-4: Extra Fuel Consumption Cost for Vehicles Operating in Dar es Salaam City during 2016 (in TAS)

Vehicle		Congestion Days per Year	Fuel		Price per Litre	Total Cost
Type	Number		Type	Daily Consumption (Litres)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)=[(2)x(3)x(5)x(6)]
Private cars/vans	162,474	312	Petrol	4.4	2,060	**459,471,272,832**
Lorries	56,233	312	Diesel	16.5	1,913	**554,368,531,860**
Buses/Pub. Trans.	9,993	312	Diesel	23.0	1,913	**137,324,205,720**
Motorcycles	21,390	312	Petrol	1.1	2,060	**15,122,558,880**
Tricycles	4,715	312	Petrol	2.9	2,060	**8,788,231,920**
Total	-	-	-	-	-	**1,175,074,801,212**

Source: *Field Survey, 2017*

From the above table, the estimated extra fuel consumption costs attributed to traffic congestion for vehicles in Dar es Salaam city during 2016, were **TAS. 1,175,074,801,212** equivalent to **USD 524,586,965** at the December, 2016 exchange rate.

6.4 DIRECT ECONOMIC COST ESTIMATES OF TRAFFIC CONGESTION IN MWANZA CITY

6.4.1 Travel Time Zoning

Mwanza city'stravel zones were also demarcated in consideration of the mono-centric spatial settlements. Three (3) zones were created starting from the CBD outwardly towards the city peripheries. The settlement zones were generated in the context of the city's wards and sub-wards administrative boundaries (NBS, 2013) as presented in **Map 6.2** below. The wards sub-wards that are closer to the CBD are densely populated as compared to those located in the outskirts. It is noteworthy that due the hilly and rocky geophysical features, the city's road network is non-linear and limited in terms of connectivity.

Map 6.2: **Travel Settlement Zones of Mwanza City as per Spatial Accessibility to CBD, Main and Feeder Roads**

Source: *Generated Through Consultant's Survey, 2017.*

The spatial locations and constituents of the wards in each zone are as below:

- **Zone 1:** This zone covers sub-wards and wards in the city's CBD which is located in Nyamagana Municipality. There are 13 wards in this zone that extend from the city centre to 3.79 km eastwards, 5.11 km southwards and 6.44 km northwards. The zone is constituted by Igogo, Mkuyuni, Pamba, Nyamagana, Milongo, Isamilo, Mbugani, Nyakato, Nyamanoro, Kilumba, Kitangiri, Pasiansi and Ilemela wards. These wards consist of 79 sub-wards. The zone has the highest density of road network which includes the three (3) arterial roads that start in the CBD. Residents of these wards are within walking distance to the city centre. However, the majority of these residents use motorized modes of transport to commute to places of work in the CBD and other destinations in peri urban areas.

- **Zone 2**: This zone covers the secondary part of the city which is located immediate to the CBD. The zone experiences traffic congestion problems particularly in areas which are on the southern end of the city towards Butimba, Nyegezi and Buhongwa. This zone is located within the band of 3.79 km to 13.82 km eastwards, 5.11 km to 13.21 km southwards and 6.44 km to 9.51 km northwards. The 10 wards forming this zone consist of a total of 72 sub-wards. These wards include Buswelu, Nyakato, Pasiansi, part of Ilemela, Mkuyuni, Mahina, Igoma, Buhongwa, Mkolani and Butimba. The zone has slightly higher road network and modest traffic volumes. Elevated traffic delays are experienced on arterial road networks namely Kenyatta, Nyerere and Airport roads. Due to longer distances from the CBD, the majority of residents use motorised travel modes of transport. While the larger part of Zone 1 is commercial-cum-residential, Zone 2 is constituted by largely residential, industrial, commercial and institutional developments. This zone is fast-growing and is a fairly serviced peri urban area. As such, the areas in this zone attract many new urban developments including housing.

- **Zone 3**: This zone comprises of the fringes of Mwanza city. It is constituted by seven (7) wards and 47 sub-wards. The wards forming this zone include Buhongwa, Buswelu, Ilemela, Usagara, Igoma, Kayenze and Mkolani. The distance limits of this zone from the CBD are 13.82 km to 15.74 km eastwards; 9.51 km to 17.86 km north-eastwards; 13.82 km to 18.55 km south-eastwards; and 13.21 km to 15.54 km southwards. This zone is the least serviced zone in terms of road network and settlements. Equally, its population densities are still low. The residents of this zone spend longer time while connecting to major roads for the purpose of accessing public transport. Due to the long distances from the CBD, residents of this zone prefer to travel by private cars.

6.4.2 Extra Time Spend on Travels Due to Traffic Congestion

The extra travel time was obtained through questionnaires administered to the city's road user respondents for the three (3) surveyed routes. The respondents consisted of public transport commuters; private car drivers; public bus drivers; traffic police; and motor- and tri-cycle drivers. The weighted average daily extra time spent on travel by commuters in the three zones is presented in **Table 6-5** below:

Table 6-5: Daily Extra Travel Time Caused by Traffic Congestion per Commuter in Mwanza City during 2016 (in Hours)

Zone	Level Of Congestion Severity During Year		Weighted Average of Extra Time
	Severe – 234 days (75%)	Less Severe 78 days (25%)	
Zone 1	27 minutes	10 minutes	23 minutes
Zone 2	2:30 hours	1.15 hours	2:01 hours
Zone 3	3.30 hours	2.30 hours	3.05 hours

Source: Field Survey, 2017

6.4.3 Opportunity Cost of Congestion on Residents of Mwanza City

On the basis of the assumptions made in Section 6.2.2 above, the weighted daily delay time attributed to traffic congestion; population projections for 2016; and 81% traveling population, the estimated VOT spent in road traffic congestion in Mwanza city is presented in **Table 6-6** below:

Table 6-6: Estimated Annual Value of Time Lost Due to Traffic Congestion during 2016 in Mwanza City (in USD)

Zone	Population Projection (6.24% p.a.)			Traveling Days in a Year	Per Capita Hourly Rate	Daily Time Lost (Hours)	Value of Time Lost
	2012	2016	Traveling Population				
(1)	(2)	(3)	(4)=(3)X81%	(5)	(6)	(7)	(8)=(4)X(5)X(6)x(7)
Zone 1	290,856	352,188	285,272	312	0.33	0:23	11,161,221
Zone2	289,478	336,452	272,526	312	0.33	2:01	56,595,587
Zone 3	126,119	161,360	130,702	312	0.33	3.05	41,447,673
Total	**706,453**	**850,000**	**688,500**	**312**	**0.33**	-	**109,204,481**

Source: *Field Survey, 2017*

From the above table, the estimated VOT lost due to traffic congestion in Mwanza city during 2016 was **USD 109,204,481,** equivalent to **TAS 245,054,855,364** at the December, 2016 exchange rate. In terms of national annual per capita income, the resulting USD 128.48 is equivalent to 13.4%.

6.4.4 Estimation of Extra Vehicle Fuel Consumption Costs Attributed to Congestion in Mwanza City

The cost of extra fuel consumption due to congestion in Mwanza was computed on the basis of similar parameters obtaining in Dar es Salaam City. The Mwanza city parameters include vehicle fuel consumption per day, number and types of vehicles, prices of fuel as per 2016 rates that were provided by EWURA, type of fuel and traffic congestion days.

The prices for fuels per litre during December, 2016 were TAS. 2,240.00 and TAS.2,013.00 for petrol and disease respectively. Other assumptions presented in **Section 6.3.4** above, also hold for the case of Mwanza city. The 2016 daily weighted average for the cost of extra fuel consumption per vehicle during the active and less active days in Mwanza city is presented in **Table 6-7** below:

Table 6-7: Mwanza City's Weighted Average for Daily Extra Vehicle Fuel Consumption Attributable to Traffic Congestion during 2016 (in Litres)

Type of Vehicle	Type of Fuel	Level of Congestion Severity/Daily Fuel Consumption During Year		Weighted Average of Extra Fuel
		Severe 234 days (75%)	Less Severe 78 days (25%)	
Private cars/vans	Petrol	3.5	1.5	3.00
Lorries	Diesel	9.0	5.0	8.00
Buses	Diesel	12.0	8.5	11.13
Motorcycles	Petrol	1.0	0.5	0.88
Tricycles	Petrol	2.0	1	1.75

Source: *Field Survey, 2017*

The estimation of the cost of extra fuel consumption is based on the number of vehicles, motorcyles and tricycles issued with annual licences by TRA. The estimates are presented in **Table 6-8** below:

Table 6-8: Extra Fuel Consumption Cost for Vehicles Operating inMwanza City during 2016 (in TAS)

Vehicle		Congestion Days per Year	Fuel		Price per Litre	Total Cost
Type	Number		Type	Daily Consumption (Litres)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)=[(2)x(3)x(5)x(6)]
Private cars/vans	17,169	312	Petrol	3.00	2,240	**35,997,212,160**
Lorries	6,536	312	Diesel	8.00	2,013	**32,839,792,128**
Buses/Pub. Trans.	2,154	312	Diesel	11.13	2,013	**15,057,027,105**
Motorcycles	2,242	312	Petrol	0.88	2,240	**1,378,862,285**
Tricycles	146	312	Petrol	1.75	2,240	**178,563,840**
Total						**85,451,457,518**

Source: *Field Survey, 2017*

From the above table, the estimated cost for extra fuel consumption attributed to traffic congestion for Mwanza city during 2016, was **TAS 85,451,457,518** equivalent to **USD 38,147,972** at the December, 2016 exchange rate.

6.5 CONCLUSION

The cost of traffic congestion was calculated on the basis of two cost elements namely, the annual extra VOT spend on commuting and the annual extra vehicle fuel consumption by motorists. The combined road traffic congestion for Dar es Salaam and Mwanza cities presented below, is a walloping USD 2.183 billion equivalent to TAS 4.9 trillion.

Name of City	Cost of VOT Lost (USD)	Cost of Extra Fuel Consumption (USD)	Total Cost (USD)
Dar es Salaam	1,510,611,926	524,586,965	**2,035,198,891**
Mwanza	109,204,481	38,147,972	**147,352,453**
Total Cost (USD)	**1,619,816,407**	**562,734,937**	**2,182,551,344**

In terms of the annual national per capita income, these results indicated that the extra cost of traffic congestion inflicted on the wider society, was equivalent to a substantial 41.0% for Dares Salaam and 18.1% for Mwanza.

CHAPTER SEVEN:

FINDINGS ON ROAD TRAFFIC CONGESTION EXTERNALITIES

7.1 INTRODUCTION

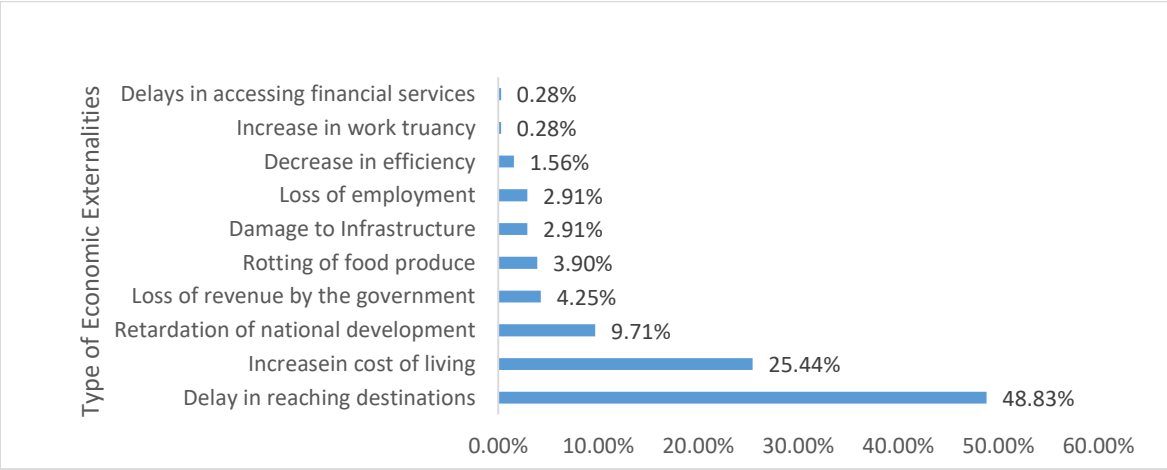
Road traffic congestion externalities involve impacts or costs that are borne by the society in general and not individuals who are benefiting from use of road transport. These externalities include economic (other than the foregoing direct costs); social, environmental and health problems. This chapter presents the findings on these externalities as responded upon by 1,182 and 692 respondents from Dar es Salaam and Mwanza cities respectively. Responses from road users and stakeholders were elicited through both close-ended and mainly open-ended questions posed in the questionnaires. The open-ended questions that needed more than one answer for a specific question, enabled respondents to provide multiple responses or answers.

7.2 EXTERNALITIES OF TRAFFIC CONGESTION ON DAR ES SALAAM CITY

7.2.1 Economic Externalities on Dar es Salaam City

Economic externalities involve the costs that are exerted on the economy by traffic congestion. The questions on economic externalities in the city generated a total of 1,411 responses through which 10 types of externalities were identified as shown in **Figure 7-1** below:

Figure 7-1: Economic Effects of Congestion in Dar es Salaam City



Source: *Field Survey, 2017*

As indicated in the above figure, the most prominent three (3) economic externalities that were identified by respondents are delays in reaching destinations (48.9%); increased cost of living (25.4%); and retardation of national development (9.8%) The other tier of externalities that were identified as marginally significant by scoring between 4.9% and 2.9%, include loss of revenue by the government; rotting of food products destined to markets; increased cost of infrastructure; and loss of employment. The rest of the externalities were not relevant. These include decrease in production efficiency; increase in work truancy; and delays in accessing financial services.

The above results justify the fact that the society was aware of the economic externalities of traffic congestion. Apparently, congestion impinged on both personal and national economic welfare. On the personal front, externalities such as delays in reaching destinations especially work places, increase in cost of living and loss of employment were high on societal array. On the national economy front, the identified externalities included loss of revenue by the government and damage to infrastructure.

The Consultant also sought to understand how traffic congestion was affecting the public transport business and services. The responses provided by 78 bus owners and 121 bus drivers from Dar es Salaam elicited through a likert scale and analysed by using the R.I.I model, provide a further insight into the economic externalities. These results are presented in **Figure 7-2 (a) & (b)** below:

Figure 7-2 (a): Responses by Public Bus Owners Traffic Congestion Economic Externalities in Dar es Salaam

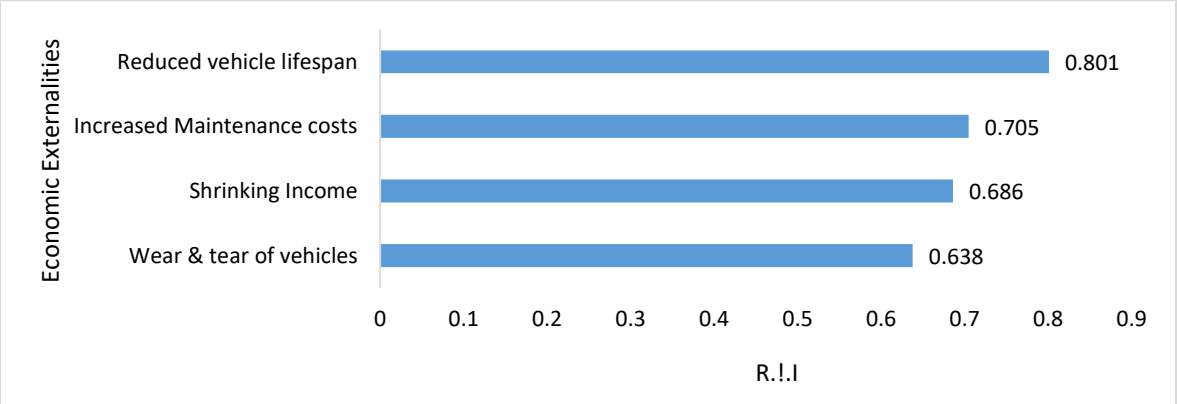
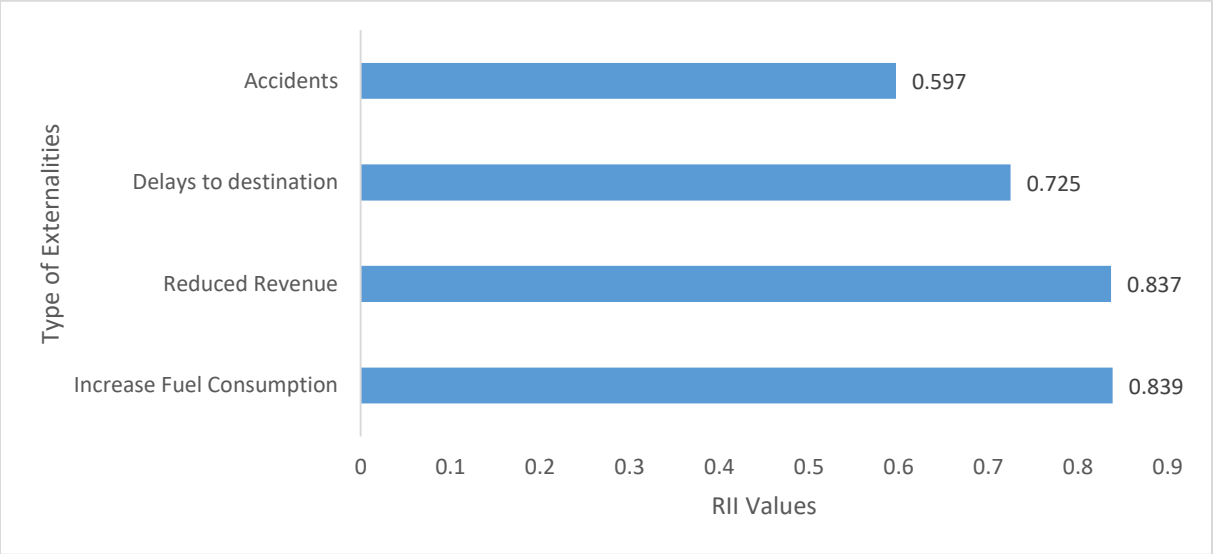


Figure 7-2 (b) 1: Responses on Economic Externalities by Public Bus Drivers in Dar es Salaam City



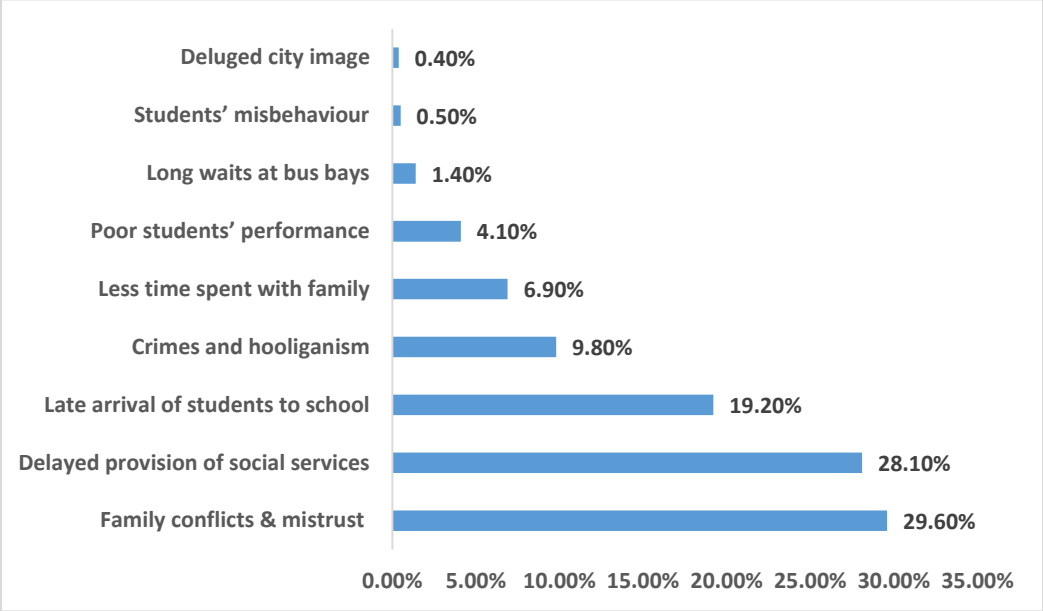
Source: *Field Survey, 2017*

The above results are indicative of the economic strains that the traffic congestion is exerting on both *daladala* owners and drivers. For the owners, respondents indicated that traffic congestion was negatively affecting their businesses in terms of shrinking income; increased motor vehicle maintenance costs; reduced vehicle lifespan; and wear and tear of vehicles in descending order. These aspects that are above the 0.500 significance threshold on the R.I.I scale, cut deep into the bus owners' profits. Equally, *daladala* drivers were also of the opinion that congestion was adversely impacting on their employment. Particularly, reduced revenue; increased fuel consumption; delay to destinations; and accidents were above the significance level of 0.500. Implicitly, these factors represented serious economic externalities to this group of road users.

7.2.2 Social Externalities on Dar es Salaam City

The social externalities of congestion involve the disutilities occasioned by traffic jams on the society. The 1,281 multiple responses on social externalities elicited from 1,182 respondents in Dar es Salaam city are presented in **Figure 7-3** below:

Figure 7- 3: Social Externalities of Traffic Congestion in Dar es Salaam City



Source: *Field Survey, 2017*

The first top tier of negative social externalities that attracted the highest proportions of responses of between 29.6% and 19.2%, is constituted by family conflicts, mistrust and tensions; delayed provision of social services; and students' late arrival to schools and homes. Follow-up interviews with a number of road users reveled that traffic congestion was a source of discomfort among married couples. There were suspicions of infidelity on pretext of congestion that even led to separation and divorces. Delays in delivery of social services were related to emergency fire and ambulance services. These services were obstructed by congestion to the extent that it caused unwarranted loss of properties and lives. Late arrival of students to and from schools, negatively impacted on their performance. More than often, school children and students were not accorded boarding priority by *daladala* operators.

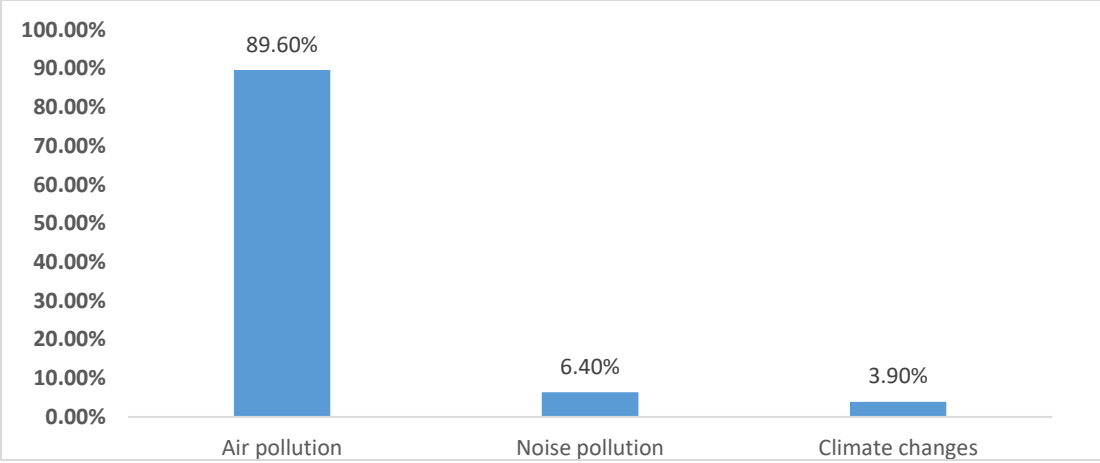
The other serious social externalities identified by road users were spiked crime and hooliganisms especially by youths and bus touts. This externality which scored 9.8% of responses, was rife at bus stands. It was revealed by a section of road users interviewed, that women commuters were harassed by hooligans or robbed and especially during the evenings when people are heading to their homes. The inadequate time accorded to

families by parents was another social bother that was supported through 6.9% of responses. Interviews revealed that in most cases parents and school-going children leave very early in the mornings as a precaution for travel buffer time. Further, parents returned home very late. Under these circumstances, parents do not have enough time to relate or follow-up the school performance of their children. The other social externalities that include poor students' performance; long waits at bus bays; students' misbehaviour; and deluged city image, seem to carry less weight.

7.2.3 Environmental Impact of Traffic Congestion in Dar es Salaam City

In Dar es Salaam city, a total of 1,043 multiple responses on the impact of traffic congestion on the environment were obtained from 1,182 respondents. The results on this issue are presented in **Figure 7-4** below:

Figure 7-4: Environmental Impacts of Road Congestion in Dar es Salaam City



Source: *Survey data, 2017*

The above results are indicative of the fact that air pollution was the most significant negative externality attributable to traffic congestion by attracting 89.6% of responses. Air pollution is related to noxious gas emitted by vehicles through burning fuels and especially diesel and leaded petrol. These gases include carbon dioxide (CO_2), sulphur dioxide, nitrogen oxide and carbon monoxide. These gases when released in big volumes in the atmosphere, they contribute to **greenhouse effect** and the consequential climate change. However, it would seem that the majority of respondents were unable to relate traffic congestion to climate changes since this externality received a paltry 3.9% of responses. On the other hand, noise pollution is generated by speeding and defective

motor vehicles. The noise effect of traffic congestion was acknowledged as a problem by a insignificant 6.4% responses. Understandably, noise pollution affects a small section of the population especially those living along roads with high volume of vehicles.

Both air and noise pollution in Dar es Salaam city is caused by the big number of motor vehicles compared to other urban areas of the country. As earlier highlighted in Section 5.4 above, this city retained 68.7 per cent of all imported motor vehicles during 2012-2016 period. As indicated in **Table 7-1** below, a staggering 89.7% of all vehicles imported in Tanzania during this period, were over 5 years old.

Table 7-1: Age of Motor vehicles Imported in Tanzania during 2012-2016 Period

Age of MV	Lorries	Private Cars	Buses	Total	Per cent
New	9,061	4,053	1,894	**15,008**	**4.5%**
1-4 Years	10,914	6,426	1,986	**19,326**	**5.8%**
5-8 Years	7,619	13,786	864	**22,269**	**6.7%**
Over 8 Years	40,595	221,652	14,058	**276,305**	**83.0%**
Total	**68,189**	**245,917**	**18,802**	**332,908**	**100.0%**
Per cent	**20.5%**	**73.9%**	**5.6%**	**100.0%**	

Source: *TRA, 2017*

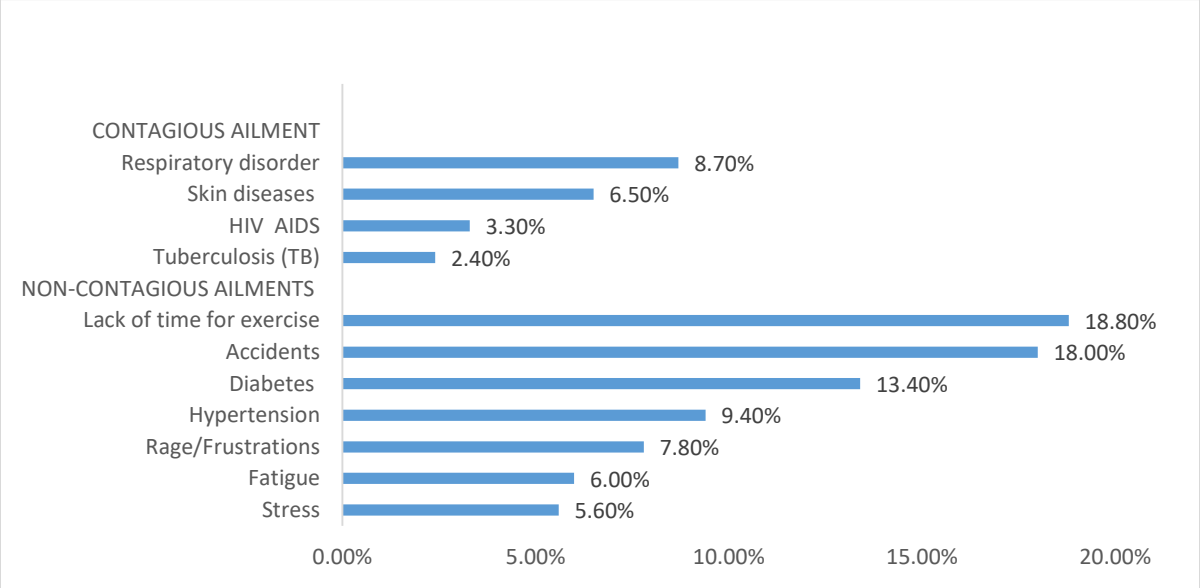
The above proportion is constituted by 6.7% of all motor vehicles that were 5 to 8 years old and 83.0% of all motor vehicles that were over 8 years. The most pollutant vehicles, namely lorries and buses which use diesel constituted 26.1% of all imported vehicles. The over 8 years old lorries and buses were equivalent to a significant 59.5% and 74.8% of the imported vehicles respectively. The overriding view is that, vehicles imported in the country, were air polluters due to their old age. The old vehicles were most likely to be inefficient in respect of fuel consumption.

While NEMC and Government Chemist officials support the fact that traffic congestion was an environmental menace in the fast growing urban areas of Tanzania, unfortunately the two institutions weren't able to provide scientific evidence of this aspect. Information such as the quantities of greenhouse gas emissions and tolerable gas emission levels, were not available.

7.2.4 Health Impact of Traffic Congestion in Dar es Salaam City

The 1,182 road users in Dar es Salaam city provided 1,729 multiple responses on non-contagious and contagious diseases as the worrisome health effects of traffic congestion. These results are presented in **Figure 7-5** below:

Figure 7-5 Health Effects of Road Congestion in Dar es Salaam City

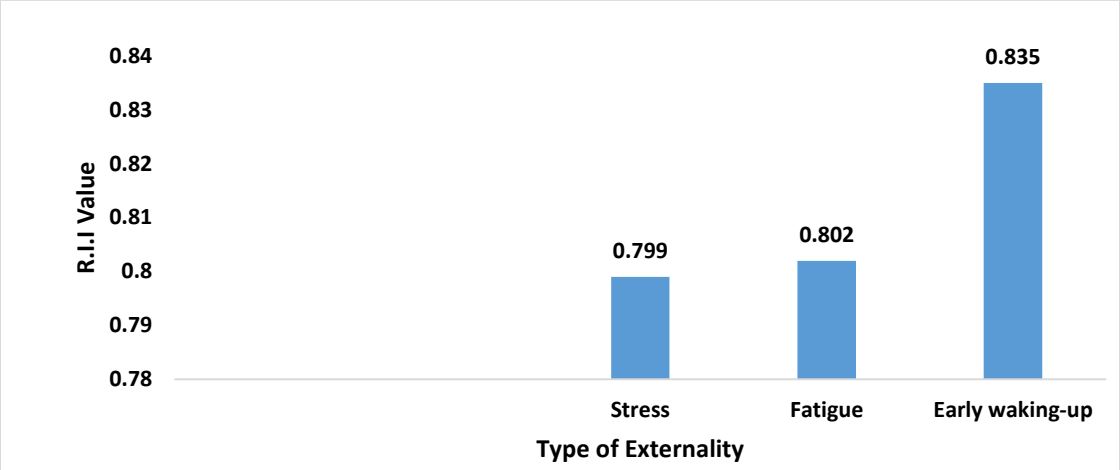


Source: *Field Survey, 2017*

The adverse health effects attributed to congestion are documented by Katala (2012) and Olagunju (2015), among others. In line with these authors' findings, the above results indicate that the non-contagious health effects of congestion were the most significant by garnering a combined 79.0% of all responses. The identified ailments were lack of time for exercising, accidents, diabetes, hypertension, rage/frustrations, fatigue and stress. Understandably, accidents were recognized as the second most significant effect of traffic congestion by obtaining 18.0% of the responses. In fact, road users are either maimed or killed by vehicles speeding to compensate time lost in traffic jams. The contagious health maladies obtained 20.9% of the responses. These maladies included respiratory disorders, skin diseases, HIV AIDS and TB.

In further assessment of the health effects caused by traffic congestion, 192 private car drivers were required to respond on the closed self-scoring questions on likert scale. The results on the level of significance on fatigue, stress and early waking up as measured on the RII scale, are presented in **Figure 7-6** below:

Figure 7-6: Responses of Private Car Drivers on Health Effects of Traffic Congestion in Dar es Salaam City



Source: *Field Survey, 2017*

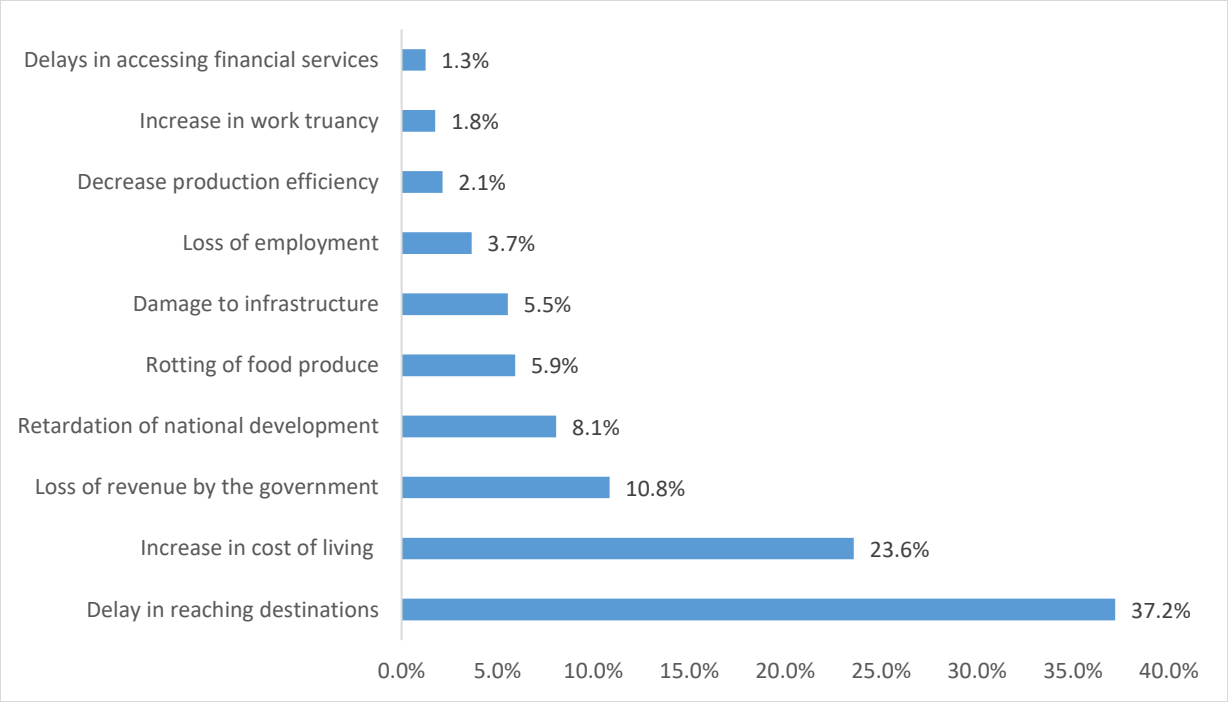
The above results strengthen the earlier ones that both motorists and commuters, are significantly exposed to fatigue and stress attributed to early waking-up and long hours spent in traffic jams. These negative health effects are recognized as key maladies as all are above the 0.500 significance threshold on the RII scale.

7.3 TRAFFIC CONGESTION EXTERNALITIES ON MWANZA CITY

7.3.1 Economic Externalities

The same questionnaires used in Dar es Salaam city were administered to road users in Mwanza city for the purpose of eliciting their views on the negative economic externalities attributed to road traffic congestion. The findings on the open-ended question on this aspect from 692 respondents that generated 793 multiple responses, are presented in **Figure 7-7** below:

Figure 7-7: Economic Effects of Road Congestion in Mwanza City

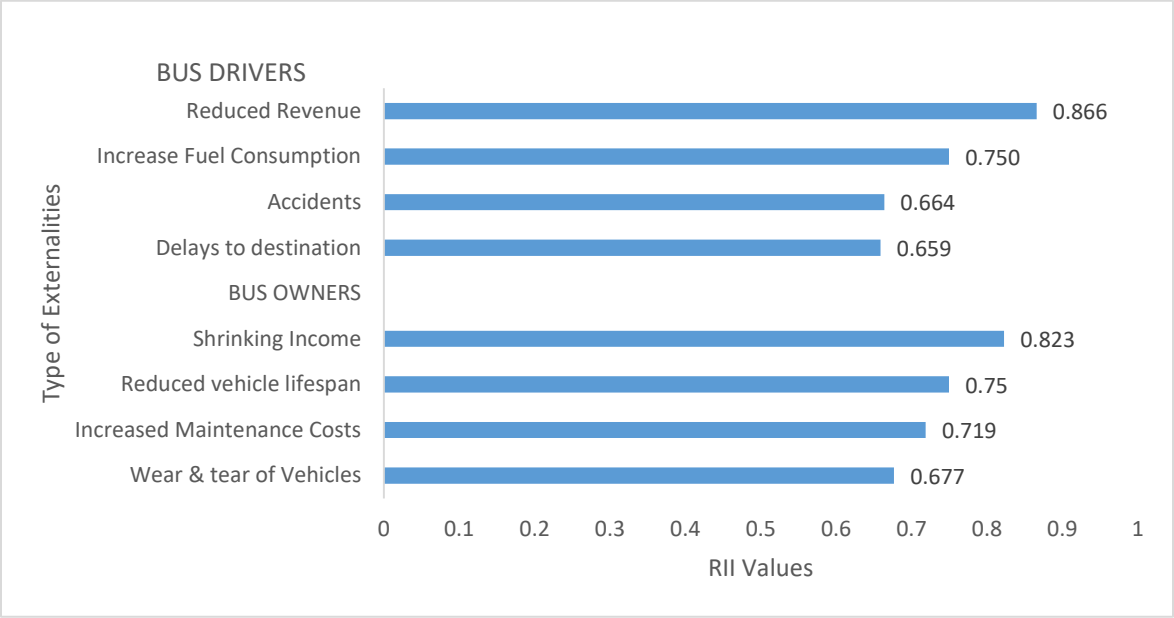


Source: *Field Survey, 2017*

The above figure depicts results that are more or less similar to those pertaining in the case of Dar es Salaam city. Delays in reaching destinations was the most prominent negative economic effect as it was supported through 37.2% of the responses. Increase in cost of living and loss of revenues by the government ranked second and third by garnering 23.6% and 10.8% of the responses respectively. The marginally significant tier of externalities which attracted between 8.1 and 5.5% include retardation of national development; rotting of food products destined to urban markets; and damage to infrastructure. The remaining five externalities did not carry much weight. These results are indicative of the fact that much as people were more concerned with personal economic welfare, they were also aware of the strain traffic congestion was exerting on the national economy.

Just like in Dar es Salaam city, traffic congestion in Mwanza city was indicated on likert scale as a negative externality by both public bus owners and drivers as presented in **Figure 7-8** below:

Figure 7-8 Responses of Public Bus Owners and Drivers on Economic Externalities of Traffic Congestion in Mwanza City



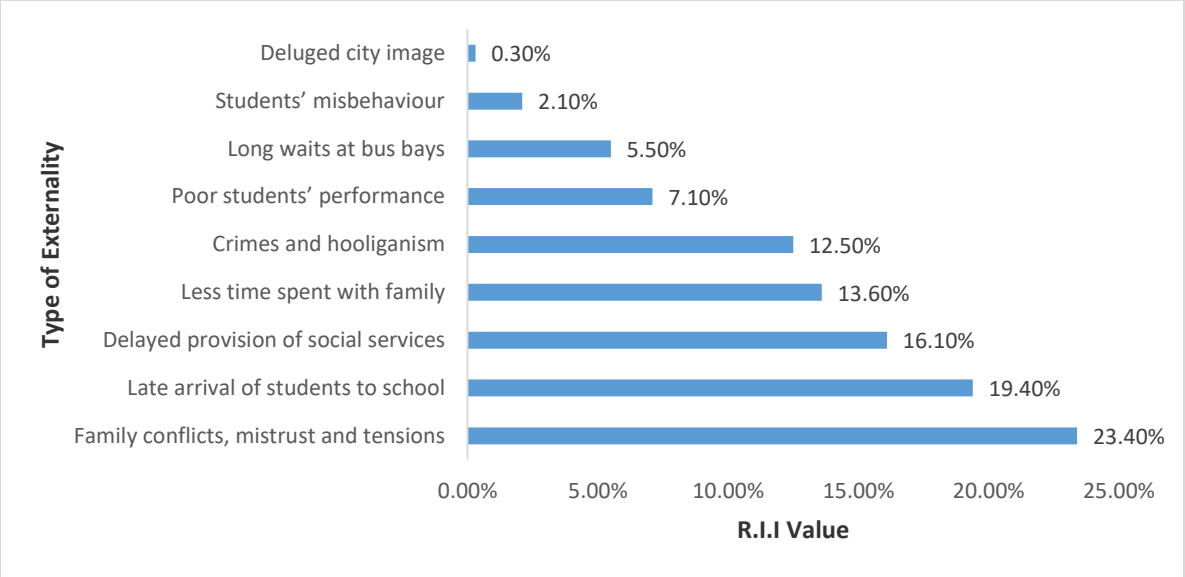
Source: *Field Survey, 2017*

The above results show that public bus owners recognize the fact that traffic congestion was adversely affecting their businesses. Particularly, traffic congestion was affecting the economic wellbeing of these owners through shrinking income; reduced vehicle lifespan; increased maintenance costs; and wear & tear of vehicles in the descending order. The seriousness of these externalities, is depicted by the high score they all received. That is, the four economic factors scored above the 0.500 significance threshold on the R.I.I scale and therefore were significantly considered. The bus drivers also indicated that they were feeling the economic squeeze consequent to traffic congestion. The four income and cost elements namely, reduced revenues; increase fuel consumption; accidents; and delays to destinations, were found to be significant as they scored above the R.I.I significance threshold of 0.500.

7.3.2 Social Externalities on Mwanza City

The findings pertaining to 751 multiple responses on negative social externalities elicited from 692 road users are presented in **Figure 7-9** below:

Figure 7-9: Social Impact of Road Congestion in Mwanza City



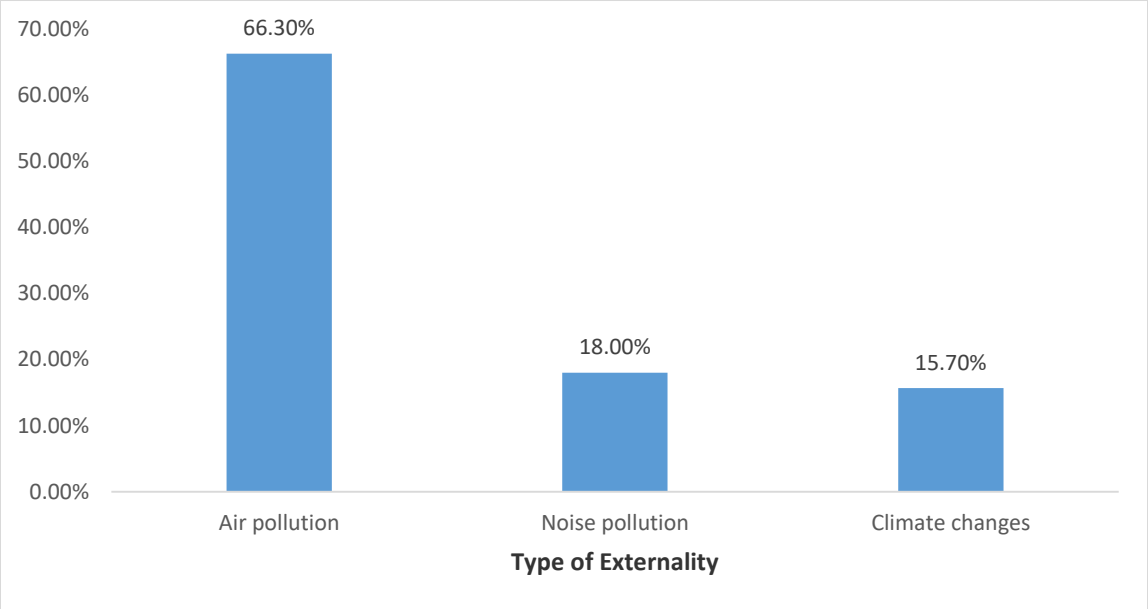
Source: *Field Survey, 2017*

As provided in the above Figure, in Mwanza city the most prominent negative social externalities were family conflicts, mistrust and tensions; late arrival of students to school; delayed provision of social services; less time spent with family by family heads; and crimes and hooliganism that were supportedby between 23.4% and 12.5% of multiple responses. Like in Dar es Salaam, residents of Mwanza city were aware of the fact that the unabated traffic congestion was adversely affecting the city's social fabric. However, other negative social impacts were less significant in the city. These impacts that scored between 7.1% and 0.3%, included poor students' performance; long waits at bus stands; students' misbehaviour; and deluged city image.

7.3.3 Environmental Impact of Traffic Congestion in Mwanza City

An assessment of the environmental impact of traffic congestion in Mwanza city was also conducted by using open-ended questions. The results obtained from road users' 643 multiple responses are presented in **Figure 7-10** below:

Figure 7-10: Environmental Effects of Road Congestion in Mwanza City



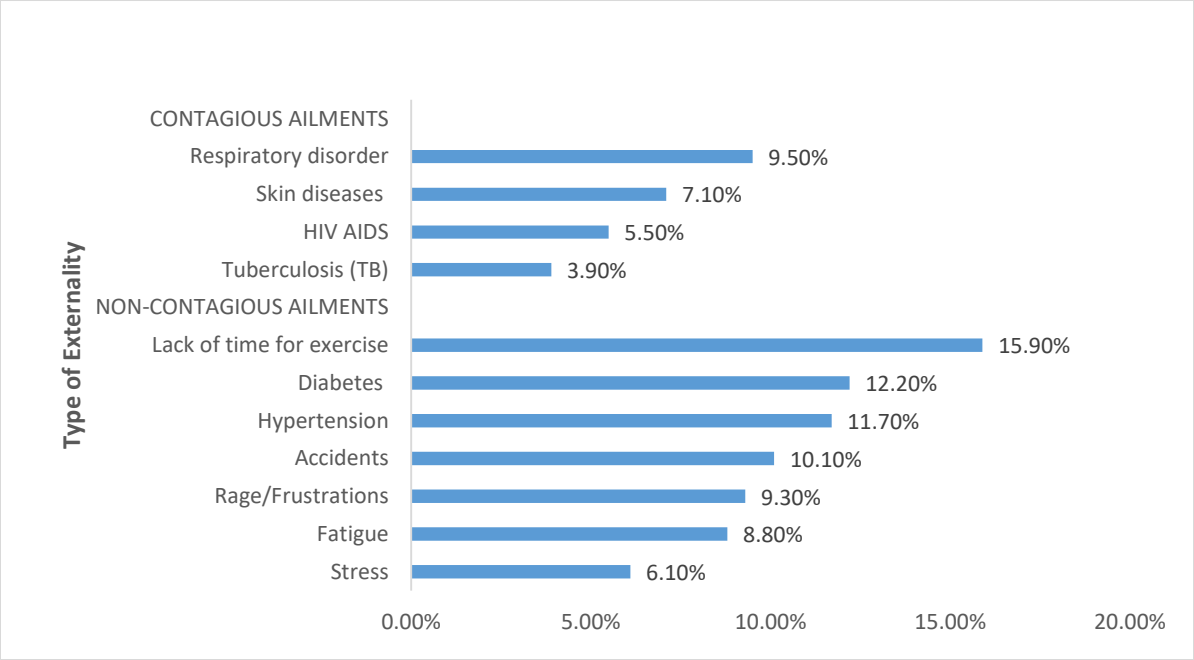
Source: *Survey data, 2017*

From the above Figure, it is clear that air pollution was identified as a major environmental concern by Mwanza City residents through two thirds of the multiple responses. Though the level of responses were lower than the 89.6% obtained in Dar es Salaam city, they were also highly significant. Noise pollution was supported by 18.0% while climate changes obtained 15.7% of the total responses. Since Mwanza city had the second highest number of motor vehicles in the country i.e. 9.6% of all imports, the negative environmental effects attributed to traffic congestion were likely to be on the rise.

7.3.4 Health Impact of Traffic Congestion in Mwanza City

In Mwanza city, 831 multiple responses were obtained from 682 road users regarding the negative health effects caused by traffic congestion. The responses on the identified non-contagious and contagious ailments were as presented in **Figure 7-11** below:

Figure 7-11: Summary of Health Effects of Road Congestion in Mwanza City

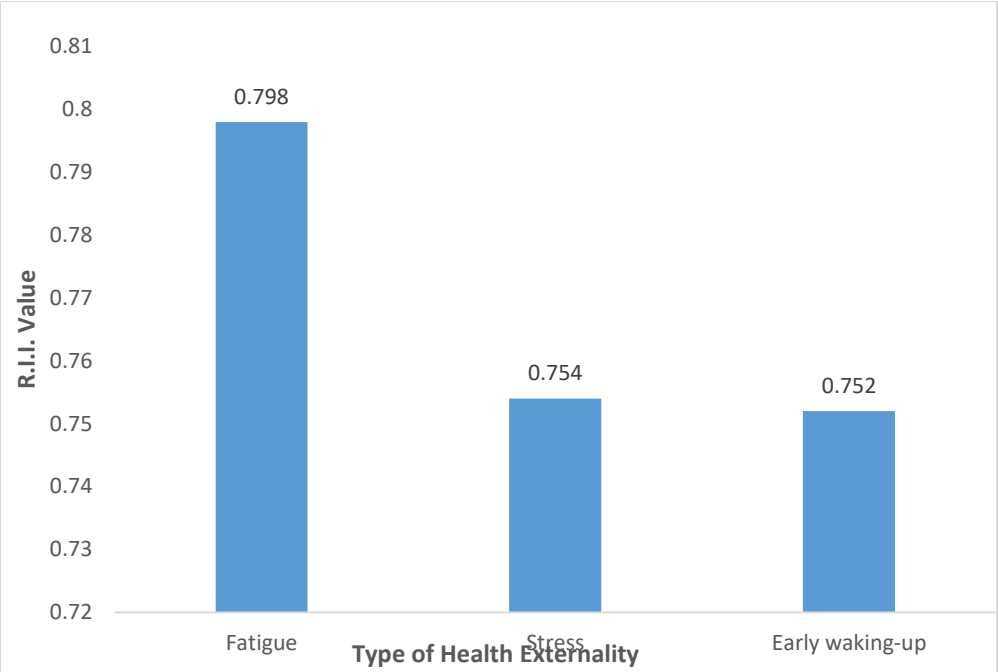


Source: *Field Survey, 2017*

In Mwanza city, the non-contagious ailments such as lack of time for exercising, diabetes, hypertension accidents, rage, fatigue and stress, were recognized as the most prominent health externalities through a combined 74.1% of responses. These responses were comparable to 79.0% of responses obtained in Dar es Salaam city. The contagious ailments that include respiratory disorders, skin diseases, HIV AIDS and TB obtained a combined 24.9% of the responses. Like in Dar es Salaam city, these results reflect the fact that Mwanza residents were aware of the negative health effects of traffic congestion.

The responses on negative health effects highlighted above, were also felt by motor vehicle drivers. The R.I.I analysis undertaken on the responses from 125 private car drivers are presented in **Figure 7-12** below:

Figure 7-12: Responses of Private Car Drivers on Health Effects of Traffic Congestion in Mwanza City



Source: *Field Survey, 2017*

From the above Figure, it is apparent that private car drivers and certainly other drivers were feeling the health strain caused by traffic congestion in form of fatigue, stress and early rising. The R.I.I values on the three health ailments being above 0.75 augment the findings that the congestion effects on people's health were increasingly being recognized by the society.

7.6 CONCLUSION

This chapter has presented the findings on the economic, social, environmental and health externalities attributed to road traffic congestion. Despite that these externalities could not be quantified due to lack of baseline data, the society is increasingly concerned about the quality of life as affected by traffic congestion in both Dar es Salaam and Mwanza cities. It is worthwhile to note that, these externalities need to be considered in the policy framework designed to mitigate the traffic congestion menace in urban Tanzania.

CHAPTER EIGHT:

STAKEHOLDERS' PROPOSALS ON ROAD TRAFFIC CONGESTION INTERVENTIONS

8.1 INTRODUCTION

The views of various stakeholders are important in the process of developing strategies and policies for socio-economic endeavours. This chapter presents the opinions provided by stakeholders on interventions for mitigating the problem of road traffic congestion in Dar es Salaam and Mwanza cities. These stakeholders include various groups of road users as well as officials of the public and private institutions. The views that are in form of multiple responses, were elicited from road users through open-ended questions contained in the questionnaires and interviews conducted with officials of public and private institutions. These views reflect both general and city specific perceptions on interventions for road traffic congestion that were advanced by the residents of Dar es Salaam and Mwanza cities.

8.2 PROPOSALS ON GENERAL INTERVENTIONS BY ROAD USERS IN DAR ES SALAAM CITY

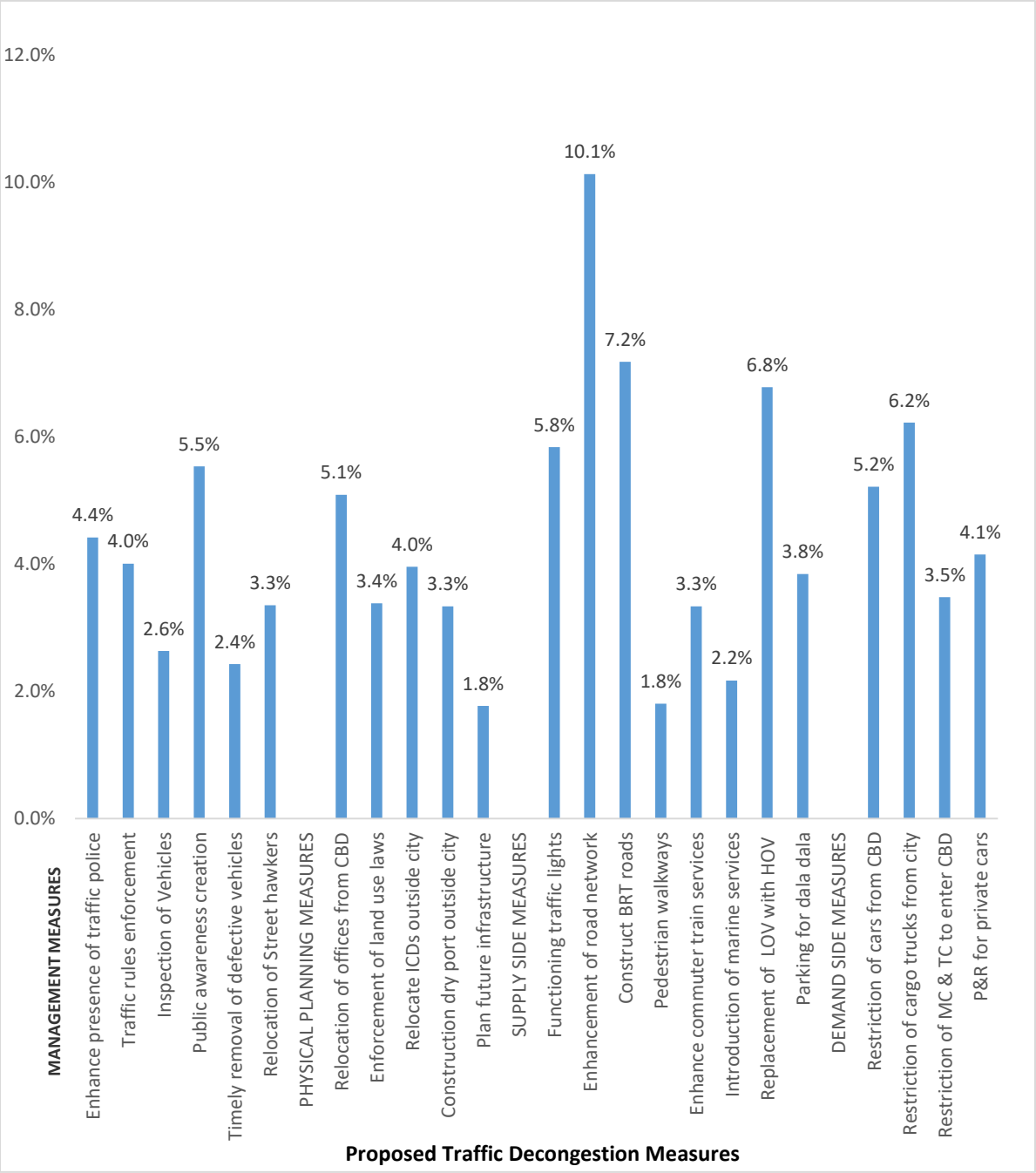
8.2.1 Data on General Proposals of Road Users for Dar es Salaam City

The open-ended question on interventions to curb traffic congestion in Dar es Salaam city generated a total of 6,271 multiple responses that were elicited from 1,364 road users and institutional stakeholders. A total of 2,338 responses equivalent to 37.3% were provided by public transport commuters. Private car drivers provided 1,094 responses equivalent to 17.4%. Public bus *(daladala)* drivers provided 920 responses equivalent to 14.7%. Public bus owners provided 914 responses equivalent to 14.6%. Motorcycle and tricycle drivers provided 271 responses equivalent to 4.3%. Lastly, traffic police provided 734 responses equivalent to 11.7%.

The obtained multiple responses, were categorized into 23 general intervention proposals. These proposals were further grouped into four (4) major categories namely

traffic management, physical planning, supply side and demand side interventions. The results on various respondents' opinion are provided in **Appendix 8.1** and presented in **Figure 8-1** below:

Figure 8-1: Respondents' Proposals on Traffic Congestion Interventions in Dar es Salaam City



Source: *Field Survey, 2017*

The detailed findings on these responses are discussed in the subsequent sub-sections.

8.2.2 Proposed Traffic Management Interventions for Dar es Salaam City

A total of 1,402 multiple responses equivalent to 22.4% of all responses on the proposed traffic congestion interventions, were advanced by road users as traffic management measures that would mitigate the congestion problem in Dar es Salaam city. These responses were grouped into six (6) traffic management interventions. The details of these interventions are discussed below:

1. ***Enhancement of the presence of traffic police on roads:*** In the recent past, the number of traffic police regulating motor vehicles flows especially during peak periods in Dar es Salaam was increased. Overall, this intervention attracted 277 responses equivalent to 4.4 per cent and ranked ninth (9^{th}). Among the six (6) traffic management interventions, this measure ranked the second best proposal. The high responses, signifies the fact that road users believe that the presence of traffic police on roads eases traffic congestion and thus must be enhanced. However, there were complaints from sections of respondents that the regulation of traffic flows tend to create lengthy congestion on other roads.

2. ***Enforcement of traffic laws and regulations:*** The increased number of traffic police on Dar es Salaam roads has gone in tandem with the enhanced enforcement of traffic laws and regulations. Road users supported this intervention through 251 responses equivalent to 4.0% of all responses. These responses ranked the intervention 11^{th} overall and third among the six traffic management measures. Understandably, save for the traffic police and public bus commuters, this intervention ranked lowly among the other four categories of respondents that distaste traffic offence penalties. However, this intervention remains relevant in respect of achieving orderly flows of motor vehicles.

3. ***Inspection of Vehicles:*** This intervention garnered 165 responses equivalent to 2.6% of the proposed interventions and ranked 19^{th}out of the proposed 23

interventions. Within the traffic management interventions, the inspection of vehicles measure ranked sixth and last but one. The intervention seems to be distasted by motorists as it was certainly perceived to cause travel delays.

4. ***Creation of public awareness to road users:*** This intervention was supported through 347 responses equivalent to 5.5% and ranked sixth overall and first among the proposed six road traffic decongestion interventions. The high support of this proposal might be influenced by the fact that road users were of the view that the public was ignorant of the regulations governing road usage and thus further education on this matter was deemed necessary.

5. ***Timely removal of defective vehicles from roads:*** A section of road users held the view that it took too long for responsible bodies to remove from roads defective motor vehicles and those involved in accidents. Such delays are partly blamed for traffic congestions experienced on city roads. Much as this reasoning seems appealing, the proposed intervention received 152 responses equivalent to 2.4%. The proposal ranked 20th overall and last among the proposed traffic management interventions.

6. ***Relocation of street vendors:*** These traders who spread their merchandises on roads and pursue moving vehicles for businesses, were deemed as an obstruction to both pedestrian and traffic flows. A section of road users suggested that the vendors need to be relocated elsewhere from the roads in order to improve traffic flows. This view was supported through 210 responses equivalent to 3.3% and ranked sixteenth overall. While this intervention received a lukewarm support among road users, there needs to be a policy measure to counteract street vendors as it is a growing menace.

8.2.3 Proposed Physical Planning Interventions for Dar es Salaam City

The multiple responses elicited from road users on physical planning measures were 1,099 equivalent to 17.5% of overall responses. The five (5) land planning interventions

ranked last but one among the four major categories of measures. The findings on this category congestion measures are provided below:

1. ***Development of satellite towns:*** There were 319 responses that indicated that road users preferred the relocation of offices and businesses outside the CBD. This proposition is equivalent to 5.1% of all responses and ranked ninth overall. Among the five physical proposed planning interventions, it ranked first. This view is reflective of the fact that road users were convinced that the location of most of public and private offices as well as socio-economic amenities in the CBD, partly contributed to traffic congestion.

2. ***Enforcement of land use laws:*** This view was supported through 212 responses equivalent to 3.4% of all responses and ranked 15th overall. While this intervention did not receive a wider support, these responses indicate that a section of road users were aware of the fact that the longstanding non-enforcement of land use laws had led to the haphazard development of the city and the consequential difficulties in providing road infrastructure and public transport services.

3. ***Relocation of ICDs outside the city:*** Most of the ICDs are located on the fringes of the CBD in areas such as Shauri Moyo, Pugu Road industrial area, Chang'ombe, Kurasini, Buguruni and Tabata, among other areas. The negative impact of the location of these ICDs on traffic flows and the need to relocate them outside the city, attracted 248 responses equivalent to 4.0% of all responses and ranked 13th overall. Despite the low ranking of this intervention, roader users felt the need for relocating of such ICDs in order to ease the traffic congestion in the city.

4. ***Construction of dry port outside the city:*** This intervention was supported through 209 responses equivalent to 3.3% of all responses and ranked 18th overall. Nevertheless, the intervention did not attract wider support of road users much as it is important towards easing the pressure of heavy cargo trucks on city roads.

5. ***Planning of future infrastructure:*** This intervention received a total of 111 responses equivalent to 1.8% of all responses and ranked 23rd and last overall.

From these responses, it would seem that proper planning of infrastructure is not an appealing solution for mitigating traffic congestion in the city. Alternatively, road users might be ignorant of the advantages of infrastructural planning.

8.2.4 Proposed Supply Side Interventions for Dar es Salaam City

The supply side measures of traffic congestion involve the increasing of capacity and efficiency of transportation infrastructure systems. As provided in Appendix 8-1, there were eight (8) proposed interventions that generated 2,575 multiple responses. These responses are equivalent to 41.1% of all responses and were ranked first overall among the four major categories. The said interventions are explained as below:

1. ***Installation of well-functioning traffic lights:*** This intervention was supported through 366 responses equivalent to 5.8% of all responses and ranked 5th overall. The relatively high response among road users, indicates that the dysfunction of traffic rights (and probably other road signals) was recognized as a part of the causes of traffic congestion in the city that needs redress.

2. ***Enhancement of road network capacity:*** According to the responses, this intervention entails road expansion; construction of ring roads; construction of fly-overs; maintenance of existing roads and storm water drainage; and upgrading of feeder roads. The intervention was supported by 635 responses equivalent to 10.1% of all responses and ranked first among the 23 proposed interventions. The highest support of this intervention, is reflective of the fact that the road network capacity in the city is still regarded as insufficient to enable speedy flow of vehicles notwithstanding the Government continued heavy investment.

3. ***Construction of BRT roads:*** This intervention received 450 responses equivalent to 7.2% of all responses and ranked second among the 23 proposals. Following the completion of Phase I of the project, there is evidence that traffic jams on Morogoro and Kawawa roads have eased. Besides, the BRT system has enabled commuters to spend shorter durations on travels. Road users in the city

expect that the BRT system will be extended to other areas of the city in order to ease traffic congestion and enable commuters to travel smoothly.

4. ***Construction of pedestrian walkways:*** This intervention seems to have not appealed to road users as a solution to traffic congestion after receiving 113 responses equivalent to 1.8% and ranking 22nd overall which is the last but one position. The low support for this measure might be emanating from the fact that the city residents have long abandoned the culture of walking (and probably cycling).

5. ***Enhancement of intra city commuter train services:*** This intervention had a support of 209 responses equivalent to 3.4% of all responses and ranked 17th. Despite the low support, passenger train services presently provided by TAZARA and TRL, have been a relief to commuters along areas they serve.

6. ***Introduction of intra city marine services:*** This intervention was supported through 136 responses equivalent to 2.2% of all responses and ranked 21st among the 23 proposed interventions. While the introduction of these services have been on the Government agenda for a while, it seems that road users have little faith in their ability to mitigate the problem of traffic congestion in the city.

7. ***Replacement of high occupancy buses with low occupancy buses:*** Road users supported this intervention through 425 responses equivalent to 6.8% of all responses and ranked 3rd overall. The high support of this measure is reflective of the fact that the present low capacity commuter buses *(daladala)* are recognized as part of the traffic congestion problem and the need for introduction of buses of bigger carrying capacity.

8. ***Establishment of proper parking spaces for commuter buses (daladala):*** This intervention is not among the top ones by garnering 241 responses equivalent to 3.8% of all responses and ranking 19th. However, lack of adequate parking

spaces both on roads and terminals, is being recognized as one of the factors contributing to traffic congestion.

8.2.5 Proposed Demand Side Interventions for Dar es Salaam City

The demand side interventions involve actions that lead to reduction in the use of private cars on urban roads by providing quality public transport services and promoting of non-motorized transport. Overall, the four interventions under this category received 1,195 responses equivalent to 19.1% of all responses. These interventions are as follows:

1. ***Restriction of cars from entering the CBD**:* This intervention received 327 responses equivalent to 5.2% of all responses and ranked 7th. These responses indicate that a considerable number of road users supported the view that limiting the entrance of private cars in the CBD may ease traffic congestion on city roads.

2. ***Restriction of heavy cargo trucks from the city**:* This intervention was supported through 390 responses equivalent to 6.2% of all responses and ranked 4th overall. This high ranking reflects the belief of road users that if heavy cargo trucks are prohibited from the city roads, it might ease the traffic jams hitherto experienced especially along Mandela, Morogoro and Sam Nujoma roads.

3. ***Restriction of motorcycles and tricycle from entering the CBD:*** The intervention obtained 218 responses equivalent to 3.5% of all reponses and ranked 14th overall. Understandably, this proposal did not get the support of the motorcycle and tricycle drivers. So far, these means of transportation are prohibited from entering the CBD. However, the zero responses for these drivers illustrates the fact that they are craving to conduct their businesses in the CBD.

4. ***Provision of park and ride (P&R) facilities for private cars:*** These facilities involve spaces where private car users residing in distant areas from

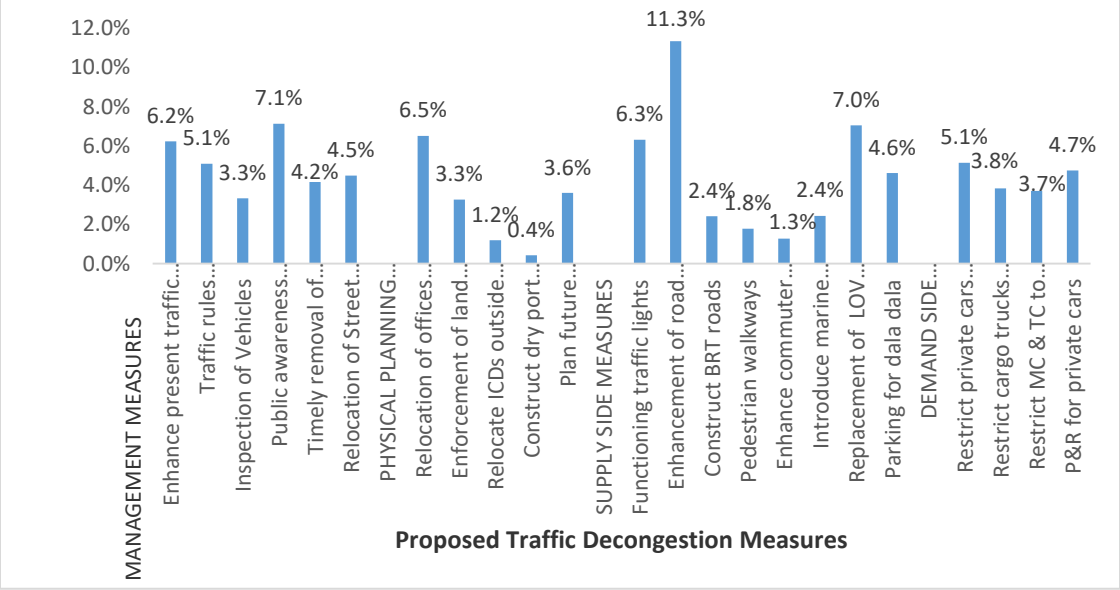
the CBD, can park their vehicles and ride on the public transport. This type of intervention was supported through 260 responses equivalent to 4.1% of all responses and ranked 9th overall. These responses indicate that to some extent the P&R intervention was acceptable by road users as one of the measures that could serve to unclog the city roads from traffic jams.

8.3 PROPOSALS ON GENERAL INTERVENTIONS BY ROAD USERS IN MWANZA CITY

8.3.1 Data on General Proposals of Road Users for Mwanza City

In Mwanza city, a total of 3,946 multiple responses were obtained from 751 respondents. That is, 1,495 responses from 497 public transport commuters; 1,020 from 125 private car drivers; 637 responses from 58 public bus drivers; 273 responses from 24 public bus owners; 195 responses from 20 motor- and tri-cycle drivers; and 326 responses from 27 traffic police. Like for the case of Dar es Salaam, these responses were grouped into 23 traffic congestion intervention proposals. The interventions were also further grouped in four major categories that are similar to those of Dar es Salaam city. The data on the findings are provided in **Appendix 8.2** and graphically summarized in **Figure 8-2** below:

Figure 8-2: Road Users' Proposals on Traffic Congestion Interventions in Mwanza City



Source: *Field Survey, 2017*

The above findings on each category of the proposed interventions are presented in the subsequent sections.

8.3.2 Proposed Traffic Management Interventions for Mwanza City

The responses of road users on the identified six (6) traffic management interventions that are expected to bring efficiency in the traffic management system and thus reduce traffic congestion are as follows:

1. ***Enhancement of the presence of traffic police on roads:*** In Mwanza city this intervention received 246 responses equivalent to 6.2% of total responses and ranked 6thoverall. Implicitly, a substantial section of road users in this city were convinced that the increase in the number of traffic police on roads might help to alleviate traffic jams.

2. ***Enforcement of traffic laws and regulations:*** Like in Dar es Salaam, this intervention received a lukewarm support by garnering 201 responses equivalent to 5.1% of all responses and ranked 8th overall. This intervention scored lowly among motorists. However, it received a support of 21.2% from both public transport commuters and traffic police.

3. ***Inspection of Vehicles:*** This intervention garnered 131 responses equivalent to 3.3% of all responses and ranked 16th among the 23 proposed measures. Like the law enforcement intervention, this particular intervention was detested by motorists.

4. ***Creation of public awareness to road users:*** This intervention was supported through 281 responses equivalent to 7.1% of all responses and ranked second overall. Implicitly, residents of Mwanza city were of the view that public awareness on road usage might greatly improve the vehicular flow and help to mitigate the presently experienced traffic jams.

5. ***Timely removal of defective vehicles from roads:*** This intervention received 164 responses equivalent to 4.2% of all responses and ranked 11th overall. The intervention seems to have a wider support in Mwanza city as compared to Dar es Salaam. It would seem that in the former city defective vehicles and those involved in accidents, stay on road unattended for longer than in the latter.

6. ***Relocation of street vendors:*** This view was supported through 177 responses equivalent to 4.5% of all responses and ranked 11th overall. The intervention seems to have a bigger proportion of supporters compared to Dar es Salaam where it was supported by 3.3 per cent of respondents and ranked 16th overall.

8.3.3 Proposed Physical Land Planning Interventions for Mwanza City

The multiple responses obtained from road users on physical land planning interventions were 592 equivalent to 15.0% of overall responses and was last among the four major categories of interventions. As presented in Figure 8-2 above, the multiple responses for this category were grouped in five (5) measures that are discussed below:

1. ***Development of satellite towns:*** There were 257 responses that indicated that road users preferred the relocation of offices and businesses outside the CBD. This proposition is equivalent to 6.5% of all responses and ranked 4th overall. These results illustrate the fact that road users were convinced that relocation of socio-economic amenities, businesses and offices outside the city was one of the top interventions which was likely to ease traffic congestion problem.

2. ***Enforcement of land use laws:*** This view was supported through 129 responses equivalent to 3.3% of all responses and ranked 17th. Like in Dar es Salaam, in Mwanza city it seems that road users and the public at large were less informed on the essence of this intervention regarding orderly urban development and the associated infrastructure delivery.

3. ***Relocation of ICDs outside the city:*** This view was supported through 47 responses equivalent to 1.2% of all resposes and ranked last but one at 22nd among the proposed interventions. The implication of these results is that in Mwanza city, ICDs either might not be located within CBD or heavy cargo trucks do not ply on inner city roads. As such, cargo trucks are not a big bother to traffic flows.

4. ***Construction of dry port outside city:*** This intervention was supported through 17 responses equivalent to 0.4% of all responses and ranked 23rd and last overall. Like in the foregoing case, it would seem that the cargo trucks are not a big bother to traffic flows. Alternatively, the Mwanza South Port is not operating to capacity due to the decline of cargo transportation by rail. Otherwise, in future when the rail transportation is operated efficiently, there would be a need to have a dry port further away from the city.

5. ***Planning of future infrastructure:*** This intervention received a total of 142 responses equivalent to 3.6% of all responses and ranked 15thoverall. From these responses, it would seem that unlike in Dar es Salaam, in Mwanza city the public was much aware of the need for proper planning of infrastructure in the course of mitigating traffic congestion.

8.3.4 Proposed Supply Side Interventions for Mwanza City

As provided in Figure 8-2 above, there were eight (8) proposed interventions grouped under supply side interventions. This group was constituted by 1,467 multiple responses that are equivalent to 37.2% of all responses. These responses ranked first overall among the four major categories. However, the above proportion is a bit lower than that of Dar es Salaam which is 41.1%. The said interventions are discussed below:

1. ***Installation of well-functioning traffic lights:*** This intervention was supported through 249 responses equivalent to 6.3% of the total responses. Coincidently, the intervention ranked 5th overall just as the case of Dar es Salaam city. The relatively high response among road users, indicates that Mwanza city

which hitherto has two intersections with traffic lights, needs the installation of more of these lights at major intersections for orderly vehicular flows.

2. ***Enhancement of road network capacity:*** As earlier indicated, this intervention entails road expansion; construction of fly-overs; maintenance of existing roads and storm water drainage; and upgrading of feeder roads. The intervention was supported by 447 responses equivalent to 11.3% of all reponses and ranked first among the 23 proposed interventions. Like in Dar es Salaam, the highest support of this intervention, illustrates the fact that the road network capacity in Mwanza city is still regarded as insufficient. As such, there is a need for the Government to increase investment in this area in order to enable speedy flow of vehicles.

3. ***Construction of BRT roads:*** This intervention received 95 responses equivalent to 2.4% of all responses and ranked 19th among the 23 proposed interventions. The low ranking of this intervention could be attributed to the fact that in Mwanza city, the BRT system is still unknown.

4. ***Construction of pedestrian walkways:*** The intervention was not appealing as a solution to traffic congestion after receiving 70 responses. These responses are equivalent to 1.8% of the total responses. The proposed intervention ranked 20th as compared to Dar es Salaam's ranking of 22nd. In Mwanza city, also the construction of walkways for pedestrians (and probably cyclists), seems not to be appealing as a solution for traffic congestion.

5. ***Enhancement of intra city commuter train services:*** This intervention was lowly supported through 50 responses equivalent to 1.3% of all responses and ranked 21st. The low support for the intervention may be attributed to the fact that intra city train services are yet to be introduced in Mwanza city.

6. ***Introduction of intra city marine services:*** This intervention was supported through 96 responses equivalent to 2.4% of all responses and ranked 18th among

the 23 proposed interventions. Like the case of Dar es Salaam city, Mwanza city residents were as yet to appreciate the potential of the marine services for easing the pressure on road traffic congestion.

7. ***Replacement of high occupancy buses with low occupancy buses:*** The proposed intervention was supported through 278 responses equivalent to 7.0% of all responses and ranked third overall. Like the case of Dar es Salaam, in Mwanza city the high support of this intervention is illustrative of the fact that road users believe that high occupancy buses that carry more passengers than the present low capacity commuter buses *(daladala)* can help in alleviating the problem of traffic congestion.

8. ***Establishment of proper parking spaces for commuter buses (daladala):*** This intervention seemed not to be among the top ones by garnering 182 responses equivalent to 4.6% of all responses and ranking eleventh overall. This support though low, is illustrative of the fact that public transport buses need sufficient parking spaces especially on roads and terminal points.

8.3.5 Proposed Demand Side Interventions for Mwanza City

The three measures under this category of interventions that involve actions that may lead to the reduction of the use of private cars and increase the use of public transport services, overall were supported through 687 responses equivalent to 17.4% of all responses. The findings on these demand side interventions are as follows:

1. ***Restriction of private cars from entering the CBD:*** This intervention received 203 responses equivalent to 5.1% of all responses and ranked seventh. These responses that are more or less similar to those obtained in Dar esSalaam, are indicative of the fact that a considerable section of road users supported the view that limiting the entrance of private cars in Mwanza's CBD may help to ease traffic congestion on city roads.

2. ***Restriction of motorcycles and tricycle from entering the CBD:*** The intervention obtained 146 responses equivalent to 3.7% of all responses and ranked 14th overall. This rank is likely to emanate from the fact that in Mwanza city motorcycles and tricycles are not considered as a significant cause of traffic congestion.

3. ***Provision of park and ride (P&R) facilities for private cars:*** Parks for private cars that can enable drivers to ride on public transport are essential for mitigating the problem of traffic congestion. In Mwanza city, however, this intervention received a lukewarm support of 187 responses equivalent to 4.7 per cent and ranked ninth overall.

8.4 INSTITUTIONAL STAKEHOLDERS' VIEWS ON TRAFFIC CONGESTION INTERVENTION MEASURES

Interviews conducted with officials of various institutions generated important ideas on various aspects regarding the mitigation of traffic congestion in the two cities. Some of the generated ideas are presented in the below subsections.

8.4.1 City Master Plans

Officials of the MLHHSD admitted that for long, the urban areas of Tanzania including Dar es Salaam and Mwanza cities have been developing without defined master plans. This view was concurred with officials of the municipal councils of the two cities. It was intimated further that the master plans for the two cities were under preparation. The Ministry commissioned the Singapore based M/s Singapore Co-operation Enterprise (SCE) and Surbana International Consults Pte Limited to undertake this task. It was further confirmed that when the plans are ready, they will be implemented in earnest together with the enforcement of land use laws. In Dar es Salaam there are also two other master plans that are focused on improving the infrastructural capacity in the city. These plans are the Transport Master Plan for Dar es Salaam City to year 2030 that was prepared by JICA, 2007 which is currently under review and the World Bank sponsored Dar es Salaam Metropolitan Development Project (DMDP).

8.4.2 Marine Transport Services for Dar Es Salaam City

Officials of Azam Marine in Dar es Salaam indicated that the company was supportive of the Government's efforts to introduce marine services to serve Dar es Salaam's population along the Indian Ocean shores. Besides, these officials confirmed that their company was ready and willing to undertake the below investments under PPP in collaboration with PTA:

(i) Demolish the present passenger waiting building and replace it with a multi-storey building to cater for car parking especially those dropping and picking passengers to and from Zanzibar. This could ease traffic congestion on Sokoine Drive which spills over to most of the roads in the CBD.

(ii) Start a new route to Kurasini and Mtoni for over 70% of its passengers traveling to and from Zanzibar who live in Temeke District.

(iii) Expand the two jetties it is currently using in order to accommodate its envisaged expansion of marine services.

Officials of the Government owned TEMESA also indicated willingness to invest in provision of marine services for Dar es Salaam and Bagamoyo subject to the availability of funds.

8.4.3 Marine Transport Services for Mwanza City

Interviews were conducted with officials of different companies currently operating marine services in Lake Victoria. Some of the ideas on mitigating traffic congestion in this city are as follows:

(i) Officials of Kamanga Ferries and Nyahonge Marine Xpress also indicated their companies' willingness to invest in marine services to cater for Mwanza city. This willingness was contingent on Government participation in terms of providing necessary infrastructure especially construction of jetties.

(ii) The Mwanza based public company Marine Services Company Ltd also indicated willingness to participate in offering intra city marine services. However, its officials indicated that the company's participation was subject to securing funds from the Government.

(iii) Officials of SONGORO Marine Transport Ltd indicated that their line of business does not involve provision of passenger marine services but construction of marine vessels. They further confirmed that, should the need to introduce marine services arise, their company was willing and ready to get involved in construction of vessels.

8.4.4 City Train Services

TAZARA official indicated that currently they are operating the passenger train services between the Main Station and Mwakanga Station route. They indicated further that, the operations under this route were presently marginally viable and that the initiative has been important towards decongestion of traffic in the city. TAZARA's trains were carrying an average of 10,000 passengers per day. Prior to the introduction of TRL's train services from the city to Pugu, TAZARA was carrying between 14,000 and 15,000 passengers per day. The official suggested that in order to operate efficiently and viably, there is a need to have a dedicated double truck rail or interchange points to enable two trains to run from opposite directions. The official further suggested that TAZARA services could be extended to reach the City centre and extend to areas such as Chanika, Kisarawe and Bagamoyo. It was also pointed out that TAZARA's participation in decongesting road traffic in the city will depend on the outcome of the protocols between the governments of Tanzania and China that are currently under way.

8.4.5 Replacement of Low Occupancy Buses with High Occupancy Buses

The DART official argued that the continued operation of shorter/rigid or low occupancy buses to provide public transport services is no longer a feasible solution to resolve the problem of traffic congestion in both Dar es Salaam and Mwanza cities. The official was

of the view that, DART needs to import only articulated buses. Upon completion of phase I of the BRT project, DART was supposed to have a fleet of 305 buses. However, it is currently operating 140 buses i.e. 75 rigid buses, 39 articulated buses and 26 feeder buses. The feeder buses are operating on Mbezi-Kimara route. UDA-RT official emphasized that in order to mitigate the problem of traffic congestion, the *daladala* buses have to be banned from operating on arterial roads leading to the CBD. He further argued that *daladala* buses, were part of the traffic congestion problem in the two cities as they are so many on roads. Once the articulated buses start operating on arterial roads, *daladala* may start plying on feeder roads feeding passengers to articulated buses operating on arterial roads and other major feeder roads.

8.4.6 Establishment of Park and Ride (P&R) Spaces for Private Cars

A DART official explained that as a measure to address the road congestion problem in Dar es Salaam city, the Agency has embarked on the exercise of identifying potential areas for P&R facilities along the major bus terminals of Kimara, Ubungo, Gerezani, Kivukoni and Kawawa. Such facilities are expected to motivate private car users to travel on BRT buses. In the view of this official, such areas are expected to be developed and operated by the private sectors and especially respective land owners. Again, DMDP which is under the PO-RALG in collaboration with DART, is presently undertaking the upgrading of feeder roads that will help to expand public transport services in sync with the increasing demand.

8.5 CONCLUSION

The foregoing views on traffic congestion mitigation measures provided by both road users and institutional stakeholders are crucial in making recommendations on the subject matter. All of the proposed interventions are relevant and are thus a guidance towards evolving feasible and effective recommendations. However, the priority levels accorded to the proposed interventions by respondents, will not necessarily be followed.

PART THREE: RECOMMENDATIONS

CHAPTER NINE:

RECOMMENDATIONS ON ROAD TRAFFIC CONGESTION INTERVENTIONS

9.1 INTRODUCTION

This chapter presents the recommendations on common and city specific interventions to be taken by principal actors in order to mitigate the problem of road traffic congestion in Dar es Salaam and Mwanza cities. These recommendations are expected to contribute towards developing a sustainable transport system for both people and goods that minimizes adverse impact on the economy, society and environment. The recommendations are based on three aspects. First, the findings on the causes and effects of traffic congestion presented in Chapter 5 to 7. Second, the traffic congestion intervention measures presented in Chapter 8 that were proposed by various groups of road users and stakeholders in the two cities obtained during field study. Third, intervention measures adopted by cities of other countries that have experienced similar traffic congestion problems.

The recommendations are structured along a five-pronged approach that takes into account the three-pronged approach proposed by Kiunsi (2013). While this researcher suggests that measures to mitigate road traffic congestion should have bearing on physical planning, supply side and demand side approaches, the Consultant adds traffic management and environmental sustainability as other critical approaches. These five approaches are complimentary in the process of mitigating traffic congestion elsewhere in the world and are equally valid for the case of the two cities under study.

9.2 FACTORS UNDERLYING PROPOSED ROAD TRAFFIC CONGESTION INTERVENTIONS

The proposed recommendations are advanced in consideration of the future outlook of the two cities and particularly the below listed underlying factors:

1. ***Fast urbanization:*** The fast population growth, the ensuing urban sprawl, increased number of households and income levels, will continue to exert elevated pressure on both transport infrastructure and travel demands in the two cities.

2. ***Budgetary constraints:*** The Government's scarce investment resources that limit its ability to effectively respond to competing priorities which are stipulated in the nation's Vision 2025.

3. ***National Policies:*** Through the National Transportation Policy (NTP), 2003 and National Road Safety Policy (NRSP), 2009, the Government acknowledges the growing problem of road traffic congestion in urban areas and is committed to mitigate it.

9.3 GENERAL ROAD TRAFFIC MANAGEMENT INTERVENTIONS FOR DAR ES SALAAM AND MWANZA CITIES

9.3.1 Strengthening of Institutional Arrangements for Urban Transport Management

At the national level, the management of different urban transport activities are scattered among various key actors namely, ministries and other public institutions.This arrangement renders it difficult to coordinate efforts for effective planning and management of transport services. While the present set-up might inevitably be retained, in order to have an effective institutional arrangement, the following interventions are proposed:

1. ***Development of a coherent policy framework:*** Continue streamlining the institutional functions and responsibilities for the purpose of developing a coherent policy framework that will enable greater coordination of efforts.

2. ***Establishment of principal actors' forum:*** Institute a forum with legal mandate to bring together the principal actors of urban transport management for the purpose of evolving sustainable coordination and oversight of traffic management.

3. ***Legal reforms:*** The multiplicity of laws, decrees, regulations, actors and the consequential overlapping jurisdictions and policies, necessitates the enactment of a legislation that will clearly define the responsibilities of each actor in the traffic management and road use to supplement the role played by the proposed forum.

4. ***Improvement of urban authorities' management capacity:*** Continue to improve the capacity of urban authorities to effectively plan, manage and regulate provision of effective urban transport infrastructure and services.

5. ***Enhancement of the capacity of Ministry of Transport:*** Continue to strengthen the capacity of the ministry responsible for transport and its institutions to effectively develop policies and strategies relating to instilling efficiency in urban transport.

9.3.2 Management of Road Traffic Flows

In order to minimize traffic congestion in the CBD and outskirts of the two cities, the below interventions should be pursued:

1. ***Installation of automated well-functioning traffic lights:*** Traffic lights that are programmed to be responsive to peak periods or traffic congestion (**signal priority)** should be installed at major road intersections experiencing serious congestion in order to increase vehicular mobility in both Dar es Salaam and Mwanza cities.
2. ***Minimizing the presence of traffic police on roads:*** While the regulation of motor vehicle flows by traffic police has eased traffic congestion on some of the roads in the two cities, it is also creating congestion on other roads. As a long-term objective, traffic police on roads should be replaced by the well-functioning traffic lights.

3. ***Timely response to incidents:*** Motor vehicle accidents and breakdowns block traffic flows for considerable time. The views to enhance timely response to such occurrences were more pronounced in Mwanza city where breakdown services are still limited. As such, timely removal of vehicles involved in accidents or defective ones, would facilitate the normalization of traffic flows. The Traffic Police, Road

Safety Board (RSB) and Fire and Rescue Services (FRS) as well as private breakdown operators need to be empowered to effectively respond to this role.

4. ***Dissemination of real-time traffic information:*** As an interim intervention particularly in the absence of traffic control systems, there should be greater communication of real-time road situation through radios to enable motorists to make pre-trip decisions on which road to use or avoid. In Mwanza, the City Council is collaborating with City Radio FM 90.2 and Barmedas Television to monitor and announce vehicular movements and problems on roads.

5. ***Establishment of intelligent transportation system (ITS):*** This system which is used to manage road traffic has the potential to address urban road transport problems. The ITS includes traffic signal systems, traffic surveillance systems using CCTV and tracking systems using GPS. The system also consists of electronic ticketing services, electronic toll collection and fare payment systems, bus management systems, and traveler information systems. The ITS is necessary for improvement of road safety conditions and mitigate traffic congestion in the two cities. In the developed countries, ITS have only been adopted at a moderate pace and in developing countries, adoption has been even slower especially in East Asia and Latin America. In Africa, the ITS was installed by the Lagos Metropolitan Area Transport Authority (LAMATA) in Nigeria. The slow adoption of this system is mainly based on cost considerations particularly where the infrastructure is already in existence. Despite its slow adoption in other countries, the adoption of ITS in Dar es Salaam and Mwanza cities is likely to revolutionize traffic management by assisting both the motorists in terms of travel decision making and enforcement agents in respect to traffic flow regulation and control.

9.3.3 Enforcement of Traffic and Road Safety Laws and Regulations

In order to promote orderly traffic flows and safe use of roads, there is a need to pursue enforcement interventions aimed at changing poor road use behaviours by drivers that cause accidents and traffic congestion. Such interventions include the following:

1. ***Penalties on law violators:*** The current on-spot penalties meted on traffic and road safety rule violators and especially drivers, should be pursued relentlessly in order to curb indiscipline. Other forms of penalties such deduction of points on driving licenses; cancelation of licenses; disqualification of license holders; and ensuring new driving licenses are not issued to frequent violators, should be administratively centralized to plug loopholes inherent in the present system.

2. ***Reforming driver training, examination and licensing:*** As provided in the NRSP, 2009, The Government needs to continue reforming driver examination and licensing by transferring the certification and supervision of driving schools from traffic law enforcement institutions to the envisaged DVELA. Under this strategy, the driver testing and licensing will be separated from traffic law enforcement and tax collection institutions in an endeavour to enhance drivers' competence and instill accountability and compliance with the regional protocols or road safety.

3. ***Motor vehicle inspection:*** Regular inspection of vehicles by traffic police will ensure that the defective and road unworthy motor vehicles that contribute to congestion, are kept out of roads so as to mitigate incidents that cause traffic congestion.

9.3.4 Relocation of Street Vendors from Roads

Street vendors should be relocated to alternative trading spaces and their stay be strictly enforcement in order to unclog streets and roads narrowed by the merchandises spread on such roads for smoother traffic and pedestrian flows.

9.4 PHYSICAL PLANNING INTERVENTIONS

The proposed land use planning interventions seek to achieve greater accessibility through increased road connectivity and increased use of non-motorized transport in a bid to mitigate road traffic congestion at the present and future. These interventions are discussed in the below sub-sections.

9.4.1 Develop Master Plans that Promote Greater Accessibility to Socio-economic Amenities

The current master plans, 2035 for the two cities that are presently under preparation by the MLHHSD in collaboration with DCC and MCC should take into account the issue of greater accessibility needs to socio-economic amenities by the urban population. Transport demand is a derivative of accessibility needs. If these needs are directly addressed, transportation problems are likely to be reduced. Greater accessibility will involve better attention to land-use planning and urban development that reduces demand for travel trips. Some of the best-practice principles in land-use/urban planning are as follows:

(i) Designate primary rights of way and movement corridors to take into account location, land-use and building-pattern decisions for the future.

(ii) Internalize the cumulative impact of land-use on transport needs.

(iii) Correct pricing distortions in the transportation system so that they are not transferred to land prices.

(iv) Ensure the inclusion of full infrastructural costs in land prices through the development process.

(v) Locate socio-economic amenities such as light industries, schools, businesses, shopping centres and markets, among others, close to residential neighbourhoods in order to reduce the number of trips to CBDs.

(vi) Provide necessary infrastructure that meet minimum spatial-road coverage requirements and present and future demands.

(vii) Provide cycling lanes and walkways that are planted with trees in order to encourage non-motorized forms of travel.

(viii) Pursue high-rise compact neighbourhood concept that reduces travel demand.

(ix) Densification and intensification of land uses around transport modes and along transport corridors in the context of transit-oriented development (TOD) model for the purpose of increasing accessibility to socio-economic amenities by the majority of the population.

(x) Avoid inappropriate regulations and excessive reliance on regulatory measures to influence land use without commensurate, compatible and supportive infrastructural investments and transportation system.

(xi) Foster amenity and access in urban design as counter weights to the demand for space as incomes grow.

9.4.2 Enforcement of Land Use Planning Laws and Controls

Ineffective urban land use planning and laxity in enforcing land use regulations prevalent in the two cities, are recognized as one of the key causes of traffic congestion in urban areas. For orderly settlements development including infrastructure and public transport delivery, there is an urgent need to enforce the urban planning laws and regulations in the following context:

(i) Spaces provided for transport infrastructure should be protected for this specific use and not any other uses.

(ii) Prevention of unplanned settlements growth in peri-urban areas that stifle proper infrastructure and services planning and provision.

(iii) Regulation of the informal peri-urban land market in order to limit indiscriminate land subdividing and sale in order to avoid the creation of chaotic human settlements.

(iv) Enforcement of the condition for provision of adequate parking in high-rise commercial and residential building and especially in the CBD areas.

9.4.3 Coordination of Institutional Efforts to Implement Master Plans

Key stakeholder institutions need to coordinate efforts for successful implementation of the cities' master plans. For Dar es Salaam, there are three master plans. These plans include JICA's Transport Master Plan, 2030 (currently under review); Dar es Salaam Metropolitan Development Project (DMDP), 2025; and the underway Land Use Master Plan, 2035. For Mwanza city, there is the Land Use Master Plan, 2035 which is under preparation. The successful implementation of these plans will depend on, *inter alia,* the cooperation among stakeholders with regards to management, devotion of resources and avoidance of duplication of efforts. These stakeholders include the City Councils, Municipal Councils, TANROADS, MWCT, MLHHSD, PO-RALG, doners and development partners.

9.4.4 Development of Satellite Towns

Satellite towns in the two cities' outskirts, need to be developed in order to mitigate the effects of the monocentric structures that include one directional vehicular flows. Satellite town projects in Dar es Salaam city include Kawe, Kigamboni and Luguruni. These projects that are implemented by NHC will provide residential and commercial premises. The concept of non-dormitory satellite towns planned for Luchelele, Kishili and Bugarika areas in Mwanza city, need to be reconsidered as it is likely that it will result into one directional vehicular flows.

9.4.5 Redevelopment of Unplanned Settlements and Other Areas Located Close to the Cities

Low income earners like to live in the proximity of city centres that provide for their livelihoods. The key consideration in such decisions mainly hinges on the commuting costs to and from the places of livelihood. In Dar es Salaam the unplanned settlements of Kigogo, Manzese, Msasani, Tandika, Keko, Buguruni and Vingunguti that are close to the CBD, are also homes for a substantial population of the city. Other areas that are ripe

for redevelopment include the government quarters of Ilala, Kinondoni and Temeke. The former areas are already prime and are increasingly attracting real estate investors who are developing high-rise buildings. For Mwanza City, areas that could be redeveloped include Ghana Quarters, Kilumba and areas along Rufiji and Uhuru roads. As a long-term traffic congestion intervention, these areas need to be redeveloped into compact high-rise residential and commercial properties to accommodate more people than hitherto. Such redevelopments would ease pressure on transport infrastructure and services demand as well as limit the urban sprawl.

9.4.6 Limiting the Volumes of Heavy Trucks by Relocating ICDs and Truck Parking Areas Outside Cities

These ICDs are obstructive to traffic flows particularly when heavy cargo trucks are entering to or exiting these areas. Although this problem is presently more pronounced in Dar es Salaam, in future it might also arise in Mwanza city. The existing ICDs need to be closed down and new ones relocated away from the city and in the destination directions of the transported cargo in order to reduce the number of trucks plying on the city roads as well as the ensuing traffic congestion. If at all these ICDs are needed, areas beyond Kimara in Dar es Salaam city, are suitable for the purpose and truck parking facilities.

9.5 SUPPLY SIDE INTERVENTIONS

9.5.1 Improvement of Road Transport Infrastructure

Roads are the most dominant mode of both passengers and goods transport in urban areas. The NTP, 2003 and NRSP, 2009 prioritize investing in improving the capacity and quality of road infrastructure to accommodate the ever-growing traffic. Since the road networks in both Dar es Salaam and Mwanza cities are still below demand, the perception by both policy makers and respondents is that the additional road network capacity reduces traffic congestion. The key road infrastructure that could ease congestion in the two cities needs to focus on improvement of road connectivity and traffic flows. The proposed interventions are as follows:

1. ***Enhancement of road network connectivity:*** This intervention seeks to improve the connectivity of various areas and thus give motorists alternative routes rather than being confined in few roads as it is the case hitherto. This intervention will entail construction of more feeder roads, ring roads, planned secondary roads as well as upgrading existing ones through expansion and maintenance. Road designs need to have provisions for walkways and cycling lanes to enable urban inhabitants adopt walking and cycling as a heathier means of travelling.

2. ***Improvement of road intersections:*** The road intersections and roundabouts experiencing excessive traffic congestion include Mbagala Rangi Tatu, Kawe–Maringo roundabout, Tabata/Mandela roads, A. H. Mwinyi/Africana roads and New Bagamoyo/Goba roads in Dar es Salaam city and Kemondo roundabout in Mwanza city. These intersections need to be improved by either widening or installation of traffic lights for smooth flow of vehicles.

3. ***Rectification of bus bays:*** Most of bus bays on roadsides are inadequate to allow convenient parking of public buses when loading and offloading passengers and thus cause traffic congestion mayhem. The rectification of these bays to accommodate more buses will ease traffic congestion particularly during peak periods.

4. ***Segregation of lanes:*** This strategy involves the creation of bus lanes on existing roads (painting of a lane in different colour from the rest of the asphalt) as a low-cost strategy for improving the movement of public buses. Under this strategy, traffic lights will automatically allow vehicles in bus lanes to gain priority at intersections. That is, such lights will turn red for private cars and green for buses whenever the later approach shared intersections.

5. ***Redirection of funds for construction of flyovers and interchanges to road network improvement:*** The six flyovers planned for Dar es Salaam city

include TAZARA, Ubungo, Magomeni, Fire, KAMATA and Chang'ombe junctions. These flyovers are estimated to cost a walloping USD. 688.3 million. Experience from elsewhere, indicates that flyovers are not a permanent solution for mitigation of traffic congestion. First, like the two flyovers presently under construction at TAZARA and Ubungo intersections, they tend to offload vehicles in narrow roads ahead thereby creating incidental congestion at road sections where they meet other roads. Second, in the absence of vehicle restrictions, flyovers tend to encourage use of private cars. It is thus compelling to suggest that, funds earmarked for the four (4) flyovers that aren't started, be directed to improvement of road network connectivity.

It is noteworthy that, while improved road infrastructure is generally accepted as a key solution for the problem of traffic congestion, evidence from other countries points to the contrary. In fact, increasing the road capacity can lead to greater vehicular use demand as a result of induced travelor latent travel demand (Pojani and Stead, 2015). This type of travel demand is attributed to the fact that improved roads induce more cars that would have otherwise travelled during off-peak periods, to travel during peak periods. Consequently, congestion levels are soon restored to almost pre-expansion levels and little travel time savings are realized. As such, investment in expensive roads needs to be taken cautiously if the problem of traffic congestion is to be effectively addressed. This view prompts Pojani and Stead (2015) to suggest that resources earmarked for construction of new roads, may have lower socio-economic payoff compared to when they are invested in existing road maintenance and especially preventive maintenance that costs less. This reasoning may be valid for the case of Dar es Salaam and Mwanza cities.

9.5.2 Rehabilitation of TRL and TAZARA Infrastructure for Cargo Transportation

Decades of neglect and under-investment in the railway system, have left TRL/RAHCO and TAZARA railway systems in bad and unreliable conditions. This situation has

encouraged the use of heavy cargo trucks to transport goods destined for upcountry and neighbouring countries of Zambia, D.R. Congo, Burundi, Rwanda, Malawi and Uganda. These trucks have caused traffic congestion mayhems on Mandela Expressway, Morogoro, Sam Nujoma and New Bagamoyo roads in Dar es Salaam.

It would seem that the Government is still lukewarm on rehabilitating the two railway systems as the investment emphasis is presently on construction of the underway standard gauge rail (SGR) along the central railway system. Phase 1 of this system involves the construction of 300 km. main way and interchanges from Dar es Salaam to Morogoro at a cost of TAS 2.6 trillion (USD 1.1 billion). The SGR system will have a capacity of hauling 6,000 to 10,000 tonnes per single train equivalent to 17.0 million tonnes per annum. However, it might take longer for the SGR rail to reach the last stations of Kigoma and Mwanza and thus have an impact on cargo hauling. In the interim, TRL and TAZARA system will continue to be vital links to Tanzania Mainland regions and landlocked neighbouring countries. There is therefore a need to invest in the rehabilitation of the two railways' infrastructure, locomotives and goods rolling stocks. The TRL system also requires cargo ships and a wagon ferry to transport cargo to destinations such as Kemondo Bay Port in Bukoba as well as D.R. Congo, Burundi and Uganda lake ports. However, when SGR is operational, the TRL system is likely not to survive.

9.5.3 Pipeline Transportation of Bulk Petroleum Products

Presently, Tanzania operates two pipelines namely TAZAMA that transports crude oil from Dar es Salaam port to Ndola, Zambia and the recently completed Songo Songo that transports natural gas from Mtwara to Dar es Salaam. The Dar es Salaam-Mwanza pipeline for transporting bulk petroleum products to upcountry destinations and neighbouring countries such as Burundi, Rwanda, D.R. Congo and Uganda, has been on the Government's agenda for a while. Since the collapse of petroleum products railway transportation, Dar es Salaam roads especially Mandela, Morogoro, Sam Nujoma and New Bagamoyo, have experienced increased tanker trucks that also contribute to road traffic congestion. In order to relieve urban centres along the centre corridor including Dar es Salaam and Mwanza cities from these tanker trucks, it is imperative that the construction of this pipeline is moved up on the development agenda.

9.6 DEMAND SIDE INTERVENTIONS

The demand side interventions seek to promote the use of public and non-motorized modes of transportaimed at reducing the use of single occupant private cars. Notwithstanding their versatility in addressing traffic congestion problems, the demand side interventions take a rear position in most of the transportation policies as compared to the supply side interventions. Some of the demand side interventions that are relevant for the case of Dar es Salaam and Mwanza cities are explained in the below subsections.

9.6.1 Formalization of Commuter Bus Operations to Improve Quality of Services

Presently, in both Dar es Salaam and Mwanza cities the public transport services provided by commuter buses *(daladala)* are operated informally and are mainly chaotic, unreliable and unsafe. As such, these services are unattractive to commuters though they are used by over 70% of the two cities' population. Many *daladala* operators own one or two buses. Implicitly, there are many operators in the market, the fact which constrains regulation and law enforcement. The *daladala* owners' association DARCOBOA in Dar es Salaam city, which presently acts as a pressure group could be repositioned to assume the management responsibility of the city commuter buses with an objective of providing quality services that are attractive to users.

Formalization of commuter bus services will involve the establishment of companies or cooperatives through which individual bus owners will be able to operate their bus under a franchise. The proposed institutions could be modeled along the Kenya Bus Service Management Limited (KBSML). This company offers quality public transport services in Nairobi city using buses owned by individuals through a bus franchising and commercialization model. The company manages the bus operations by assuming the roles of recruiting, training and monitoring behaviours of crews; insurance of buses; collection and remittance of revenues; ensuring that buses operate according to schedule; and servicing and maintenance of buses. The advantage of the KBSML management model are threefold as follows:

(i) Improving quality of services by instilling efficiency, frequency, reliability and safety in bus operations.

(ii) Well behaved, good mannered and responsible bus crews.

(iii) Saves individual bus owners the time and bus management stress.

The *modus operandi* of this franchise is provided in **Appendix 9.1.**

9.6.2 Replacement of Low Occupancy Buses with High Occupancy Buses

Currently, the 34 to 45-seater minibuses form a substantial proportion of the motor vehicles plying the roads of the two cities. The sheer number of these buses coupled with reckless driving contribute to traffic congestion experienced in the two cities. For the purpose of mitigating the problem of congestion and making public transport more attractive, low occupancy buses should be phased out from operating on arterial roads leading to the CBDs. Such buses need to be replaced by higher occupancy 60-seater buses and 140 seater articulated buses such as those operated by UDA-RT on BRT road system (or even higher capacity buses of 160 to 260 passengers). One 60 seater bus is able to eliminate two (2) 34-seater minibuses and 1.3 45-seater buses. The 140 seater articulated bus can eliminate four (4) 34-seater minibuses and three (3) 45-seater buses. It is noteworthy that during the 1970s through to the 1980s, the articulated **"Icarus"** buses operated on the Dar es Salaam city's ordinary roads.

The operations of the existing low occupancy *daladala* buses should be delegated to the feeder roads for the purpose of providing feeder connections to remote areas. That is, ferrying passengers to and from places of domiciles to arterial and BRT terminals. These buses should also be phased out as the road networks improve. This intervention is expected to stimulate the use of public transport through greater connectivity of peri-urban areas with urban mass transit systems. The recommendation of phasing out the *daladala* buses from CBD and confining them to feeder roads is based on the fact that in 2006, SUMATRA managed to phase out the 16-seater microbuses famously known as "***vipanya***" from plying to the CBD. However, individual private commuter bus owners indicated reluctance and lack of adequate capital to invest in the purchase of large buses. For the purpose of attracting investments in public transport, the following policy measures should be considered:

1. ***Provision of investment incentives:*** Under the Tanzania Investment Centre (TIC) Act, 1997, the transportation sub-sector is defined among the priority sectors. However, in practice urban commuter or passenger transportation services are not accorded the priority status to deserve investment incentives such as those extended to cargo transportation services. In consideration of the contribution of the urban commuter bus transportation services to the national socio-economic wellbeing, it is compelling to suggest that the TIC Law needs to be reviewed so as to include this sub-sector among the priority sectors.

2. ***Banks loans****:* Banks be encouraged to increase the level of loans offered to public bus operators because urban public transport business is lucrative.

9.6.3 Development of Mass Rapid Transit

Mass rapid transit has an advantage of carrying many passengers than any other transportation modals. While in Dar es Salaam city the mass transit systems are under implementation or in the offing, they are also equally relevant for Mwanza city's future. These systems are as follows:

1. ***Dar Rapid Transit (DART) system:*** The completed Phase 1 of the six (6) phases of the BRT project has demonstrated that the mass transit system could alleviate the commuter transport and traffic congestion problems. The 20.6 km BRT road system currently transports an average of 350,000 to 406,000 passengers per day. The system has greatly improved the travel conditions and quality and especially travel time savings and enhanced reliability. Despite that the BRT system would cost a staggering average of USD 11.2 million per km., on the basis of Phase 1 and 2 projects, the Government is committed towards investing in this venture for the purpose of alleviating passenger transport and traffic congestion problems. Most of the cities that adopted the BRT systems, have been successful in easing both passenger transportation and traffic congestion problems. As presented in **Appendix 9.2**, Bogota City in Columbia has been successful in redressing these two problems by adopting the BRT system in tandem with the promotion of the

culture of walking and cycling. The Bogota model could also be adopted in the settings of Tanzania's cities.

2. ***Mass rail transit system:*** City railway transport is used worldwide to mitigate the problem of passenger transport and traffic congestion. Presently in Tanzania, the below options are being pursued:

   (i) *Existing Commuter City Train Services:* In Dar es Salaam, it is acknowledged that TAZARA that operates up to Mwakanga Station and TRL that operates two routes up to Pugu Station and Ubungo Siding, have to an extent eased passengers' transport problems but not congestion problem. The two city passenger service trains were launched in October, 2012. However, these trains are not well suited to operate along the routes they operate because of lack of ideal infrastructure especially passenger platforms. Again, the sustainability of these railway services is doubtful because currently both TAZARA and TRL are barely breaking even. The underperformance is due to the fact that, operating engines and wagons meant for long distances for short journeys is not cost effective. If these systems have to operate as city mass transits, they will need substantive investments. That is, they require diesel multiple units (DMU) that are formed by two light locomotive engines and 4 to 8 passenger wagons. The DMU are lower in platform height, faster and fuel efficient compared to the presently operated rolling stock.

   (ii) *Metro transit network:* In 2015 RAHCO the holding company of TRL, engaged GIBB of South Africa to undertake a pre-feasibility study and design for the metro railway lines from its central station to four destinations. These destinations are Luguruni (Morogoro Road), Chamazi (Kilwa Road), Pugu (via Julius Nyerere International Airport) and Kerege in Bagamoyo District. The three modal options were light rail transit (LRT); light rapid rail transit (LRRT); and metro rail transit (MRT). The latter option was the most preferred due to its flexibility and carrying capacity of 45,000 passengers per hour per direction (phpd). The MRT system has since been

included in the intermodal passenger transport in the presently under review JICA's Dar es Salaam transport master plan.

Worldwide, there is an opposition on adoption of the MRT system on the basis of cost considerations. According to the comparative data provided by ITDP on alternative mass transit systems, the cost of BRT system is between USD 500,000 and USD 15 million per km while that of at-grade trains and LRT is between USD 13.0 million and USD 40.0 million per km. The cost of LTR elevated systems range from USD 40.0 million to USD 100.0 million per km. The cost of LRT subway systems range from USD 45 million to USD 320 million per km (AfDB Group, 2015). However, RAHCO officials who are proponents of MRT/LTR system argue that the on-surface cost of construction in Dar es Salaam city is estimated at USD 4.0 million per km (excluding compensation) as compared to BRT system average construction costs of USD 11.2 million per km. It is argued that, the cost advantage of the MRT over BRT is based on the fact that the former is designed to utilize the existing vehicle road ways and require less space compared to the latter. It is further argued that, while the BRT system has a maximum capacity of 8,000 to 12,000 phpd, the MTR has the capacity of 45,000 phpd.

Although the MRT system is already integrated in the Dar es Salaam transport master plan, its consideration for implementation should take into account a number of factors that have been experienced in other countries. These factors are follows:

(i) High capital costs that may end up to be a long-term debt which may affect investment in more pressing priority areas.

(ii) High operating costs which in most cases require operating subsidies even in developed countries to keep travel costs affordable (Pojani and Stead, 2015).

(iii) Unreliable electric power which means that a public transport system that relies on grid electricity may not always be a feasible option.

The above factors render the economic viability of MRT system in both Dar es Salaam and Mwanza cities doubtful at least in the short and medium terms.

9.6.4 Provision of adequate parking for public transport vehicles *(daladala)*

Presently, these vehicles do not have adequate parking spaces especially at terminal points. This inadequacy contributes to serious traffic congestion in such areas. In line with the road users' observations in the two cities and the suggestion of integrating the feeder transport system and mass transit system for efficient operation of the public transport services, it is imperative that there are adequate and convenient passenger loading and offloading parking facilities for the *daladala* that are to be delegated to operate on feeder roads. Given that parcels of land close to arterial and BRT terminals are owned by individuals, it is in the Government's interest to acquire and develop such parcels. As proposed by DART officials, this could be done through PPP. However, Government participation in such undertakings should be prominent.

9.6.5 Reducing the Use of Single Occupant Private Cars

Upon improvement of the mass passenger city transportation services to acceptable quality and for sustainability of the mass transit systems, the use of private cars on the two cities' roads should be reduced through the following measures:

1. ***Making car-pooling compulsory:*** This strategy involves sharing of private cars which are usually occupied by single or two persons and largely contribute to traffic congestion during peak hours. This strategy is aimed at encouraging family members and neighbours to use fewer vehicles in a bid to promote higher vehicle occupancies and travel cost sharing. The strategy should be made compulsory for cars entering the CBD.

2. ***Provide Park and Ride (P&R) Facilities:*** On presumption that efficient public transport services are provided, private cars entering the CBD need to be reduced by providing secure P&R facilities close to arterial, BRT and metro terminals. Such facilities will enable private car drivers to park cars at a fee and board public buses. In Dar es Salaam city, potential areas located close to BRT terminals are in Kimara,

Ubungo, Gerezani, Kivukoni and Kawawa Road areas. DART however, indicated that it does not invest in such facilities. Instead, it encourages individuals to invest in these ventures. The responsibility of dealing with interested individual land owners and investors is left to Municipal Councils and TANROADS. The Government needs to get involved through acquisition of appropriate sites for the purpose of investing in these facilities through either PPP or on its own. Criteria for the choice of appropriate sites include distance to P&R, distance to CBD, road congestion levels, high visibility of P&R, easy accessibility, size of the lot and surrounding population densities.

3. Reintroduction of employer transport services*:* Although in Tanzania provision of employer transport services was abandoned in line with the cost cutting strategies, employers continue to provide transport to entitled executives and car loans to senior employees. Few employers still provide bus transport to junior employees. While it is not clear that this strategy has been successful in cutting costs, what is clear is that it has contributed towards the increased number of single occupancy vehicles on roads. The strategy of providing collective transport by employers, needs to be reintroduced in order to cut down the number of single occupancy vehicles that contribute to traffic congestion during peak periods.

4. Restrict private cars from entering the CBDs: The increase in private car ownership is a primary contributor of traffic congestion in Dar es Salaam and Mwanza cities. On presumption that quality public transport services are provided, private cars need to be restricted from entering the CBDs through the following ways:

(i) Charging of CBD entry tolls: As a disincentive to use private cars in CBDs, heavy tolls or congestion fees should be charged by using a prepayment electronic mechanism. In Dar es Salaam gantry toll machines could be installed at the intersections of Kinondoni/New Bagamoyo/Kaunda Drive; Morogoro/United-Nations/Swahili; Kigogo/Uhuru roads;

Nyerere/Msimbazi/Kilwa roads; and Sokoine Drive/Kilwa/Gerezani roads. In Mwanza city such machines could be installed at Milongo River Bridge on Makongoro Road; Mabatini on Mwanza-Musoma road; and the junction of Kenyatta/Pamba roads. The strategy of charging tolls is commonly used in most cities experiencing traffic congestion such as Singapore.

(ii) *Restriction of CBD car parking:* Once again, on presumption that the public transport services are improved to provide quality and efficient services, the Municipal Councils need to restrain private cars from entering CBDs by prohibition on-roads parking and by charging higher parking fees. Such restrictions can be applicable during working hours of the week days.

9.6.6 Introduction of Passenger Marine Transport Services

Dar es Salaam city is on the Indian Ocean shores and Mwanza city is on the Lake Victoria shores. These water bodies can enable the two cities provide passenger marine transport service to relieve pressure on road transport. In Dar es Salaam city, officials of AZAM Marine and TAMESA indicated willingness of these institutions to invest in the intra-city passenger marine transportation services. In Mwanza city, Nyahonge, Kamanga Ferries and the Government owned Marine Services Company Ltd (MSCL) also indicated willingness to invest in marine transportation. Officials of SONGORO Marine Transport Ltd also were keen on participating in this endeavour as marine vessel builders.

The willingness to participate in providing marine passenger services by the above companies, is conditional on the Government and TPA's participation in providing necessary infrastructure and especially construction of piers through PPP arrangements. In line with the objectives of the NTP, 2003, the Government should encourage the involvement of the private sector in enhancing marine infrastructure, port development, operations and shipping services.

9.6.7 Introduction of Special BRT and Daladala Coaches as an Interim Measure

In Dar es Salaam City, private car users indicated that they were willing to board BRT buses provided that they were not overcrowded and were reliable and comfortable. These respondents also indicated their willingness to pay a higher fare for such buses rather than driving their cars to the city. Their view was based on driving stress, time wasted in traffic jams, inadequate parking in the CBD, cost of car parking and lack of safety of parked cars. However, UDA-RT and DART officials were of the view that this proposal was contrary to the policy of mass transit of passengers and was also discriminatory.

While DART policy stance is acknowledged, this proposal is worthy consideration as an interim congestion intervention. Its consideration need to be based on the fact that private cars constitute 73.9 of motor vehicles operating on city roads. In the same vein, these cars are the biggest contributors to traffic congestion, time wasted on roads, toxic gas emitters and air pollution. For this socio-economic group, which is more time - than price - sensitive, service enhancements are more effective than fare restraint or fare subsidies. Similarly, *daladala* operators with at least five (5) buses, could be required to convert some of their buses to operate as special couches carrying sitting passengers at an increased fare. This intervention is equally applicable for Mwanza city.

9.7 CITY SPECIFIC TRAFFIC CONGESTION INTERVENTIONS

9.7.1 Dar es Salaam City

1. ***Provision of passenger bus routes on secondary roads:*** SUMATRA should evaluate passenger transport services demands on secondary roads that were recently rehabilitated but do not have such services. These roads, among others, include Africa-Kawe in Kinondoni Municipality and Mtongani-Tandika in Temeke Municipality. The areas along these roads, are mainly served by motorcycle and tricycle taxis.

2. ***Rerouting of passenger bus services on the overcrowded Mandela Expressway route:*** SUMATRA should look into the possibility of de-assigning this

route of numerous passenger buses passing through this road in order to relieve it from traffic congestion.

3. ***Construction of multi-storey packing at AZAM Jetty:*** AZAM Marine Limited is willing to invest in multi-storey packing building in order to ease inconveniencies to its client and unprecedented congestion along Sokoine Drive that spills over to other CBD roads. It is imperative for TPA to team up with this company for construction of the proposed building.

4. ***Provision of adequate bus packing facilities at Mbagala Rangi Tatu:*** Notwithstanding the lack of parking space for the turning public transport buses, the distance between *daladala* turning point along Kilwa Road and the roundabout to Mbande at Mbagala Rangi Tatu area, is too short. There is a need for rectifying this section of the road so that it can ease congestion pressure in the area. This might entail relocation of the terminal along Kilwa Road and the roundabout to Mbande.

5. ***Increase efficiency in coordinating VIP entourages:*** Since VIP entourages and especially those to and from Julius Nyerere International Airport, cause considerable traffic congestion to the inconvenience of commuters, it is imperative for the traffic police to step up coordination efforts for efficient management of such entourages.

6. ***Enforcement of prescribed vehicle speeds:*** Years of traffic congestion have compelled motor vehicles to adopt to slower speeds of 30 to 50 km/hour even when it is not necessary. Regulators of traffic flows need to enforce driving conditions for motorists to adjust to ordinary or higher speed limits of 60 to 80 km/hour and especially on highways. Such adjustments will increase vehicular flows and reduce gas emissions.

7. ***Construction of Kwala dry port:*** The under construction Kwala dry port in Kibaha rural district is executed through The Merchant Shipping (Verified Gross Mass of Container Carrying Cargo) Regulations, 2016 and SUMATRA (Dry Port) Regulations, 2016 published vide Government Notes No. 197 and 198 respectively both dated 17th June, 2016. This dry port is meant to relieve Dar es Salaam Port and the city roads from overflow of container cargo and heavy cargo trucks respectively. Nevertheless, there is a likelihood that this dry port will transfer heavy cargo truck congestion between Chalinze and Morogoro Municipality and might be irrelevant when the SGR is completed.

9.7.2 Mwanza City

1. ***Planning and development of road infrastructure in accordance with geophysical features:*** The city and municipal councils should plan and provide road infrastructure within the limitation of the geophysical features of the city. Importantly, pass-ways in the unplanned and overcrowded settlements, where feasible, could be upgraded into roads for the purpose of increasing connectivity.

2. ***Rectification of the central roundabout (Kemondo):*** This roundabout is a meeting point for Makongoro, Nyerere, Kenyatta/Regional, Kamanga and Port roads. As the motor vehicle pass-through capacity of this roundabout is no longer congruent with the vehicular volumes especially during peak hours, it is imperative that it is redesigned to ease traffic on this spot. The rectification could include construction of a flyover from Kenyatta to Makongoro road or introducing vehicular volumes sensitive traffic lights.

3. ***Relocation of industries, godowns and petrol depots within CBD:*** These facilities are located along Kenyatta Road between Nofa and Mkuyuni areas. As the city expands, it will be compelling to move these facilities to the outer of the city for the purpose of easing the plying of trucks on CBD roads and reduce one-direction traffic flows. However, relocation from these areas might be difficult due to high cost of relocation and high premiums for CBD land. The city and municipal

councils need to consider land price concessions for relocating businesses and penalizing tax measures for businesses resisting relocation.

4. ***Restriction of motor cycle taxis from entering the CBD:*** Unlike Dar es Salaam city where motorcycle and tricycle taxes were prohibited to operate in CBD a while ago, in Mwanza city these motorcycles are still operating in the CBD. As highlighted by road users, there is growing descent on motorcycle taxis because drivers are the leading violators of traffic rules. In the process they frequently cause accidents and the ensuing traffic congestions. In view of this concern, Nyamagana Municipal Council needs to ban the motorcycle taxis from operating in the CBD.

5. ***Introduction of passenger bus services on the Pasiansi-Usagara via Nyasaka route:*** SUMATRA should look into the feasibility and viability of establishing this route which is presently served by motorcycles.

9.8 CROSSCUTTING ISSUES

9.8.1 Environmental Sustainability in Transport Services

The below strategies and interventions can be adopted for the purposes of evolving environmentally sustainable green travel in Dar es Salaam and Mwanza cities

1. ***Behavioural change strategy:*** This strategy seeks to change the public's mindset in respect of reducing the amount of vehicular travel. The pertinent interventions that should mainly focus on the mode of travel shift are as follows:

   (i) *Promotion of walking and cycling:* The walking and cycling cultures for short trips that were predominant in Tanzania's major urban areas until the 1980s should be revived and promoted. Although non-motorized trips may last longer compared to motorized trips, for low income groups, higher time cost is preferred over higher financial costs. The non-motorized modes of travel succeeded in reducing the use of private cars in Chinese cities, Bogota city in Columbia, Sao Paolo in Brazil and Amsterdam city in The Netherlands. In these cities, cycling and walking networks were developed.

The non-motorized modes of travel will likely relieve Dar es Salaam and Mwanza cities from private cars usage, traffic congestion and air pollution.

(ii) *Promotion of public transport use:* The intervention should focus on improving the services of public transport in order to change the structure of its accessibility for a larger segment of the society. Such improvements should target the reduced use of private cars as the overall income and productivity of urban inhabitants increase.

(iii) *Shifting the cost of travel to private car users:* This intervention involves the earlier mentioned road or congestion pricing. The pricing mechanism should seek to transfer the cost burden associated with pollution by motor vehicles from the society to individual users.

2. ***Technological interventions:*** These measures seek to limit air pollution by reducing the level of motor vehicle gas emissions from a technological or technical perspective. Some of the measures adopted by other countries that could gradually be adopted by Tanzania, are as follows:

(i) *Enforcement of emission standards and regulations:* Through the Environmental Management Regulations of 2007, Tanzania adopted environmental quality standards including vehicular gas emissions. However, these standards are not enforced by NEMC due to lack of technical personnel and budgetary constraints. NEMC is mainly funded from Government budget. If enforcement of the vehicular gas emissions has to be effective, the Government needs to adequately fund NEMC's undertakings.

(ii) *Enforcement of motor vehicles testing and inspection regulations:* Section 4 of the Standards Act No. 2 of 2009, confers the TBS powers to undertake through agents, pre-shipment verification of conformity (PVoC) and verification of conformity locally for all imports including motor vehicles.

Under the existing laws and regulations, the Police Force is responsible for inspection and testing of road worthiness of motor vehicles. Currently, there is a requirement of inspecting vehicle road worthiness on annual basis. However, thorough inspection of vehicles is currently not done. Instead, the Police Force sells inspection certification stickers to vehicle owners. It is therefore important that regular and annual stringent inspection of motor vehicles be enforced.

(iii) *Enforcement of maintenance of motor vehicle regulations:* Motor vehicle maintenance is an important part of the technical intervention to reduce per kilometer emissions of pollutants. This is because of the fact that the proportion of in-use vehicles is always substantial compared to new vehicles. As such, there is a need to ensure that in-use vehicles keep their emissions at acceptable levels by enforcing regular servicing and maintenance of vehicles.

(iv) *Introduction of mandatory age limits for in-use and imported vehicles:* The Anti-dumping and Countervailing Measures Act, 2004 was enacted to protect the nation from dumping of subsidized and cheap imports including motor vehicles. Old motor vehicles that are imported at cheap prices are charged anti-dumping import fees. Despite having this law in place, at least 89.7% of motor vehicles imported in the country between 2012 and 2016 were over 5 years old. The importation of old vehicles is motivated by, *inter alia,* increase in income among the citizens and the attendant social status; cheap car prices; and inefficiency of public transport service. Such vehicles contribute to air pollution as they are not fuel efficient. It is against this backdrop that, when the quality of public transport services improve, the Ministry of Finance and TRA in collaboration with TBS and NEMC should impose the age limit of imported vehicles to five (5) years and below. Besides, there is need to put in place a policy that accelerates the retirement from roads excessively polluting vehicles.

(v) *Introduction of mandatory emissions testing:* There is a need to make catalytic convertors compulsory to reduce pollutants from vehicle exhaust emissions. The Police Force and NEMC need to be provided with appropriate equipment such as remote sensors to enable them conduct motor vehicle roadside emission tests.

(vi) *Adoption of alternative vehicle fuels:* In developed and a number of emerging economies, technological advancements have enabled motor vehicles to convert to the use of cleaner alternative fuels instead of diesel and petrol as a measure for controlling noxious gas emission levels. Alternative fuels include compressed natural gas (CNG), unleaded petrol, biodiesel, alcohol-based fuels, and electric or hybrid-electric vehicles in certain applications. Since the 1990s, Brazil, Argentina, India, China, and Pakistan, have significantly converted to natural gas use in vehicles. In Tanzania, natural gas from Songo Songo is transported via pipeline to Dar es Salaam. Therefore, there is a need to start thinking of converting in-use vehicles to natural gas and making it mandatory for imported vehicles to be compatible with the use of natural gas instead of petrol and diesel. However, adoption of natural gas for vehicles will require the steady supply, refueling stations, and appropriate vehicles. Besides, unleaded petrol which emits less pollutants compared to leaded petrol is currently expensive. Pricing of these petrol products need to be interchanged to enable unleaded petrol to be sold at lower prices compared to leaded petrol.

(vii) *Adoption of motor vehicles of low capacity engines: A* substantial number of private cars imported in the country are four wheel drive (4WD) with big capacity engines. The adoption of these types of vehicles is motivated by poor road and drainage infrastructure that make accessibility to residences in most of the suburbs difficult. As the infrastructure and public transport services improve, there will be a need to limit the importation of big capacity engine vehicles through tax regime.

(viii) *Empowering NEMC to effectively execute its responsibilities:* NEMC is presently underfunded. The Council depends on Government budget which is inadequate to enable it to effectively assert its environmental quality management role. As such, more funds, equipment and technical skills are needed to enable the Council to perform its role. Apart from the Government, other sources such as anti-dumping fees on imports could be channeled to the Council.

3. ***Fiscal regime interventions:*** These interventions that are mostly supportive of the above measures, are mainly negative incentives that target particular groups for the purpose of forcing them to change their choices or operational culture for the benefit of the larger society. Some of the fiscal interventions proposed by Gorham (2002) that are more relevant in the context of Tanzania's need to abate the problem of vehicle emissions, are as follows:

(i) *Targeting fuel consumers through fuel pricing:* Fuel consumers may respond to changes in fuel prices by changing the types of vehicles they own and drive; the types of fuel these vehicles burn; how much they drive them; or some combination of these choices. In Dar es Salaam and Mwanza cities where the quality of public transport services are still poor, demand for use of private cars will remain inelastic notwithstanding the upward adjustment of fuel prices. Such an intervention should be instituted once public transport services improve. Nevertheless, CNG pump prices that are below the petrol price may provide an incentive for motorists to use this fuel as is the case in India which offers a subsidy of 40 to 60% below petrol prices.

(ii) *Targeting motor vehicle users by pricing variable costs of motor vehicle use:* This intervention involves charging other costs of motor vehicle use such as vehicle import duties, purchase and registration taxes that are

based on emission levels. These taxes may influence the frequency of private car uses.

(iii) *Targeting motor vehicle operators by changing driving conditions and managing traffic:* Improving driving conditions and managing traffic can have an important positive effect on emission rates and operational characteristics. Particularly, when these measures are oriented towards promoting ridership on public transport networks, through measures such as dedicated lanes and signal priority.

(iv) *Targeting commuters by influencing travel choices:* This intervention involves travel demand management (TDM) that targets the day-to-day travel choices of travelers, including time and means of travel. TDMs can involve incentives to use public transport, incentives to change patterns of trip-making (through, for example, carpooling or adopting different working hours), and disincentives with regard to private cars use.

(v) *Targeting vehicle purchasers by influencing vehicle model demand and turnover:* Interventions targeting vehicle purchasers affect the kind of vehicle choices made and the speed with which vehicles are cycled out of the in-use fleet. They might include tax regime to give an incentive to purchase more environmentally friendly vehicles and voluntary accelerated vehicle retirement programmes or scrappage.

9.8.2 Awareness-Raising Campaigns for Sustainable Transport

For most of the interventions proposed in this chapter to gain acceptance and thus become effective in addressing the problems of traffic congestion and environmental problems, the public needs basic understanding of the issues and stakes involved. Motorists and non-motorists need to have an understanding of how the sum of their individual decisions affects the quality of life they live on a day-to-day basis. Providing knowledge and creating awareness to the population through information, education,

training, persuasion and publicity campaigns, are prerequisites for policy implementation. Public support for policies that may be perceived to raise costs or impose burdens on individuals in the short run, can only be achieved if people at large have a clear idea of the expected long run benefits. Some of the key areas requiring public awareness and education are as follow:

1. ***Road use safety:*** Road users including pedestrians, cyclists, motorists and commuters, need to be educated on how best they can prevent road traffic congestion and accidents that claim lives and properties. Such awareness could improve traffic management and road safety. As provided in the NRSP, 2009, public awareness on safety aspects will reduce the need for enforcement activities.

2. ***Driving behaviours:*** Motorists and especially *daladala* drivers are key violators of traffic laws. In order to attain smooth traffic flows on roads and avoid traffic congestion as well as accidents, awareness on proper driving behaviour needs to be inculcated into drivers.

3. ***Public awareness on advantages of public transport:*** There is a need to create awareness of public transport as an alternative to private car use in order to change the travelling population's mindset. That is, travelers need to be educated on the fact that private car travel is not the only feasible alternative. Also there is a need to communicate the true cost of using private cars, travel time and the long-term unsustainability of this mode of transport as well as the payoffs of public transport that include convenience, safety, security and environmental impact.

4. ***Environmental sustainability:*** The public needs to be educated on the need for reducing the use of private cars and especially the environmental damages they exert on the wider society.

Public awareness campaigns need to portray images of professionalism, expertize, vision, creativity, and persistence. In other countries, lower-cost activities that are likely to be more feasible and constructive are used. Such activities include car-free days, bicycle-to-work days, free-vehicle-inspection days, bicycle film festivals, car-pooling days, free-

public-transport days, and media attention (Pojani and Stead, 2015). These techniques can also be employed in both Dar es Salaam and Mwanza cities.

9.8.3 Institutional Capacity Building

Capacity building in terms of human resources, professional skills, technology and equipment is required in almost all of the institutions involved in traffic management and regulation as well as environmental management. These institutions include, among others, Ministries, Police Force, Municipal and City Councils, SUMATRA, NEMC, TBS and EWURA.

9.8.4 Financing Mechanism of Infrastructure and Public Transport Services

In the context of market-oriented economic policies pursued by Tanzania, the Government retains the responsibility of financing transport infrastructure and especially roads maintenance, improvement and development in collaboration with donors and local authorities. Through the NTP, 2003, the government also augments the above resource funds from other sources such as charging road users; urban authorities collections from the private sector; and contributions from local communities. Regarding the financing of provision of public transport services, the Government has increasingly disengaged from this role. It has assumed the role of regulator through SUMATRA and controller through the Police force. The role of financing and operation public transport is now left to the private sector.

In view of the present policy orientation, it is suggested that for the purpose of rapid response to the problem of road traffic congestion in Dar es Salaam and Mwanza cities, there is needs to have a shift in the hierarchy of funding priorities. The proposed priority areas that need to be addressed in the short and medium term include the following:

- ***Priorities in development of road infrastructure:*** This involves the improvement of arterial and feeder roads going hand in hand with provision of P&R and daladala parking facilities as well as expanding the length of bus stands along the roads. As earlier underscored, funds devoted to future construction of flyovers and MRT may usefully be channeled in the above areas.

- ***PPP in financing of infrastructure and services:*** The private sector needs to be involved in the financing of infrastructure and services that are geared towards mitigating road traffic congestion. Financing of endeavours such as public transport services, P&R and daladala parking facilities, can be achieved through PPP and investment incentives strategies.

9.9 COST-BENEFIT ANALYSIS OF RECOMMENDED TRAFFIC CONGESTION INTERVENTIONS

The cost-benefit analysis (CBA) is a widely used method for evaluating public expenditure decisions on investment projects. This method takes into consideration the expected project costs and accruing benefits. The CBA involves identification and quantification of all the benefits and costs to society for the proposed project. The analysis thus helps to determine the economically, socially and environmentally efficient investment alternatives. This analysis involves estimation of monetary value of the direct and indirect (externalities) benefits accruing to the society as against the proposed project. The cost side includes three main variables which are project capital, operations and maintenance costs. For the traffic congestion interventions, direct benefits include reduced travel time for commuters and motorists as well as savings on operational costs. The indirect benefits include reduced levels of pollution that has negative impact on both environment and health as well as accidents. The NPV and benefit-cost ratio calculations determine the social viability of the proposed project.

In this study, calculation of NPV and cost ratios for each of the proposed traffic congestion interventions, was not attempted because of lack of baseline data and various variables. In view of this weakness, it was found imperative to list the expected costs and potential benefits for each of the proposed interventions as provided in **Appendix 9.3.**

9.10 ACTION PLAN FOR IMPLEMENTATION OF THE PROPOSED ROAD TRAFFIC CONGESTION MITIGATION STRATEGIES

The action plan presented in **Appendix 9.4**, provides congestion mitigation strategies in the context of traffic management; physical planning; demand side; supply side; and

environmental sustainability interventions. The plan also consists of action steps; policy and legal implications; responsible institutions; timelines (2-3 years: short term; 4-10 years: medium term; and over 10 years: long term); priority level (High priority, Normal Priority and Low priority); and potential challenges.

9.11 CONCLUSION

Dar es Salaam and Mwanza cities are increasingly facing the challenge of highly congested roadways in their CBDs which spill over to the outskirts. As a result, the population of these cities currently estimated at 5.6 million and 0.9 million respectively, faces economic, social, health and environmental challenges. These challenges manifest themselves, *inter alia*, in the form of travel delays; health related problems such as stress and contagious diseases; extreme air pollution, and high rates of road accidents. The cost of these externalities though unseen, are indeed colossal. These externalities are the silent killers of the urban inhabitants. The costs of traffic congestion to the nation in terms of direct economic costs especially value of time lost, vehicle extra fuel consumption and operating costs are also substantial.

In consideration of the above costs, the traffic congestion problem needs immediate redress through concerted efforts of all stakeholders including city residents, public and private institutions. Importantly, there is an urgent need to improve the traffic management system; enhancing physical planning and especially adoption of master plans that provide for greater accessibility to socio-economic amenities, adoption of compact high-rise satellite town concept and enforcement of land use laws to mitigate unregulated developments and sprawl; and redressing the supply side by improving road network connectivity through investing in road maintenance, improvement and development. Funds earmarked for expensive infrastructure ventures such as flyovers and MRT may be redirected to road improvement.

On the demand side, the emphasis should be placed on promoting the public transport system by instilling efficiency and reliability in the present paratransit *(daladala)* services and investing in the BRT system rather than the MRT/LRT system; and discouraging wider use of private cars. These measures should be aimed at attracting private car users to

use of public transport and non-motorized modes of travel. Further, incentive-based, technological and deterrent measures to contain vehicular noxious gas emissions, if effectively enforced, will deter polluting vehicles from roads. Public awareness through campaigns, education and training will be vital in making the population understand the long-term costs and advantages of sustainable transport in Dar es Salaam and Mwanza cities. Institutional capacities need to be enhanced and the private sector needs to be involved in both infrastructure development and mass transit services.

The foregoing traffic management, physical planning, supply-side, demand-side and environmental sustainability intervention packages are complementary to each other in a bid to address the challenge of traffic congestion in cities. The combination of the elements of each intervention package, will likely have significant synergies in terms of their combined impact on alleviating road traffic congestion in the two cities. However, it is most likely that some of interventions within and outside the packages will compete for both financial resources and business. Particularly, on the demand-side, BRT system will be in completion with MRT/LRT system and on the supply-side, pipeline for transporting petroleum products, SGR system and rehabilitation of TRL and TAZARA system on one hand and expensive road infrastructure and road improvement on the other, will be in competition. The choice among these alternatives should be guided by the need to avoid costly duplication of efforts and long-term viability of each of the interventions. Again, experience from elsewhere in the world indicates that demand–side interventions that focus on promoting the wider use public transport and limit wider use of private cars, have a significant impact on containing traffic congestion as compared to supply-side interventions that focus on expanding road network capacity.

LIST OF APPENDICES

Appendix 1.1: Terms of Reference for the Study on Causes, Impact and Management of Road Traffic Congestion in Selected Tanzania Cities: Dar es Salaam and Mwanza

THE UNITED REPUBLIC OF TANZANIA

SUMATRA

For Competitive, Efficient, Quality and Safe Transport Services

Surface and Marine Transport Regulatory Authority
Mamlaka ya Udhibiti Usafiri wa Nchi Kavu na Majini

1.0 OBJECTIVES OF THE ASSIGNMENT

While the main objective of the present assignment is to establish causes, impact and management of road congestion in Dar es Salaam and Mwanza cities, the specific objectives are well stated in the terms of reference (TOR) of the assignment. These objectives include the following:

(i) To identify general causes of road congestion in the country and city-specific causes of congestion in Dar es Salaam and Mwanza;

(ii) To bring to the fore front necessary data and information on the extent and impact of road congestion to the economy;

(iii) To explore effectiveness of road congestion management practices currently in place in Dar es Salaam and Mwanza and suggest avenues for improvement;

(iv) To recommend achievable, well-informed and city – specific interventions to manage road congestion; and

(v) To have a detailed cost-benefit analysis of the recommended interventions to manage road congestion.

2.0 SCOPE OF THE ASSIGNMENT

The consultant is required to establish causes, impact and management of road congestion in the cities of Dar es Salaam and Mwanza. The TOR specify that the consultant shall be required to undertake the following:

(i) Review available documentations, records and literature relevant in understanding the road traffic situation in the study cities of Dar es Salaam and Mwanza;

(ii) Identify causes of road congestion specific to the study cities of Dar es Salaam and Mwanza;

(iii) Consolidate various initiatives taken or planned by different stakeholders in order to manage road congestion in the study cities of Dar es Salaam and Mwanza.

(iv) Establish the nature of travel demand in the study cities of Dar es Salaam and Mwanza and its impact on congestion;

(v) Estimate (quantitatively) the cost incurred to the national economy as a result of prevailing road congestion in cities of Dar es Salaam and Mwanza;

(vi) Consult with key stakeholders, including road users, to collect their views on the nature, extent, impact and ways and means of managing road congestion;

(vii) Assess the efficacy of existing land use plans in managing congestion in the study cities of Dar es Salaam and Mwanza;

(viii) Examine existing institutional arrangement/set-up and its effectiveness in managing road congestion in the study cities of Dar es Salaam and Mwanza;

(ix) Recommend strategies to be adopted to reduce/manage road congestion in the study cities of Dar es Salaam and Mwanza;

(x) Undertake cost-benefit analysis of each strategy proposed to manage road congestion;

(xi) Show policy and regulatory implications of recommendations made on managing road congestion;

(xii) Make presentations of study findings and recommendations to stakeholders.

Appendix 2.1: List of Institutions whose Officials were Interviewed

S/NO.	NAME & ADDRESS OF INSTITUTION	NAME OF OFFICIAL INTERVIEWED
1.	SUMATRA,DAR ES SALAM	Messrs. N. Sigala & J. Kahatano
2.	Ministry of Works, Transportation and Communication, DAR ES SALAM	Eng. Mwanyika
3.	Ministry of Lands, Housing and Human Settlements Development,DAR ES SALAM	Ms. Immaculate Senje
4.	Ministry of Home Affairs,DAR ES SALAM	Mr. Musilimu
5.	President's Office - Ministry of Regional Administration & Local Government Authorities,	Eng. E. Kayanda. Eng. Moga, Ms. Mmbaga & Dr. M. Hante
6.	TANROADS, DAR ES SALAM	Eng. Asha Hussein
7.	EWURA, DAR ES SALAM	
8.	Dar es Salaam City Council, DAR ES SALAAM	
9.	Kinondoni Municipal Council, DAR ES SALAM	
10.	Ilala Municipal Council, DAR ES SALAM	
11.	Temeke Municipal Council, DAR ES SALAM	Eng. Swai
12.	UDA-RT, DAR ES SALAM	Mr. Deo Malongo
13.	DART, DAR ES SALAM	Mr. Edward
14.	DSM Special Zone Traffic Police, DAR ES SALAM	
15.	Regional Traffic Police – Ilala, DAR ES SALAM	
16.	Regional Traffic Police Commander – Kinondoni, DAR ES SALAM	
17.	Regional Traffic Police Commander – Temeke, DAR ES SALAM	
18.	Tanzania Revenue Authority DAR ES SALAM	Mr. Mdee
19.	AZAM Marine Ltd, DAR ES SALAM	Capt. J.B. Mkwiche & Eng. Abdul S. Hongo
20.	TEMESA, DAR ES SALAM	
21.	Tanzania Ports Authority, DAR ES SALAM	
22.	TRL, DAR ES SALAM	Mrs. Baturi Kimwaga
23.	RAHCO, DAR ES SALAAM	Eng. Machibya Masanja
24.	Regional Office - TAZARA, DAR ES SALAM	Mr. Hemed J. Msangi
25.	NEMC, DAR ES SALAM	Mr. Jandwa Wanjara
26.	Government Chemist,DAR ES SALAM	
27.	Temeke Regional Referral Hospital, DAR ES SALAM	
28.	Muhimbili National Hospital, DAR ES SALAM	
29.	Mwanza City Council, MWANZA	
30.	Ilemela Municipal Council, MWANZA	

31.	District Traffic Commander – Nyamagana, MWANZA	
32.	District Traffic Commander – Ilemela, MWANZA	
33.	Marine Services Company Ltd, MWANZA	
34.	SONGORO Marine Transport Ltd, MWANZA	
35.	Kamanga Ferry Limited, MWANZA	
36.	Nyehunge Marine Xpress, MWANZA	
37.	Bugando Medical Centre, MWANZA	
38.	Sekou Toure Regional Referral Hospital, MWANZA	

Appendix 2.2: Sample Elements Selected as Sources of Primary Data

S/NO.	TYPE OF RESPONDENTS	SAMPLING METHOD	DATA COLLECTION TOOLS	WEIGHT (%)	DAR ES SALAAM (65%)	MWANZA (35%)	TOTAL
A	**ROAD USERS**						
1	Public Transport Commuters & Pedestrians	Random	Interview	70%	910	490	**1,400**
2	Public Transport Owners	Random	Interview	4%	52	28	**80**
3	Motorcycle Drivers	Random	Interview	2%	20	11	**30**
4	Tricycle Drivers	Random	Interview	2%	20	11	**30**
5	Public Transport Drivers	Random	Interview	9%	117	63	**180**
6	Private Car Drivers	Random	Interview	14%	182	98	**280**
	Sub-total			**100%**	**1,300**	**700**	**2,000**
B	**PUBLIC SECTOR STAKEHOLDERS**						
1	**SUMATRA**						
	Directorate of Econ. Regulation	Purposive	Questionnaire/Interview		3	-	3
	Directorate of Road Trans. Reg.	Purposive	Questionnaire/Interview		3	-	3
2	**MINISTRY OF WORKS & TRANSP.**						

	Directorate of Transportation	Purposive	Questionnaire/Interview		2	-	2
	Directorate of Policy & Planning	Purposive	Questionnaire/Interview		2	-	2
3	**MINISRY OF LANDS**						
	Directorate of Urban & Regional Plan	Purposive	Questionnaire/Interview		2	-	2
4	**MINISTRY OF ENERGY**						
	Directorate of Petroleum	Purposive	Questionnaire/Interview		2	-	2
5	**EWURA**						
	Directorate of Petrol. Regulation	Purposive	Questionnaire/Interview		2	-	2
6	**MLGRA**						
	Directorate of Policy & Planning	Purposive	Questionnaire/Interview		2	-	2
7	**COUNCILS**						
	City Town Planner	Purposive	Questionnaire/Interview		2	2	4
	City Land Officer	Purposive	Questionnaire/Interview		2	2	4
	Municipal Town Planner	Purposive	Questionnaire/Interview		3	2	5
	Municipal Land Officer	Purposive	Questionnaire/Interview		3	2	5
	Municipal Infrastructure Eng.	Purposive	Questionnaire/Interview		3	2	5
8	**DAR RAPID TRANST**						
	Transport Planning	Purposive	Questionnaire/Interview		2	-	2
	Operations & Infrastructure Management	Purposive	Questionnaire/Interview		2	-	2

9	**TRA**						
	Director of MV Registration	Purposive	Questionnaire/Interview		2	-	2
10	**TANROADS**						
	Director of Planning	Purposive	Questionnaire/Interview		2	-	2
11	**TANZANIA ROAD FUND**						
		Purposive	Questionnaire/Interview		2	-	2
12	**TANZANIA POLICE FORCE**						
	Commissioner of Traffic Police	Purposive	Questionnaire/Interview		1	-	1
	Zonal Traffic Police	Purposive	Questionnaire/Interview		6	-	6
	Regional Traffic Police	Purposive	Questionnaire/Interview		-	4	4
	Traffic Police on Roads	Purposive	Questionnaire/Interview		30	20	50
13	**NEMC**						
	Environ. Impact Assessment	Purposive	Questionnaire/Interview		3	2	5
	Environ. Research and Planning	Purposive	Questionnaire/Interview		3	2	5
14	**HOSPITALS**				8	6	14
	Referral Hospital	Purposive	Questionnaire/Interview		6	4	10
	District Hospital	Purposive	Questionnaire/Interview		6	4	10
	Sub-Total				**109**	**54**	**163**
C	**PRIVATE SECTOR STAKEHOLDERS**						
1	Petroleum Vendors	Random	Questionnaire/Interview		15	10	25
2	UDA	Random	Questionnaire/Interview		30	-	30

3	Cargo Transporter	Random	Questionnaire/Interview		15	10	25
	Sub-total				**60**	**10**	**70**
	GRAND TOTAL				**1,469**	**764**	**2,233**

Appendix 2.3A: Interview Guide – General Questions

SECTION ONE

Dar es Salaam ☐ **Mwanza** ☐

Travelling from _____ to _____

Means of transport: _____

Name of Institution

_____

1. Demographic information:
   (a) Gender M ☐ F ☐

   (b) Age (in years) _____

   (c) Education level (Tick where appropriate)
   Primary_____

   Secondary_____

   Tertiary_____

   (d) Marital status (Tick where appropriate)
   - Single_____ ☐
   - Married_____ ☐
   - Widowed_____ . ☐
   - Divorced /separated ☐

   (e) Occupation:
   - Employed ☐
   - Self-employed ☐
   - Student ☐

   Other (specify) _____

2. (a) Main causes of congestion ***(Rank from 4 = very serious; 3=serious; 2=less serious; and 1= not serious)***
   - Too many people travelling ☐
   - Too many motor vehicles ☐

- Bad roads ☐
- Accidents ☐
- Too many motor- & tri-cycles ☐
- Careless driving ☐
- Dysfunctional traffic lights ☐
- Heavy cargo track ☐
- Location of ICDs with the city ☐
- Inadequate road capacity/network ☐

3. List other reasons for road congestion specific to the city:
_____
_____
_____
_____

4. What are the effects of road traffic congestion in the city?:

(a) Economically
_____
_____

(b) Socially
_____
_____
_____

(c) Environmentally:
_____
_____

(d) Health-wise:
_____
_____
_____

(e) Who are the most affected people by road traffic congestion?

(a) Economically

_____
_____

(b) Socially:

_____
_____
_____

(c) Environmentally:

_____
_____
_____

(d) Health-wise:

_____
_____
_____

5. How do you cope with road traffic congestion?

_____
_____
_____

(b) Are you aware of any measures taken by the Government to reduce road traffic congestion? **Yes** ☐ **No** ☐

(c) If **YES**, list those measures:

_____
_____
_____

(d) How effective are the above listed measures?

_____
_____
_____
___
_____
_____
__

(e) What should be done to improve road traffic congestion management practices?

_____
_____

_____
_____
_____
_____
_____

6. What specific times, days and months is road traffic congestion most serious in the city?

_____
_____
_____
_____
_____
_____

7. Which areas of city often experience serious road traffic congestion?

_____
_____
_____
_____
_____
_____

Appendix 2.3B. I: Interview Guide for Road Users and Private Cars Drivers

Dar es Salaam ☐ **Mwanza** ☐

1. Travel details:
   (a) From_____ Destination_____

   (b) Travel time to destination when there is traffic congestion _____ hours.
   (c) Travel time to destination when there is no traffic congestion _____ hours
2. (a) Are you a commuter: (tick whichever is appropriate)

Yes ☐ No ☐

(b) If YES,

i) Which of the following means of transport do often you use? (***Rank from 4 = very frequent; 3=frequent; 2=less frequent; and 1= not used***)

- Private car____ ☐
- Bodaboda _____ ☐
- Tricycle_____ ☐
- Taxi_____ ☐
- Daladala _____ ☐
- DART _____ ☐
- Office transport ___ ☐
- Bicycle _____ ☐
- Other _____(specify)

ii) Which problems do you encounter while commuting by the above means of transport? ***(Rank from 4 = very serious; 3=serious; 2=less serious; and 1= not serious)***

a) Delays in reaching destination ☐
b) Overcrowding ☐
c) Pickpocketing ☐

d) Tiredness ☐
e) Stress ☐
f) Getting up early ☐
g) Getting from work late ☐

4. (a) Buffer travelling time

(i) Time of waking up _____ AM

(ii) Time of boarding means of transport _____ AM

(iii) Time of arrival at destination _____ AM

(iv) Time of starting work/business ____ AM.

(b) Preferred travel time in order to avoid road traffic congestion:

(i) During morning _____
(ii) During evening _____

5. To be answered by private car users:
   (a) Number of passengers normally carried in your car _____
   (b) Average speed during road traffic congestion _____ Km/hour
   (c) Average speed during off-peak hours _____ Km/hour
   (d) Cost of fuel per day from home to place of work and back:
      (i) Petrol _____ Litres. Cost: TAS _____
      (ii) Diesel _____ Litres Cost: TAS. _____

6. Which of the bellow efforts are effective in easing road traffic congestion? ***(Rank from 4 = very effective; 3=effective; 2=less effective; and 1= not effective)***

- Rapid transit buses ☐
- Improvement of ring roads ☐
- Improvement of atrial roads ☐
- Deployment of Traffic Police ☐
- Trains ☐
- Use of large buses ☐
- Use of boats/water ways ☐

- Limiting private cars in CBD ☐

Appendix 2.3B. II: Questionnaire for Public Transport Owners

Dar es Salaam ☐ **Mwanza** ☐

1. (a) Type of passenger vehicle owned:

- Minibus(es) ☐
- Large bus(es) ☐

(b) Since when have you been in the passenger transport business?

_____

2. Problems experienced as owner attributable to road traffic congestion ***(Rank from 4 = very serious; 3=serious; 2=less serious; and 1= not serious)***

(a) Wear and Tear of vehicle ☐

(b) Shrinking income ☐

(c) Increased maintenance costs ☐

(d) Reduced lifespan of vehicle(s) ☐

3. Indicate the average income and major maintenance costs for the following periods (in TAS):

ITEM	**YEAR**				
	2012	2013	2014	2015	2016
Average daily income per bus					
Annual maintenance costs per bus					

4. (a) If the Government has to phase out minibuses and introduce bigger buses, would you be ready to invest in such a business? **Yes** ☐ **No** ☐

(b) If YES or NO, Explain Why?

_____

_____

Appendix 2.3B. III: Interview Guide for Passenger Transport Drivers

Dar es Salaam ☐ **Mwanza** ☐

1. (a) Type of motor vehicle driven (tick)
   - Minibus ☐
   - Large bus ☐

   (b) Which route do you operate? From _____ to _____

2. For how long have you been operating in this city? _____ (Years)
3. Average motor vehicle speed:
   (a) During road traffic congestion _____Km/hour
   (b) Off peak hours _____Km/hour

4. (i)Types of problems encountered ***(Rank from 4 = very serious; 3=serious; 2=less serious; and 1= not serious)***
   (a) Increased delays ☐
   (b) Loss of revenue collected due to reduced trips ☐
   (c) Accidents ☐
   (d) High Fuel Consumption ☐
   (e) Wear and Tear ☐

(iii) List other problems related to road traffic congestion:
_____
_____
__

4. (a) Time spent by the vehicle to destination when there is no congestion_____ (hours)

   (b) Time spent by the vehicle to destination when there is congestion _____ (hours)

5. Indicate average daily net income, maintenance cost and fuel consumption for vehicle you are driving during the past 5 years (TAS)

ITEM	YEAR				
	2012	2013	2014	2015	2016
Net income per day					
Maintenance costs per day					
Fuel consumption without congestion (litres) per day					
Fuel consumption with congestion (litres) per day					

6. What particular time(s) of the day do you experience the most intense congestion? _____ (hrs)

7. What should be done to mitigate road traffic congestion? ***(Rank from 4 = very effective; 3=effective; 2=less effective; and 1= not effective)***

- Improvement of arterial roads ☐
- Improvement of feeder roads ☐
- Replacement of minibuses with large buses ☐
- Increase the efficiency of traffic police ☐
- Increase rapid transit roads ☐
- Improvement of traffic lights efficiency ☐
- Limit use of private cars ☐
- Allow motorcycles & tricycles to ply in the CBD ☐
- Create awareness on proper use of roads traffic transport ☐

8. List other factors that cause road traffic congestion in the city:

_____
_____
_____
___

Appendix 2.3B. II: Questionnaire for Sumatra

Dar es Salaam ☐ **Mwanza** ☐

1. Number of passenger/public transport motor vehicles licensed to operate for the past 5 years

TYPE OF BUS / CITY	YEAR									
	2012		2013		2014		2015		2016	
	Mini	Large	Mini	Large	Mini	Large	Mini	Large	Mini	Large
Dar es Salaam City										
Mwanza City										
Rest of the country										

2. Number of passenger motor cycles (MC) and tricycles (TC) licensed to operate for the past 5 years

TYPE OF CYCLE / CITY	YEAR									
	2012		2013		2014		2015		2016	
	MC	TC	MC	TC	MC	TC	MC	TC	MC	TC
Dar es Salaam										
Mwanza										
Rest of the Country										
TOTAL										

3. Number of cargo transportation trucks licensed to operate in Dar es Salaam and Mwanza City as well as the rest of the country during the past five (5) years:

CITY	YEAR				
	2012	2013	2014	2015	2016
Dar es Salaam					
Mwanza					
Rest of the Country					
TOTAL					

4. Significance of roads traffic congestion problem ***(Rank from 4 = highly significant; 3=significant; 2= insignificant; and 1= highly insignificant)***

(a) Country wise ☐

(b) Dar es Salaam City ☐

(c) Mwanza City ☐

5. List major causes of traffic congestion

(a) Nation wise:

_____
_____
_____
_____
____

(b) Dar es Salaam City:

_____
_____
_____
_____
_____
_____
_____

(c) Mwanza City:

_____
_____
_____
___

6. (a) List the current strategies used to manage road traffic congestion:

_____
_____
_____
_____
_____
_____

(b) List future plans/strategies to be used for the purpose of managing road traffic congestion:

_____
_____

_____
_____
_____
_____
___

(c) List the challenges faced by your Agency in managing road traffic congestion:

_____
_____
_____
_____
_____
_____

7. Provide average annual costs and benefits/savings for managing road traffic congestion (in TAS):

ITEM	**YEAR**				
	2012	2013	2014	2015	2016
Costs					
Benefits/Savings					

8. Explain the currents institutional arrangements for managing road traffic congestion:

_____
_____
_____
_____
_____
_____
_____
_____

9. How can the institutional arrangements be improved in order to efficiently manage road traffic congestion?

_____
_____
_____
_____
_____
_____
_____

_____
_____

10. Could you explain on the issue of Dry Port Regulations and how it can assist alleviation of the road traffic congestion?

_____
_____
_____
_____
_____
_____

11. Who are the major stakeholders affected by the road traffic congestion and how are they affected?

_____
_____
_____
___

12. What are the key areas of complaints from stakeholders related to road traffic congestion?

_____
_____
_____
_____
_____
_____

13. What are the short-, medium- and long-term plans to decongestion road traffic in Dar es Salaam and Mwanza cities?

_____
_____
_____
_____
____

Appendix 2.3B. III: Questionnaire for Government Ministries

1. Name of Ministry and Department:
_____

2. Mandate of the Ministry in relation to management of road traffic congestion:
_____
_____
_____
_____
_____
_____

3. Seriousness of the problem of road traffic congestion ***(Rank from 4 = very serious; 3=serious; 2=less serious; and 1= not serious)***

   (a) Dar es salaam city ☐
   (b) Mwanza ☐
   (c) Other urban areas countrywide ☐

4. What are the short-, medium- and long-term plans to decongest road traffic in Dar es Salaam and Mwanza cities?
_____
_____
_____
_____
_____
_____
_____

5. List the current strategies that are used by Ministry to mitigate the problem or road traffic congestion:
   (i) _____
   (ii) _____
   (iii) _____
   (iv) _____
   (v) _____
   (vi) _____

6. How effective are the above strategies? ***(Rank from 4 = highly effective; 3=effective; 2= ineffective; and 1= highly ineffective)***
   (i) _____ ☐

(ii) _____ ☐
(iii) _____ ☐
(iv) _____ ☐
(v) _____ ☐
(vi) _____ ☐

7. (a) What other stakeholders does the Ministry collaborate with in managing road traffic congestion?

_____
_____
_____
_____
_____
_____

(b) How does the Ministry coordinate its efforts with other stakeholders?

_____
_____
_____
_____
_____
_____
_____

8. Provide quantifiable costs and benefits accruing to road traffic congestion management (in TAS)

ITEM	**YEAR**				
	2012	2013	2014	2015	2016
Costs					
Benefits/Savings					

9. Future plans to manage road traffic congestion.

_____
_____
_____
_____
____

10. What investment components and costs that are anticipated by the Ministry if the Government decides to provide alternative intra-city passenger transport?

(a) Marine services:_____
_____
_____
_____
_____

(b) Railway services:
_____
_____
_____
_____
_____
_____

11. Does the location of considerable number of internal container depots (ICDs) within the city neighbourhood contribute to road traffic congestion?

Yes ☐ No ☐

(a) If YES, explain how Ministry planning to handle this issue in mitigation of road traffic congestion.
_____
_____
_____
_____
_____

(b) If NO, explain
_____
_____

Appendix 2.3B. IVI: Questionnaire for Energy, Water and Utilities Regulatory Authority (EWURA)

1. EWURA's Mandate:

_____
_____
_____
_____
_____
_____
_____

2. Imports of petroleum products over the past five (5) years (in Quantity/metric tons and Value/TAS)

QTY/VALUE TYPE OF PETROLEUM	YEAR									
	2012		2013		2014		2015		2016	
	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE
Petrol										
Diesel										
Kerosene										
Others										

3. Yearly fuel consumption of petroleum products nationwide, Dar es Salaam and Mwanza cities:

(***a) Petrol:***

QTY/VALUE CITY	YEAR									
	2012		2013		2014		2015		2016	
	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE
Nationwide										
Dar es Salaam										
Mwanza										
Total										

(b) Diesel

QTY/VALUE / CITY	YEAR									
	2012		2013		2014		2015		2016	
	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE
Nation										
Dar es Salaam										
Mwanza										
Total										

3. Would you comment on the state of motor vehicle fuel efficiency in the light of congestion in Dar es Salaam and Mwanza Cities?

   _____
   _____
   _____
   _____
   _____
   _____

4. Do you have any view on how to redress the problem of road traffic congestion in the urban areas of Tanzania and specifically Dar es Salaam and Mwanza cities?

   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

Appendix 2.3B. VII: Questionnaire for City/Municipal Councils

1. Name of City/Municipal Council: _____
2. Department: _____
3. Mandate of Council in respect of road traffic management:
   _____
   _____
   _____
   _____
   ____

   Road network requirements and constructed during the past five (5) years:

KM./VALUE / CITY	YEAR									
	2012		2013		2014		2015		2016	
	Km.	VALUE	Km.	VALUE	Km.	VALUE	Km.	VALUE	Km.	VALUE
1. Road Requirements:										
(a)Tarmac										
(b) Gravel										
2. Roads constructed:										
(a) Tarmac										
(b) Gravel										

4. Major causes of road congestion in the Municipality:
   _____
   _____
   _____
   _____
   ____
5. Currents strategies adopted to manage road traffic congestion by the Municipal Council:
   _____
   _____
   _____
   _____
   ____
6. Challenges encountered in managing road traffic congestion in the Municipality
   _____
   _____

_____
_____

7. Future plans for managing road traffic congestion in the Municipality:

_____
_____
_____
_____
_____

8. Effects of road traffic congestion on the Municipality:

_____
_____
_____
_____
_____

9. Costs of current road traffic congestion management efforts in the Municipality:

_____
_____
_____
_____
_____

10. List short-, medium- and long-term plans and associated costs for decongesting road traffic in the Municipality:

_____
_____
_____
_____
_____
_____

Appendix 2.3B. VIII: Questionnaire for Dar Rapid Transport [DART] and UDA

DART ☐ **UDA** ☐

1. Mandate of your institution regarding road traffic congestion:

   _____
   _____
   _____
   _____
   _____
   _____

NAME OF ROAD/STATUS	**CONSTRUCTION PERIOD**	**KILOMETERS**	**COST (TAS)**
Completed:			
Kawawa Road			
Morogoro Road			
Planned			

2. Type of buses owned:

   _____
   _____
   __

3. Number of buses owned _____
4. Number of drivers _____
5. Daily fuel consumption per bus [on average] _____
6. Average speed of a bus _____
7. Average number of passengers currently ferried per day:

   _____

8. Does road traffic congestion benefit your business? Yes ☐ No ☐

   If YES or NO how does it benefit or not benefit your business?

   _____
   _____
   _____
   _____

9. What are the causes of road traffic congestion?

   _____
   _____

_____
_____
_____

10. What measures should be taken to mitigate road traffic congestion?

_____
_____
_____
_____
_____

11. What is the current and projected levels of the business profitability?

_____
_____
_____
_____
_____

12. Is the city passenger transportation business feasible? (Indicate payback period, IRR, NPV, etc.)

_____
_____

13. What are the future investment plans regarding road traffic decongestion?

_____
_____
_____

14. Provide the cost of infrastructure development for the completed roads and planned ones:

Appendix 2.3B. VIIX: Questionnaire for Tanzania Revenue Authority (TRA)

1. Trend of motor vehicle, motor cycle, tricycle importation for the past 5 year:
   i) Number of lorries imported:

AGE OF MV	YEAR				
	2012	2013	2014	2015	2016
New					
1-4 Years					
5-8 years					
Over 8 years					
TOTAL					

   ii) Number of private cars/vans imported:

AGE OF MV	YEAR				
	2012	2013	2014	2015	2016
New					
1-4 Years					
5-8 years					
Over 8 years					
TOTAL					

   iii) Number of buses imported:

AGE OF MV	YEAR				
	2012	2013	2014	2015	2016
New					
1-4 Years					
5-8 years					
Over 8 years					
TOTAL					

   iv) Number of tricycles imported:

AGE OF TC	YEAR				
	2012	2013	2014	2015	2016
New					
1-4 Years					
5-8 years					

Over 8 years					
TOTAL					

v) Number of motorcycles imported:

AGE OF MC	**YEAR**				
	2012	2013	2014	2015	2016
New					
1-4 Years					
5-8 years					
Over 8 years					
TOTAL					

2. Number of motor vehicles, motorcycles and tricycle issued with **road licenses** for Dar es salaam and Mwanza Cities

CITY/ TYPE	**YEAR**				
	2012	2013	2014	2015	2016
DAR					
Private cars/vans					
Lorries					
Buses					
Motorcycles					
Tricycles					
MWANZA					
Private cars/vans					
Lorries					
Buses					
Motorcycles					
Tricycles					

3. Amount of petroleum products destined to Dar es Salaam and Mwanza cities **(in Metric Tons):**

PETROLEUM / **CITY**	**Petrol**	**Diesel**	**Others**
Dar es salaam			
2012			
2013			

2014			
2015			
2016			
Mwanza			
2011			
2012			
2014			
2015			
2016			

4. What are the costs and extent of road traffic congestion to TRA:
   _____
   _____
   _____
   _____
   _____

5. Does the location of considerable number of internal container depots (ICDs) within the city neighbourhood contribute to road traffic congestion?
   Yes ☐ No ☐

(c) If YES, explain how Ministry planning to handle this issue in mitigation of road traffic congestion.
   _____
   _____
   _____
   _____

(d) If NO, explain
   _____
   _____
   _____

Appendix 2.3B. X: Questionnaire for TANROADS

1. TANROADS' Mandate:

   _____
   _____
   _____

2. Status of road network requirements and construction under TANROADS jurisdiction in Dar es Salaam and Mwanza cities for the past five (5) years **(in Km.):**

QTY/VALUE / CITY	YEAR									
	2012		2013		2014		2015		2016	
	TAR.	MUR.	TAR.	MUR.	TAR.	MUR.	TAR.	MUR.	TAR.	MUR.
Dar es Salaam										
Road requirements										
Ilala										
Kinondoni										
Temeke										
Total										
Mwanza										
Road requirements										
Nyamagana										
Ilemela										
Total										

NOTE:
TAR: Tarmac roads
MUR: Murom roads

3. Road construction and maintenance costs per year for roads under TANROADS jurisdiction during the past five years (TAS):

COUNCIL	YEAR				
	2012	2013	2014	2015	2016
Dar es Salaam					
Ilala					
Kinondoni					
Temeke					
Mwanza					

Nyamagana					
Ilemela					
Total					

4. What are the technical issues that are causing road traffic congestion?

   _____
   _____
   _____

5. Impact of road traffic congestion on TANROADS plans:

   _____
   _____
   _____
   _____

6. TANROADS' short-, medium- and long-term plans/strategies to mitigate the problem of road traffic congestion in Dar es Salaam and Mwanza cities

   _____
   _____
   _____
   _____

7. What are the costs related to the above road traffic decongestion plans/strategies?

   _____
   _____
   _____
   _____

8. Besides the above plans, what should be the specific permanent solutions to decongest Dar es Salaam and Mwanza cities?

   _____
   _____
   _____

10 What are the costs associated with road traffic decongestion?

_____
_____
_____

Appendix 2.3B. VIIII: Questionnaire for Tanzania Commissioner Of Traffic Police

DAR ES SALAAM: Ilala ☐ Temeke ☐ Kinondoni ☐

MWANZA: Nyamagana ☐ Ilemela ☐

1. Number of traffic police officers for the past five (5) years:

NUMBER DEPLOYED	YEAR				
	2012	2013	2014	2015	2016
District/ Region					
On roads					
Direction of Vehicles					

2. Is the number of traffic officers deployed on roads for directing vehicles sufficient, if not what is the sufficient number?

   _____
   _____
   _____
   ___

3. List the challenges faced by traffic officers who are deployed on roads to direct motor vehicles:

   _____
   _____
   _____
   ___

4. Impact of road traffic congestion on the Police Force on daily responsibilities:

   _____
   _____
   _____
   _____
   ____

5. What should be done to solve the problem of road traffic congestion?

   _____
   _____
   _____
   ___

6. Number of road traffic accidents in the district/region attributed to congestion over the past five (5) years:

YEAR	**NUMBER OF ACCIDENTS**
2012	
2013	
2014	
2015	
2016	

7 Cost of managing road traffic congestion?

_____
_____
_____

8 What are the measures taken in managing road congestion?

_____
_____
_____
_____

9 What are the impacts of road congestion on

(a) Health:

_____
_____
_____
___

(b) Environment:

_____
_____
_____
___

(c) Economic:

Appendix 2.3B.IXII: Questionnaire for Passenger Marine Vessel Operators

Dar es Salaam ☐ **Mwanza** ☐

AZAM ☐	**SONGORO** ☐	**TPA** ☐
TEMESA ☐	**KAMANGA** ☐	**MSCL** ☐
MKOMBOZI ☐	**NYAHUNGE** ☐	

1. In the wake of the problem of road congestion in the city, is your company willing, ready and able to participate in provision of intra-city passenger marine services as an alternative to road transportation?
   YES ☐ NO ☐

2. If YES, what are the prerequisites for your participation in provision of passenger marine services?
   _____
   _____
   _____
   _____
   _____

3. Do you think the provision of the passenger marine services along the shores of the city is a viable and sustainable business? YES ☐ NO ☐

4. If the answer is YES or NO, what are the reasons for such perception?_____
   _____
   _____
   _____
   _____
   _____

5. What investment components and costs that are anticipated by your company, if you decide to invest in the intra-city passenger marine services?
   _____
   _____
   _____
   _____
   _____
   _____

6. How many passengers do you expect to serve per year in order to make the business viable?

   _____
   _____
   __

7. What actions should be undertaken in order to make the intra-city passenger marine services a viable business?

   _____
   _____
   _____
   _____
   ____

8. What is the route that will be operated?

   _____
   _____
   _____
   ___

9. What are the anticipated fares that would be charged per trip and the level of competiveness with passenger bus transport?

   _____
   _____
   _____
   _____
   _____
   _____

10. What kind of assistance is required from the Government in order to start intra-city passenger marine services?

    _____
    _____
    __

Appendix 2.3B. XII: Questionnaire for TAZARA and TRL/RAHCO

TAZARA ☐ TRL/RAHCO ☐

1. Since when has your company been operating the passenger train services in the city in the endeavour to mitigate road traffic congestion? Year _____

2. What routes do you operate?
   _____
   _____
   _____
   ___

3. How many trips do you operate every day and during what periods?
   _____
   _____
   __

4. What are the fares you have been charging per trip per passenger?
   _____
   _____
   _____
   _____Do you intend to increase the fares, why and when?
   _____
   _____
   _____

5. What level of profits you company has been able to make since starting this business?
   _____
   _____
   _____

6. Does the current road traffic congestion benefit your business?
   YES ☐ NO ☐
   If YES or NO, to what extent does your business benefit or not?

_____
_____
_____
_____

7. Is your company intending to increase the number of daily trips?
   YES ☐ NO ☐

   If the answer is YES or NO, what are the reasons for such perception?
   _____
   _____
   _____
   _____

8. What actions should be taken by your company to ensure that the city train passenger service is sustainable?
   _____
   _____
   _____
   _____

9. What actions should be taken by the Government to ensure that the city train passenger services are sustainable?
   _____
   _____
   __

10. What investment components and costs are anticipated by your company, if you decide to invest in the intra-city passenger railway services?
    _____
    _____
    _____
    _____

11. Could the enhancement of the efficiency of cargo transportation by rail be an alternative to decongest road traffic in the city?

    YES ☐ NO ☐

    If YES, what should be done in terms of investment by?

(i) Government:
    _____
    _____
    _____
    _____

_____

_____

(ii) Company:

_____

_____

_____

_____

12. The capacity and performance of your company in cargo transportation from and to Dar es Salaam:

CAPACITY			**YEAR/ACTUAL TONAGE**				
ROLLING STOCK	**NUMBER**	**TONNEAGE**	**2012**	**2013**	**2014**	**2015**	**2016**
Goods wagons							
Fuel tankers							
Parcel wagons							
Others							
TOTAL							

13. (a) Is the proposed Dry Port to be constructed in Coast Region expected to be more effective in solving the problem of road traffic congestion in Dar es Salaam as compared to the idea of enhancing the efficiency of transporting cargo by railway to the inland and neighbouring countries?

YES ☐ NO ☐

(b) If YES or NO, explain why?

_____

_____

_____

___

Appendix 2.3B. XI: Questionnaire for Private Sector Stakeholders

1. (a) Kind of business [tick whichever is appropriate]
   i) Petroleum vendor ☐
   ii) Cargo transporter ☐
   iii) Daladala owner ☐
   iv) Bodaboda owner ☐
   v) Bajaj owner ☐
   vi) Taxi owner ☐
   (b) Others specify
   _____
   _____
   __
2. Does road traffic congestion affect your business?
   YES ☐ NO ☐
3. If YES, explain how it affects your business.
   _____
   _____
   _____
   _____
   ____
4. What do you think are the causes of road traffic congestion in your area?
   _____
   _____
   _____
   _____
5. What are the impacts of road traffic congestion on your business?
   _____
   _____
   _____
6. _What should be done to reduce road traffic congestion in your area?

Appendix 2.3B. XII: Questionnaire for Hospitals

MNH	☐	**TEMEKE**	☐
BUGANDO MC	☐	**SEKOU TOURE**	☐

1. Number of injuries related to traffic accidents recorded during the past five (5) years:

TYPE OF ACCIDENT	**YEAR**				
	2012	**2013**	**2014**	**2015**	**2016**
Motor vehicles					
Motorcycles					
Tricycles					
TOTAL					

2. Number of fatalities caused by road traffic accidents during the past five (5) years:

TYPE OF ACCIDENT	**YEAR**				
	2012	**2013**	**2014**	**2015**	**2016**
Motor vehicles					
Motorcycles					
Tricycles					
TOTAL					

3. Number health problems related to motor vehicle gas emissions/pollution?

TYPE OF PROBLEM	**YEAR**				
	2012	**2013**	**2014**	**2015**	**2016**
Pollution related ailments					
Stress					
Others					
TOTAL					

4. What is the impact of road traffic congestion on human health?

_____

TYPE OF MEDICAL EXPENSES	YEAR				
	2012	2013	2014	2015	2016
Accidents					
Pollution related ailments					
Stress					
Others					
TOTAL					

_____
_____

5. What should be done to mitigate the problem of road traffic congestion?

_____
_____
_____

6. What is the long-term impact of road traffic air pollution on people's health?

_____
_____
_____

_____ What is the average time lost per annum as a result of the diseases related to road congestion?

_____
_____

7. Provide data on the economic costs of health problems related to road traffic congestion during the last five (5) years (in TAS):

Appendix 2.3B. XIIII Questionnaire for NEMC and Government Chemist

NEMC ☐ **GOVT CHEMIST** ☐

1. Institution's mandate in relation to road traffic congestion:

_____
_____
_____
_____
_____How does road traffic congestion affect the environment and human health?
_____
_____
_____
_____

2. To what extent are the cities of Dar es Salaam and Mwanza environmentally affected by road traffic congestion?

_____
_____
_____How harmful to humans and environment are the motor vehicle gas emissions?
_____
_____
_____
_____

3. Measurements of the motor vehicle (toxic) gas emissions attributable to road traffic congestion during the past five (5) years (in M^3):

TYPE OF GAS EMITTED	**YEAR**				
	2012	2013	2014	2015	2016
Carbon monoxide					

4. The impact of the above emissions on the environment and humans:

_____
_____
_____
_____

5. What challenges does your institution encounter in enforcing laws and regulations related to preventing negative environmental effects of road traffic congestion?

   _____
   _____
   _____
   ___

6. What should be done to mitigate the problem of environmental pollution related to road traffic congestion?

_____
_____
_____

7. What are the environmentally tolerable levels of motor vehicles gas emissions and how far are the cities of Dar es Salaam and Mwanza away from, or close to, those levels?

Appendix 5.1: Profile of Respondents in Dar Es Salaam City

AGE	20-24	25-29	30-34	35-39	40-44	45-49	50+	TOTAL	%
Male	241	253	112	97	81	35	25	**844**	71%
Female	82	75	74	54	24	16	13	**338**	29%
Total	**323**	**328**	**186**	**151**	**105**	**51**	**38**	**1182**	100%
EDUCATION									
Primary	76	35	42	55	23	31	18	**280**	24%
Secondary	135	108	87	79	62	17	13	**501**	42%
Tertiary	112	185	57	17	20	3	7	**401**	34%
Total	**323**	**328**	**186**	**151**	**105**	**51**	**38**	**1182**	100%
MARITAL STATUS									
Single	279	183	107	59	2	0	0	**630**	53%
Married	43	144	78	87	102	46	28	**528**	45%
Widowed	1	0	1	4	1	5	9	**21**	2%
Divorced	0	1	0	1	0	0	1	**3**	0%
Total	**323**	**328**	**186**	**151**	**105**	**51**	**38**	**1182**	100%
OCCUPATION									
Employed	40	77	123	75	31	30	15	**391**	33%
Self employed	92	201	63	76	74	21	23	**550**	47%
Student	191	50						**241**	20%
Total	**323**	**328**	**186**	**151**	**105**	**51**	**38**	**1182**	100%
COMMONLY USED MODES OF TRANSPORT									
Public transport	297	274	138	91	72	39	24	**935**	79%
Private cars	19	32	38	53	30	8	12	**192**	16%
Motorcycle	5	13	4	3	1	0	0	**26**	2%
Tri-cycle	2	9	6	4	2	4	2	**29**	2%
Total	**323**	**328**	**186**	**151**	**105**	**51**	**38**	**1182**	100%

Source: *Road Survey data, 2017*

Appendix 5.2: Commuters' Choice of Mode of Transport in Dar es Salaam City

Preferred Mode of Transport	Response categories on Likert scale				Total response (N)	Non - response	R.I.I	Rank
	Very often	Often	Sometimes	Never				
	4	3	2	1				
Private car	103	32	15	42	192	0	**0.755**	**2**
Motorcycle (*Bodaboda*)	54	19	43	74	190	2	**0.570**	**5**
Tricycle (*Bajaj*)	101	8	5	78	192	2	**0.672**	**4**
Taxi	34	14	67	76	191	1	**0.508**	**6**
Public Transport (Daladala)	109	20	12	51	192	0	**0.743**	**3**
Bus Rapid Transit – BRT	117	21	9	45	192	0	**0.773**	**1**
Office transport	25	20	45	102	192	1	0.458	5
Bicycle	3	0	13	118	134	58	0.291	7

Source: *Survey Data, 2017*

Appendix 5.3: Road Traffic Congestion Periods in Dar es Salaam City

Traffic Congestion Time	Commuters		Traffic Police		Pub. Transp. Drivers		Private Car Users		Total Respondents	
	Count	%	Count	%	Count	%	Count	%	Count	%
Mornings (06:00-10:00) & Evenings (15:00-21:00)	645	69.5%	72	96.0%	102	84.3%	159	82.8%	**978**	**74.3%**
Afternoons only (12:00-15:00)	135	14.5%	0						**135**	**10.3%**
Mornings only (06:00-10:00)	85	92.0%					17	8.9%	**102**	**78.0%**
Mornings, Afternoons & Evening (06:30-09:00)	28	3.0%	3	4.0%	17	14.0%	3	1.6%	**51**	**3.9%**
Mornings & Afternoons 06:00&12:00-15:00)	6	0.6%							**6**	**0.5%**
Afternoons and Evenings (12:00-16:00)	2	0.2%			3	1.7%			**5**	**0.5%**
Don't Know	2	0.2%							**2**	**0.2%**
No specific time	1	0.1%					3	1.6%	**4**	**0.3%**
TOTAL	**928**	**100%**	**75**	**100%**	**121**	**100%**	**192**	**100%**	**1316**	**100%**

Source: *Survey Data, 2017*

Appendix 5.4: Road Traffic Congestion Hotspots in Dar es Salaam City

Area of Congestion	Frequency	Percentage	Rank
Pugu Road (Mombasa/Ukonga Junction)	243	15.9%	1
TAZARA (Nyerere/Mandela Roads)	228	14.9%	2
Ubungo (Morogoro/Mandela Rroads)	206	13.5%	3
Kariakoo (Uhuru/Msimbazi Roads)	176	11.5%	4
Buguruni (Mandela/Uhuru Roads)	159	10.4%	5
Kilwa/Gerezani Road	132	8.6%	6
Kawawa/New Bagamoyo Road (Morocco)	121	7.9%	7
Mwenge (New Bagamoyo/Sam Nujoma Roads)	109	7.1%	8
Old Bagamoyo/Kawe Road Roundabout	108	7.1%	9
Tabata/Mandela Road Junction	104	6.8%	10
Posta	73	4.8%	11
Magomeni (Morogoro/Kawawa Roads)	61	4.0%	12
Mbagala (Rangi Tatu)	53	3.5%	13
Total	**1,530**	**100.0%**	

Source: *Survey data, 2017*

Appendix 5.5: Profile of Respondents in Mwanza City

AGE	20-24	25-29	30-34	35-39	40-44	45-49	50+	TOTAL	%
Male	103	115	86	67	56	49	34	**510**	74%
Female	47	32	34	23	17	19	10	**182**	26%
Total	**150**	**147**	**120**	**90**	**73**	**68**	**44**	**692**	
EDUCATION									
Primary	29	36	24	44	15	13	12	**173**	25%
Secondary	97	81	69	36	31	26	23	**363**	52%
Tertiary	24	30	27	10	27	29	9	**156**	23%
Total	**150**	**147**	**120**	**90**	**73**	**68**	**44**	**692**	100%
MARITAL STATUS									
Single	134	118	55	21	10	0	0	**338**	49%
Married	16	28	63	62	59	65	38	**331**	48%
Widowed	0	1	2	4	3	2	3	**15**	2%
Divorced	0	0	0	3	1	1	3	**8**	1%
Total	**150**	**147**	**120**	**90**	**73**	**68**	**44**	**692**	100%
OCCUPATION									
Employed	11	17	42	38	35	31	24	**198**	29%
Self employed	61	61	61	51	38	37	20	**329**	48%
Student	78	69	17	1	0	0	0	**165**	24%
Total	**150**	**147**	**120**	**90**	**73**	**68**	**44**	**692**	100%
COMMONLY USED MODES OF TRANSPORT									
Public transport	122	111	80	65	56	49	35	**518**	75%
Private cars	14	29	30	17	10	16	9	**125**	18%
Motorcycle	12	8	6	8	4	3	0	**41**	6%
Tri-cycle	2	2	4	0	0	0	0	**8**	1%
Total	**150**	**150**	**120**	**90**	**70**	**68**	**44**	**692**	100%

Source: *Survey Data, 2017*

Appendix 5.6: Commuters' Choice of Mode of Transport in Mwanza City

Causes of congestion	Response categories on Likert scale				Total response (N)	Non - response	R.I.I	Rank
	Very often 4	Often 3	Sometimes 2	Never 1				
Private car	52	7	7	59	125	0	**0.604**	**2**
Bodaboda	9	21	41	54	125	0	0.470	3
Bajaj	1	2	13	109	125	0	0.290	6
Taxi	2	7	30	86	125	0	0.350	4
Daladala	53	27	23	22	125	0	**0.722**	**1**
BRT buses	0	1	1	123	125	0	0.256	8
Office transport	3	8	11	102	124	1	0.323	5
Bicycle	0	0	7	118	125	0	0.264	7

Source: *Survey data, 2017*

Appendix 5.7: Road Traffic Congestion Periods in Mwanza City

	Commuters		Traffic Police		Pub. Transp. Driver		Private Car User		Total Respondents	
Traffic Congestion Time	Count	%	Count	%	Count	%	Count	%	Count	%
Mornings (06:00-10:00 am) &Evenings (03:00-08:00 pm)	317	58.4%	38	95.0%	11	68.8%	91	72.8%	**457**	**63.1%**
Afternoons only (12:00-03;00pm)	18	3.3%	2	5.0%		0.0%		0.0%	**20**	**2.8%**
Mornings only (06:00-10:00am)	138	25.4%			5	31.3%	26	20.8%	**164**	**22.7%**
Mornings, Afternoons & Evening (06:3am0-09:00pm)	12	2.2%							**17**	**2.3%**
Mornings & Afternoons 06:00&12:00-03:00pm)	53	9.8%					8	6.4%	**61**	**8.4%**
Afternoons and Evenings(12:00-03:00 & 4:00pm)	3	0.6%							**3**	**0.4%**
Don't Know	2	0.4%							**2**	**0.3%**
No specific time										**0.0%**
TOTAL	**543**	100.0%	**40**	100.0%	**16**	100.0%	**125**	100.0%	**724**	**100.0%**

Source: *Survey data, 2017*

Appendix 5.8: Road Traffic Congestion Hotspots in Mwanza City

Area of Congestion	Frequency	Percentage	Rank
Nyerere Road	159	28.1%	1
Kenyatta Road	142	25.1%	2
Pamba Road	103	18.2%	3
Buzuruga	36	6.4%	4
Mission	31	5.5%	5
Milongo Road	27	4.8%	6
Mabatini	26	4.6%	7
Sahara	26	4.6%	8
Buhongwa Road	15	2.7%	9
Total	**565**	**100.0%**	

Source: *Survey data, 2017*

Appendix 8.1: Road Users' Proposals on Traffic Congestion Interventions in Dar Es Salaam City

S/N.	Measure	Commuters		Car Drivers		Bus Drivers		Bus Owners		MC/TC Drivers		Traffic Police		Total		
		Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Rank
1	**Management**															
1.1	Enhance present traffic police	121	24.3	58	25.7	24	10.7	41	19.2	10	16.1	23	12.8	277	4.4	9
1.2	Traffic rules enforcement	97	19.5	39	17.3	35	15.6	32	15.0	8	12.9	40	22.3	251	4.0	11
1.3	Inspection of Vehicles	58	11.7	20	8.8	17	7.6	27	12.7	11	17.7	32	17.9	165	2.6	19
1.4	Public awareness creation	102	20.5	51	22.6	81	36.0	54	25.4	22	35.5	37	20.7	347	5.5	6
1.5	Timely removal of defective vehicles	31	6.2	36	15.9	46	20.4	21	9.9	2	3.2%	16	8.9	152	2.4	20
1.6	Relocation of Street vendors	88	17.7	22	9.7	22	9.8	38	17.8	9	14.5	31	17.3	210	3.3	16
Sub-Total		**497**	**100**	**226**	**100**	**225**	**100**	**213**	**100**	**62**	**100**	**179**	**100**	**1,402**	**22.4**	
2	**Physical Planning**															
2.1	Relocation of offices from CBD	102	25.6	41	19.6	61	43.6	74	47.1	14	28.0	27	18.6	319	5.1	8
2.2	Enforcement of land use laws	85	21.4	57	27.3	14	10.0	39	24.8	3	6.0	14	9.7	212	3.4	15

S/N.	Measure	Commuters		Car Drivers		Bus Drivers		Bus Owners		MC/TC Drivers		Traffic Police		Total		
		Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Rank
2.3	Relocate ICDs outside city	71	17.8	64	30.6	48	34.3	12	7.6	18	36.0	35	24.1	248	4.0	12
2.4	Construction dry port outside city	97	24.4	29	13.9	17	12.1	25	15.9	13	26.0	28	19.3	209	3.3	18
2.5	Plan future infrastructure	43	10.8	18	8.6	0	0.0	7	4.5	2	4.0	41	28.3	111	1.8	23
Sub-Total		**398**	**100**	**209**	**100**	**140**	**100**	**157**	**100**	**50**	**100**	**145**	**100**	**1,099**	**17.5**	
3	**Supply Side**															
3.1	Functioning traffic lights	112	10.6	84	18.7	67	18.2	48	15.7	17	15.2	38	13.4	366	5.8	5
3.2	Enhancement of road network	304	28.8	105	23.3	98	26.6	51	16.7	33	29.5	44	15.5	635	10.1	1
3.3	Construct BRT roads	189	17.9	71	15.8	72	19.5	64	20.9	12	10.7	42	14.8	450	7.2	2
3.4	Pedestrian walkways	44	4.2	4	0.9	11	3.0	23	7.5	4	3.6	27	9.5	113	1.8	22
3.5	Enhance commuter train services	87	8.3	35	7.8	19	5.1	28	9.2	8	7.1	32	11.3	209	3.3	17
3.6	Introduction of marine services	42	4.0	16	3.6	17	4.6	29	9.5	2	1.8	30	10.6	136	2.2	21

S/N.	Measure	Commuters		Car Drivers		Bus Drivers		Bus Owners		MC/TC Drivers		Traffic Police		Total		
		Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Rank
3.7	Replacement of LOV with HOV	221	21.0	91	20.2	32	8.7	21	6.9	21	18.8	39	13.7	425	6.8	3
3.8	Parking for daladala	55	**5.2**	44	9.8	53	14.4	42	13.7	15	13.4	32	11.3	241	3.8	13
Sub-Total		**1054**	**100**	**450**	**100**	**369**	**100**	**306**	**100**	**112**	**100**	**284**	**100**	**2,575**	**41.1**	
4	**Demand side**															
4.1	Restriction of cars from CBD	132	33.9	13	6.2	54	29.0	93	39.1	12	25.5	23	18.3	327	5.2	7
4.2	Restriction of cargo trucks from city	171	44.0	62	29.7	48	25.8	64	26.9	16	34.0	29	23.0	390	6.2	4
4.3	Restriction of MC & TC to enter CBD	25	6.4	59	28.2	51	27.4	45	18.9	0	0.0	38	30.2	218	3.5	14
4.4	P&R for private cars	61	15.7	75	35.9	33	17.7	36	15.1	19	40.4	36	28.6	260	4.1	10
Sub-Total		**389**	**100**	**209**	**100**	**186**	**100**	**238**	**100**	**47**	**100**	**126**	**100**	**1,195**	**19.1**	
Grand Total		**2,338**	**37.3**	**1,094**	**17.4**	**920**	**14.7**	**914**	**14.6**	**271**	**4.3**	**734**	**11.7**	**6,271**	**100**	

Appendix 8.2: Road Users' Proposals on Traffic Congestion Interventions in Mwanza City

S/N.	Measure	Commuters		Car Drivers		Bus Drivers		Bus Owners		MC/TC Drivers		Traffic Police		Total		
		Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Rank
1	**Management**															
1.1	Enhance present traffic Police	98	19.4	75	28.1	27	14.1	19	22.1	8	15.7	19	19.2	246	6.2	6
1.2	Traffic rules enforcement	107	21.2	34	12.7	21	10.9	13	15.1	5	9.8	21	21.2	201	5.1	8
1.3	Inspection of Vehicles	74	14.7	15	5.6	17	8.9	9	10.5	2	3.9	14	14.1	131	3.3	16
1.4	Public awareness creation	116	23.0	67	25.1	42	21.9	18	20.9	17	33.3	21	21.2	281	7.1	2
1.5	Timely removal of defective vehicles	49	9.7	43	16.1	34	17.7	16	18.6	10	19.6	12	12.1	164	4.2	12
1.6	Relocation of Street vendors	61	12.1	33	12.4	51	26.6	11	12.8	9	17.6	12	12.1	177	4.5	11
Sub-Total		**505**	100.0	**267**	100.0	**192**	100.0	**86**	100.0	**51**	100.0	**99**	100.0	**1,200**	**30.4**	
2	**Physical Planning**															
2.1	Relocation of offices from CBD	115	47.7	54	40.0	42	48.3	15	31.3	13	37.1	18	39.1	257	6.5	4
2.2	Enforcement of land use laws	66	27.4	27	20.0	10	11.5	12	25.0	5	14.3	9	19.6	129	3.3	17
2.3	Relocate ICDs outside city	12	5.0	19	14.1	3	3.4	6	12.5	2	5.7	5	10.9	47	1.2	22

S/N.	Measure Commuters		Car Drivers			Bus Drivers		Bus Owners		MC/TC Drivers		Traffic Police		Total		
		Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Rank
2.4	Construct dry port outside city	8	3.3	4	3.0	0	0.0	1	2.1	4	11.4	0	0.0	17	0.4	23
2.5	Plan future infrastructure	40	16.6	31	23.0	32	36.8	14	29.2	11	31.4	14	30.4	142	3.6	15
Sub-Total		**241**	100.0	**135**	100.0	**87**	100.0	**48**	100.0	**35**	100.0	**46**	100.0	**592**	**15.0**	
3	**Supply Side**															
3.1	Functioning traffic lights	84	15.8	84	18.7	44	20.2	11	14.5	5	6.8	21	17.8	249	6.3	5
3.2	Enhancement of road network	223	41.8	104	23.2	51	23.4	23	30.3	20	27.4	26	22.0	447	11.3	1
3.3	Construct BRT roads	9	1.7	71	15.8	8	3.7	2	2.6	0	0.0	5	4.2	95	2.4	19
3.4	Pedestrian walkways	32	6.0	4	0.9	14	6.4	3	3.9	6	8.2	11	9.3	70	1.8	20
3.5	Enhance commuter train services	2	0.4	35	7.8	9	4.1	0	0.0	2	2.7	2	1.7	50	1.3	21
3.6	Introduce marine services	27	5.1	16	3.6	24	11.0	9	11.8	8	11.0	12	10.2	96	2.4	18
3.7	Replacement of LOV with HOV	114	21.4	91	20.3	27	12.4	9	11.8	13	17.8	24	20.3	278	7.0	3
3.8	Parking for *daladala*	42	7.9	44	9.8	41	18.8	19	25.0	19	26.0	17	14.4	182	4.6	10
Sub-Total		**533**	100.0	**449**	100.0	**218**	100.0	**76**	100.0	**73**	100.0	**118**	100.0	**1,467**	**37.2**	

S/N.	Measure	Commuters		Car Drivers		Bus Drivers		Bus Owners		MC/TC Drivers		Traffic Police		Total		
		Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Rank
4	**Demand side**															
4.1	Restrict private cars from CBD	107	49.5	9	5.3	37	26.4	14	22.2	16	44.4	20	31.7	203	5.1	7
4.2	Restrict cargo trucks from city	41	19.0	55	32.5	26	18.6	12	19.0	7	19.4	10	15.9	151	3.8	13
4.3	Restrict MC & TC to enter CBD	16	7.4	62	36.7	35	25.0	18	28.6	0	0.0	15	23.8	146	3.7	14
4.4	P&R for private cars	52	24.1	43	25.4	42	30.0	19	30.2	13	36.1	18	28.6	187	4.7	9
Sub-Total		**216**	100.0	**169**	100.0	**140**	100.0	**63**	100.0	**36**	100.0	**63**	100.0	**687**	**17.4**	
Grand Total		**1,495**	**37.9**	**1020**	**25.8**	**637**	**16.1**	**273**	**6.9**	**195**	**4.9**	**326**	**8.3**	**3,946**	100.0	

Source: *Field Survey, 2017*

Appendix 9.1: Private Buses Management Model of Kenya Bus Management Services Ltd.

Kenya Bus Service Management Ltd (KBSM) is a transport management company in Kenya that was established in 2006 from the ashes of the former Kenya Bus Services Ltd. The company offers public transport services through a bus franchising and commercialization model though it doesn't own buses. The company operates within Nairobi CBD and its environs. Using the model, it effectively and efficiently manages public transport services in a para transit dominated city which offers no subsidy. This Model offers the better solution to the otherwise chaotic transport systems in African cities. With over 250 buses (whose asset value is close to Kshs.1 billion) owned by over 150 investors, the company offers commuter, staff transport, private hires and transit advertising. KBSML is the most visible and well organized bus company in Nairobi. Monthly, it carries 2.4 million passengers, operates 0.7million kilometers and provides employment to 1,050 people. Going forward, the company will leverage on technology, especially in regard to Automatic Fare Collection (AFC) so as to gain a competitive edge.

KBSML franchises buses are from companies, institutions, cooperatives, schools and individual investors. The franchise brings the para- transit (*Matatu*) operators together to form a homogeneous group namely KBSM.

New franchisee applicants are required to pay the following fees:

- Franchise Joining Fees – Kshs 60,000 for first 5 buses.
- Administration Fee - Kshs. 3,000 per bus payable after the initial 5 Buses.
- Bus Branding Fees – Branding can only be done by KBSM or with its written authority.
- Crew Training Fee – Only crew trained by KBSM are allowed to work on the buses.
- TLB License Fee – This license fee must be applied through KBSM.
- Radio License – Vehicles fitted with radio or any music playing instrument must obtain a license from KBSM.
- City Council – Monthly Parking Fee must be paid on time.

Continuous Fee - Commission payable is 12% of Gross Revenue which covers:-

- Royalty
- Standards Supervision
- Value Adding Services
- Technical & Advisory Services

Optional payable Fee

- Legal Services
- Bus Wash
- Parking/Security & Safari Checks
- Banking Services
- Training - Platform staff (crews) and Franchisees
- Central works services

Source: *kenyabus.net/profile.html*

Appendix 9.2: Steering Clear of Congestion: Rapid Transit and Routes for Human-Powered Transportation

In the early 1990's, Bogotá Mayor Antanas Mockus initiated a Citizen Culture campaign with the intention of changing public behavior towards community and civility. Using unorthodox techniques such as mimes, Mockus was able to alter how residents viewed the relationship between motor vehicles and pedestrians, thereby laying the foundation for investment in a pioneering public transport system. The subsequent administration, led by Mayor Enrique Peñalosa, responded to the transit crisis with a Mobility Strategy that prioritized public transit and non-motorized transport modes, reduced private vehicle use, and induced a behavioral shift towards the use of alternative transport options.

To reduce the use of private vehicles, Bogotá created a roadway restriction based on license plate numbers. Vehicles with license plates ending in odd numbers are prohibited from using roadways on odd-numbered days, and those with plates ending in even numbers are prohibited from using roadways on even-numbered days. The restriction is in effect during morning and evening weekday commuting hours.

The keystone of Bogotá's Mobility Strategy is the **TransMilenio Bus Rapid Transit system**. The TransMilenio operates 87 km of trunk corridors that receive passengers from an integrated feeder system. The system increased efficiency through pre-boarding automated fare collection, free transfers, raised platforms for quick boarding and exiting, high occupancy vehicles (160 to 260 passengers), segregated bus lanes, and express routes. A single fare cross-subsidizes the poor, who often live on the city periphery. All buses comply with Euro II emission standards and are equipped with GPS that allows a centralized management system to respond in real-time to contingencies and re-route buses to meet demand. Pedestrian and bike pathways are integrated into the system, with free bike parking available at many terminals.

Source: *Center for Clean Air Policy (2013)*

Appendix 9.3: Potential Costs and Benefits for Proposed Traffic Decongestion Measures

STRATEGY/ACTION STEPS	POTENTIAL COST	POTENTIAL BENEFITS
A. Traffic Management & Control		
Strengthening of institutional arrangement by developing laws, polices, common forum and capacity building among actors.	Investment (Capacity building – HR, technology and equipment)	Enhanced inter-institutional coordination of planning management and regulation of traffic.
Creation of public awareness on road use	Investment (education)	Saving operational cost Safety benefits (reduced accidents) Saving travel time Saving travel cost
Substitute traffic police on roads with automatized vehicular volumes responsive traffic lights.	Equipment and recruitment of police officers	Reduced travel time Reduced road accidents Enhance economic developments (less time spent in travel)
Enforcement of traffic laws and regulations	Equipment and recruitment of police officers	Reduced accidents Reduced travel time Saving travel cost Reduced negative social externalities.
Timely response to incidents	Technological investment Operational (experts) Maintenance (existing and new technology)	Reduced death and injury Enhance economic developments
Relocation of street vendors from roads	Suitable land acquisition Capital investment in facilities Operational (ensuring they use the relocation site) Maintenance (services/utilities)	Reduced travel time Reduced travel costs Reduced accidents Reduced conflicts among road users. Reduced negative social externalities. Economic enhancement
Dissemination of real-time traffic information	Investment (technology and experts) Operational (instruments and salaries) Maintenance (instruments)	Reduce accidents Easy way to enhance adaptation of laws among road users Boost economic development due to reduced travel time Saving operational costs

STRATEGY/ACTION STEPS	**POTENTIAL COST**	**POTENTIAL BENEFITS**
Establishment of intelligent transportation system (ITS)	Investment (legislation for the centre, HR, hi-tech communication & surveillance equipment linking centre with road network). Operational and maintenance costs.	Efficiency in vehicular mobility and up-to-date traffic flow information to motorists and enforcement agents. Reduced negative social externalities.
Enforcement of Traffic and Road Safety Laws and Regulations	Investment (HR capacity and modern equipment).	Compliance with laws for safe use of roads and orderly flow traffic. Reduced traffic congestion. Reduced negative social externalities.
B. Physical Planning		
Develop Master Plans that promote greater accessibility to socio-economic amenities including, among others, densification, compact high-rise neighbourhoods, transit-oriented development (TOD) model and right land-use functional mixes.	Capital investment (HR, technology and equipment). Operational (land use laws enforcement)	Ease accessibility to amenities and reduced travel trips. Reduced negative social and environmental externalities.
Coordination of efforts to implement DSM's transport master plan, 2030; DMDP; and Master plan 2035.	Investment (implementation of the plan) Operational maintenance	Enhanced inter-institutional efforts coordination Reduced congestion and enhanced economic development Enhanced sustainable infrastructure development Reduced travel time Increased road safety Reduced pollution Reduced vehicular operating costs
Implement satellite town projects in Dar es Salaamand Mwanza to mitigate effects of monocentric structure of the city.	Investment Operational (services and utilities) Maintenance (infrastructure)	Decongestion of cities hence achieve sustainable development Emissions reduction Reduction of noise pollution. Reduced negative social externalities.
Enforcement of urban planning laws and controls to protect infrastructure spaces; prevention of unplanned	Investment (acquisition/compensation, design, approval and survey costs) Operational (development control)	Sustainable development of cities that mitigates traffic congestion. Reduced negative social externalities.

settlement and sprawl; regulation of land market; adequate parking.		
STRATEGY/ACTION STEPS	**POTENTIAL COST**	**POTENTIAL BENEFITS**
Physical Planning		
Redevelopment of unplanned settlements and areas ripe for redevelopment that are close to CBD.	Investment (acquisition/compensation, design, approval and survey costs) Operational (development control)	Decongestion of cities hence achieve sustainable development
Relocation of ICDs outside cities	Investment (acquisition/compensation, design, approval and survey costs) Operational (salaries, services, technology) Maintenance (services)	Decongestion of cities hence achieve sustainable development Reduced negative social externalities.
C. Supply side		
Improvement of cities' road network connectivity including trunk, ring roads, feeder and other roads; storm water drainage; road intersections; extension of bus bays; segregated lanes; and redirection of flyover funds to improved connectivity.	Investment (construction, compensation and design) Maintenance (drainage and roads)	Improved road connectivity and the consequential decongestion of cities and sustainable development. Reduced negative social externalities.
Segregation of lanes on existing roads to give public transport passage priority.	Investment (Creation of bus lanes on existing roads by painting different color from the others). Operating costs (Regular painting and maintenance)	Improve traffic flows and reduce congestion, air pollution and negative social externalities.
Rehabilitation of TAZARA and TRL railway systems to haul cargo to upcountry and landlocked neighbouring countries.	Investment (railway infrastructure rehabilitation, locomotives, rolling stock and wagon ferries). Operating costs.	Reduced number of heavy cargo trucks plying on the cities roads, traffic congestion and air pollution.
Pipeline transportation of petroleum products to upcountry and landlocked neighbouring countries.	Investment (construction of pipeline system from Dar port to Kigoma and Mwanza). Operating costs.	Reduced the number of heavy cargo trucks plying on the cities roads, traffic congestion and air pollution.

STRATEGY/ACTION STEPS	POTENTIAL COST	POTENTIAL BENEFITS
D. Demand Side		
Formalization of present daladala services through formation of franchise companies or cooperatives.	Investment (HR, management skills, communication equipment, and office infrastructure). Operating cost for the company or cooperative.	Improved public transport services that are attractive to private car users. Reduced private care usage and air pollution. Reduced negative social externalities.
Replacement of low-occupancy buses with high-occupancy buses by proving investment incentives and loans as stimulus and delegation of daladala to feeder roads.	Investment (buying buses) Operational (drivers and services)	Reduced cost of travel attributed to private car usage. Improved air quality. Replacement of expensive decongestion projects such as BRT. May not need new road infrastructures to operate.
Operate high occupancy public buses e.g. articulated buses on unsegregated lanes.	Investment (upgrading existing roads and buying buses). Operational (drivers and services)	Improve public transport services. Reduced congestion. Reduced air prolusion. Reduced social externalities.
Implementation of BRT system for mass passenger transit.	Investment (construction, compensation). Operation (salaries and Maintenance).	Reduced travel time, social externalities, congestion and pollution.
Improvement of TAZARA and TRL city passenger services.	Investment (construction of platforms at boarding and disembarking points; acquisition ofdiesel multiple units (DMU).	Increased train services efficiency and decreased private car usage; decreased congestion; social externalities and decreased air pollution.
Introduction of mass rapid train (MRT).	Investment (Construction of the railway system and procurement of rolling stock). Operations and management the system and maintenance).	Decreased private car usage; decreased congestion; and decreased air pollution.
Provision of parking spaces close to arterial roads for feeder minibuses *(daladala).*	Investment (acquisition/compensation and construction).	Safety benefits Reduced travel time

STRATEGY/ACTION STEPS	POTENTIAL COST	POTENTIAL BENEFITS
Demand Side		
Reduction of use of single occupancy vehicles by making car-pooling mandatory; provision of P& R facilities; and reintroduction of employers' transport services.	Investment (public awareness campaigns and education; and enforcement for cars entering CBDs, land acquisition for P&R facilities) Operations (costs for keeping campaigns running, security and facilities maintenance)	Increased private car occupancy and reduced usage. Reduced congestion and air prolusion. Reduced cost of travel and social externalities.
Restrict private car from entering CBD by charging tolls, higher packing fees and regulatory mechanisms.	Investment (installation of electronic gantry toll machines. Operational cost related to enforcement	Reduced private car use and consequential reduction in traffic congestion and noxious gas emissions.
Introduction of marine passenger transport services as alternative public transport.	Investment Operational Maintenance	Reduced travel cost Reduced travel time Reduced number of cars on roads hence reduced emission and noise pollution.
Reduction of use of single occupancy vehicles by making car-pooling mandatory and provision of P&R facilities	Investment (acquisition of land and construction of parking space outside the city centre) Operational costs (security) Maintenance (services)	Reduce emission Reduced noise pollution Safety benefits Reduced cost of travel Enhanced health lifestyle
Introduction of special UDA-RT and daladala coaches as an interim measure	Investment Operational Maintenance	Reduced use of private cars Reduced air pollution
E. City Specific Interventions		
Dar es Salaam City		
Provision of public transport services on secondary roads with high demand.	Operational costs for reorganization of public transport routes	Improved public transport services and alleviation of traffic congestion on trunk roads.
Rerouting public transport on overcrowded Mandela Expressway	Operational costs for reorganization of public transport routes	Improved traffic flow on Mandela Expressed Reduced traffic congestion and social externalities.
Construction of a multi-story parking space at AZAM jetty	Investment (Construction and equipment) Operational Maintenance (services and utilities)	Significantly reduced traffic congestion along Sokoine Drive. Clear conflicts among road uses at AZAM jetty

STRATEGY/ACTION STEPS	POTENTIAL COST	POTENTIAL BENEFITS
City Specific Interventions		
Dar es Salaam City		
Provision of adequate parking space at Rangi Tatu, Mbagala bus turning points	Investment (construction) Maintenance	Reduced traffic congestion and travel time. Safety benefits
Increase efficiency in coordinating VIP entourages	Operational	Reduced travel time Reduced travel cost
Enforcement of prescribed vehicle speeds	Operational	Increased traffic flow. Reduced congestion
Construction of the underway Kwala ICD	Investment (construction and cargo handling equipment) Operational costs	Reduce number of heavy cargo trucks from and to Dar es Salaam Port. Reduce traffic congestion along Mandela Expressway and Morogoro Road.
Mwanza City		
Planning and development of roads as per geophysical features	Investment (Road planning & construction and compensation) Road maintenance costs)	Ease traffic congestion on arterial roads.
Rectification the central roundabout (Kemondo) in Mwanza	Investment Maintenance	Reduced traffic congestion and travel time Safety benefits
Relocation of industries, godowns and petrol depots within CBD in Mwanza	Investment (relocation and construction) Operational (running costs) Maintenance (services)	Decongestion option for Mwanza city hence leading to sustainable development Reduced emission at the city centre. Reduced social externalities.
Restriction of motor cycle taxis from entering the CBD	Enforcement costs	Reduce traffic congestion in the CBD and accidents.
Introduction of the public transport route on Pasiansi – Usagara via Nyasaka	Operational expenses	Reduce traffic congestion on Airport, Nyerere and Kenyatta roads
Green Travel for Environmental Sustainability		
Promotion of walking and cycling culture.	Investment (compensation and construction walkways and cycling lanes). Operational costs on public awareness and education.	Reduced use of private cars. Reduced traffic congestion and noxious gas emissions. Improved healthy lifestyle. Reduced cost of travel

STRATEGY/ACTION STEPS	**POTENTIAL COST**	**POTENTIAL BENEFITS**
Green Travel for Environmental Sustainability		
Promote use of public transport	Operational costs on public awareness and enforcement	Reduced traffic congestion and noxious gas emissions. Improved respiratory health
Transfer the cost of pollution to car users.	Operational costs on public awareness and enforcement	Reduced traffic congestion and noxious gas emissions Improved respiratory health
Technological interventions: adoption of emission standards and regulations; motor vehicle inspection and maintenance; low capacity engines; and mandatory emission limits.	Operational costs on public awareness and enforcement	Reduced traffic congestion and noxious gas emissions. Improved respiratory health.
Mandatory age limits for in-use and imported motor vehicles	Operational (public awareness and enforcement of laws)	Reduced noxious gas emissions. Reduced noise pollution Improved respiratory health
Use of alternative vehicle fuel e.g. CNG and unleaded petrol.	Operational costs on public awareness and enforcement	Reduced traffic noxious gas emissions. Improved respiratory health
Fiscal targeting of polluting groups i.e. fuel consumers; and motor vehicle users, operators and purchasers.	Operational costs on public awareness and enforcement	Reduced traffic noxious gas emissions. Improved respiratory health and quality of life.
Creation on public awareness on road safety, driving behaviours, advantages of public transport and environmental sustainability.		Reduced use of private car travel demand. Increased compliance with traffic rules. Increased road safety. Increased use of public transport services. Reduced congestion and emission levels.
Traffic management and enforcement of institutional capacity building in terms of HR skills, technology and equipment		Increased efficiency in traffic management and compliance

Appendix 9.4: Action Plans to Implement the Proposed Measures

STRATEGY/ACTION STEPS	POLICY/LEGAL IMPLICATION	RESPONSIBLE INSTITUTIONS	TIMELINE	PRIORITY LEVEL	POTENTIAL CHALLENGES
A. Traffic Management					
Strengthening of institutional arrangement by developing laws, polices, common forum and institutional capacity among actors.	Amend SUMATRA Act No. 9 of 2001 to include formation of a forum that will be responsible for coordinating various urban infrastructure and transportation activities in order to eliminate overlapping and conflicting policies, roles and mandates for effective coordination.	City & Municipal Councils, MWCT, PO-RALG, SUMATRA, TPD, TANROADS, DART, VPO, NEMC, MTIM,TBS	1-10 years	High Priority	Competing mandates and priorities among principal institutional actors.
Substituting traffic police on roads with automatized vehicular volumes responsive traffic lights.	Under the objectives of NRSP, 2009 continue to modernize traffic light and signal system towards elimination of manual regulation of traffic flows.	MWCT, TANROADS and TPD	1-2 years	High Priority	Scarcity of resources
Timely response to incidents	Capacity building for Police Force, Road Safety Board (RSB), Fire and Rescue Services (FRS) and private operators of breakdowns to timely respond to incidences.	MHA, TPD, RSB & FRS	1-2 years	High Priority	Scarcity of resources to acquire adequate equipment.
Relocation of street vendors from roads	As per Section 6.5 of NRSP, 2009, Municipal Councils provide alternative spaces for street vendors and collaborate with Police and road authorities for rigorous enforcement.	Municipal & City Councils, PO-RALG, TPF and TANROADS	1-5 years	Normal Priority	Opposition of relocation by street vendors. Lack of political will.

Dissemination of real-time traffic information	In line with the NRSP, 2009, RSB in collaboration with TCRA and commutation services providers, establish an effective notification and communication system linking law enforcers, general public and motorists	MHA, RSB, TPF, MWCT & TCRA	1-2 years	High Priority	Change of culture
Establishment of intelligent transportation system (ITS)	Through the NTP, 2003 assess the feasibility and viability of establishing and implementing ITS.	TPF , MHA, TANROADS& MWTC	1-5 years	Normal Priority	Contentious viability due to lack of financial resources for investment, basic infrastructure and institutional capacity.
Enforcement of Traffic and Road Safety Laws and Regulations.	Collaboration among traffic law enforcers, transport regulators and road authorities to enforce laws and regulations and to implement the NTP, 2003 and NRSP, 2009.	MHA, TPF, MITM, SUMATRA, MWCT, TANROADS	1-2 years	High Priority	Lack ofcommon forum.
B. Physical Planning					
Develop Master Plans that promote greater accessibility to socio-economic amenities including, among others, densification, compact high-rise neighbourhoods, transit-oriented development (TOD) model and right land-use functional mixes.	Strict enforcement of land-use law and regulations to achieve comprehensive planning and mitigate growth of peripheral urban sprawl, unplanned settlements and travel demand. Pursue PPP policy for land development.	PO-RALG, MLHHSD, Municipal & City Councils,	1-3 years	High Priority	Conflict between the existing project-based piecemeal planning as against compressive planning. Laxity in enforcing planning regulations and controls.
Coordinate efforts to implement DSM's transport master plan, 2030; DMDP; and Master plan 2035.	Establishment of a coordination policy framework with an objective of developing sustainable urban transport.	PO-RALG, MLHHSD, MWCT, DSM's Municipal & City Councils, development partners.	1-2 years	High Priority	Lack of interest to form a common implementation of the plans.

Implement satellite town projects in Dar es Salaam and Mwanza cities to mitigate effects of monocentric structure of the city.	Under The Urban Planning Act No. 8, 2007 empower City and Municipal Councils and other principal actors, to collaborate in planning and developing satellite towns.	City and Municipal Councils, MLHHS, NHC and other developers (NSSF, PPF, PSPF)	1-10 years	Normal Priority	Funding constraints
Enforcement of urban planning law and controls to protect infrastructure spaces; prevention of unplanned settlement and sprawl; regulation of land market; adequate parking.	Under The Urban Planning Act No. 8, 2007 empower City and Municipal Councils empower the Municipal and City Councils & MLHHSD to enforce urban planning law, regulations and controls.	MHHSD, PO-RALG & City and Municipal Councils	1-3 years	High Priority	Land sellers and buyers being ahead of law enforcement.
Redevelop unplanned settlements and areas ripe for redevelopment that are close to CBD.	Under the existing Urban Planning Act No. 8, 2007, enable Municipal Councils to develop lands that are ripe for redevelopment	MHHSD, PO-RALG & City and Municipal Councils	2-10 years	Low Priority	Funding constraints. Resistance from property owners and tenants.
Relocation of ICDs outside cities	National Land Policy, 1995 andUrban Planning Act No. 8, 2007 relocate ICDs in the direction of cargo destinations outside cities.	Municipal Councils & MHHSD	1-3 years	High Priority	Acquisition of land
C. Supply side					
Improvement of cities' road network connectivity including construction and regular maintenance of trunk, ring roads, feeder and other roads; storm water drainage; road intersections; extension of bus bays; and redirection of flyover funds to improved connectivity.	Invest in road upgrading to improve connectivity through road maintenance, expansion and construction of new ones in unplanned settlements as a lower cost intervention in lieu of expensive planned flyovers.	TANROADS, City & Municipal Councils, MWTC and development partners/donors.	1-10 years	High Priority	High costs and induced travel demand and consequential increased use of private cars.

Segregation of lanes on existing roads to give public transport passage priority.	Within the context of NTP, 2003 and NRSP, 2009, create special public bus lanes on existing roads by painting in different colour to allow for fast passage as a low-cost intervention aimed at improving the quality of public transport services.	TANROADS, City & Municipal Councils and MWTC.	1-3 years	High Priority	Low level of respect for traffic rules and conflict with turning vehicles.
Rehabilitation of TAZARA and TRL railway systems to haul cargo to upcountry and landlocked neighbouring countries.	Rehabilitate and recapitalize the two railways as emphasized in the NTP, 2003 to enable them transport cargo to their capacities.	MWTC, TAZARA & TRL/RAHCO.	1-5 years	High Priority	Lukewarm political support as the rehabilitation of the railway systems and especially TRL, are competing with the SGR system.
Pipeline transportation of petroleum products to upcountry and landlocked neighbouring countries.	As per Section 2.5 of NTR, 2003 implement the proposed pipeline to Mwanza (and Kigoma) under PPP policy.	Ministry of Energy	5-15 years		High capital costs and resistance from tanker operators.
D. Demand Side					
Formalization of present daladala services through formation of franchise companies or cooperatives	Under the SUMATRA Act, make it mandatory for private public transport operators to form a management franchise in order to instill efficiency and liability in the services.	SUMATRA, Ministry of Communication, Municipal Councils	2-5 years	Normal Priority	Resistance from individual public transport owners and change of life style.
Replacement of low-occupancy buses with high-occupancy buses by proving investment incentives and loans as stimulus and delegation of daladala to feeder roads.	Amendment of TIC Act, 1997 to include investment incentives for public transport operations.	MOF, TIC, SUMATRA & MWCT	1-2 years	High Priority	Resistance from individual public transport operators.

Operate high occupancy public buses e.g. articulated buses on unsegregated lanes.	Invest in trunk and secondary road upgrading to enable wider operations of high occupancy buses.	Municipal Councils, PO-RALG, SUMATRA, TANROADS & MWCT	2-5 years	High Priority	Inevitability of fund to invest in road upgrading. Competing priority with expensive infrastructure e.g. flyovers and BRT system.
Implementation of BRT system for mass passenger transit.	In the context of the DART Law and NTP, 2003, continue to invest in BRT system as a long term intervention for road traffic congestion.	DART, PO-RALG, TANROADS & MWCT	1-10 years	High Priority	Rushed implementation; tight financial planning system, excessive occupancy; early deterioration of infrastructure; and setting fares that may stifle either ridership or operations.
Enhancement efficiency of TAZARA and TRL commuter train services.	As per NTP, 2003, the Government promote railway transport in urban areas for movement of mass passengers by involving the private sector under the PPP policy	MWCT, TAZARA and TRL	2-5 years	Normal Priority	Funding constraints. Lack of political will.
Introduction of metro rail transit (MRT) or light rail transit (LRT).	As per NTP, 2003, promoteMRT/LRT system for mass passengers transportation through PPP policy and development partners.	RAHCO, TRL and MWCT	10-20 years	Low priority	High capital costs, unreliablepower, high operating costs, likely operational subsidies and long-term economic payback period.
Provision of parking spaces close to arterial roads for feeder minibuses *(daladala).*	Identification and development of land in to daladala parking spaces.	Municipal Councils, TANROADS, PO-RALG, MWCT and MLHHSD	2-5 years	Normal Priority	Acquisition of suitable land and high costs.

Introduction of marine passenger transport services as alternative public transport.	Section 5.13 of the NTP, 2003, emphasizes the promotion of waterway transport in Dar es Salaam and Mwanza cities as cheaper alternative for mass passenger transit through PPP policy.	MWTC, Municipal Councils, TPA, MSCL, private investors under PPP (AZAM, Kamanga Ferry)	5-10 years	Low Priority	Attracting private investors and high cost of supportive infrastructure.
Restriction of private car from entering CBD by charging tolls, higher packing fees and regulatory mechanism.	Enact by-laws and regulations and formulate policies that discourage private cars uses and particularly entering CBDs.	PO-RALG, Municipal Councils	5-8 years	Normal Priority	Public resistance and inelasticity of travel demand by private cars in the absence of reliable public transport.
Reduction of use of single occupancy vehicles by making car-pooling mandatory; provision of P&R facilities; and reintroduction of employers' transport services.	Municipal Councils' by-laws should be amended to make car-pooling compulsory. This intervention should be complemented by provision of P&R facilities through PPP and employers' transport services.	MWTC, TANROADS, DART, PO-RALG, Municipal Councils	2-5 years	Normal Priority	High cost for acquisition of land in appropriate locations; mistrust in concept of cooperation; and employers' reluctance respectively.
Introduction of special UDA-RT and daladala coaches as an interim measure	Revisit both DART & SUMATRA laws to allow for the introduction of high fare special coaches.	DART, SUMATRA & MWCT	1-2 years	High Priority	DART reluctance
E. City Specific Interventions					
Dar es Salaam City					
Provision of public transport services on secondary roads with high demand.	Feasibility assessment of public transport routes on secondary roads in order to provide new ones.	SUMATRA & MWCT	1-2 years	High priority	Resistance by public transport operators to relocate to new routes.

Rerouting public transport on overcrowded Mandela Expressway	Feasibility assessment of rerouting public transport services operating on Mandela Expressway	SUMATRA & MWCT	1-2 years	High priority	Rearrangement of routes to lessen inconvenience to commuters.
Construction of a multi-story parking space at AZAM jetty	In the context of Urban Planning Act, 2007 and TPA mandate, implement the multi-storey car park at AZAM jetty.	TPA, MWCT, Ilala MC, MLHHSD & SUMATRA	2-5 years	Normal Priority	Investment terms
Provision of adequate parking space at Rangi Tatu, Mbagala bus turning points	Acquisition of land, expansion of roads and creating parking spaces for daladala at Rangi Tatu, Mbagala to relieve roads form traffic congestion.	TANROADS Temeke MC, MWCT	2-5 years	Normal Priority	Land acquisition for road is likely to be expensive.
Increase efficiency in coordinating VIP entourages	Improve coordination and communication among Police officers regulating the VIP entourage vehicles	TPD & MHA	1-2 years	High Priority	Change of mindset by Traffic Police and Government Officials.
Enforcement of prescribed vehicle speeds	Device penalties for motorists not complying to speed guidelines.	TPD & MHA	1-2 years	High Priority	Change of mindset by motorists.
Construction of the underway Kwala ICD	The underway ICD is being executed through SUMATRA (Dry Port) Regulations, 2016.	SUMATRA & MWCT	1-5 years	Normal Priority	Doubtful long term viability when either TAZARA and TRL systems are rehabilitated or SGR is completed.
Mwanza City					

Planning and development of roads as per geophysical features	Implement the underway Master Plan in proving roads in highly, rocky and unplanned settlements.	TANROADS, MWCT, PO-RALG, Nyamagana and Ilemela MCs, PO-RALG & MLHHSD	3-15 years	Normal Priority	Hostile terrain that makes infrastructure development expensive; resistance by property owners to give way; and costly land and property compensation
Rectification of central roundabout (Kemondo) in the city centre.	The roundabout to be rectified in the broader context of Mwanza Master Plan, 2035.	TANROADS, MWCT, PO-RALG, MCC, Nyamagana MC & MLHHSD	2-5 years	Normal Priority	Inconvenience to travelers during construction
Relocation of industries, godowns and petrol depots within CBD in Mwanza	Compliance with zoning regulations provided in the Urban Planning Act, 2007 and guidelines of the Mwanza Master Plan, 2035.	Nyamagana MC, MCC, PO-RALG & MHHSD	5-10 years	Low Priority	Resistance by property owners and factory operators.
Restriction of motor cycles from entering the CBD.	Through Municipal Council's by-laws and SUMATRA's Act, enforce the condition of motor cycles not to enter the CBD.	SUMATRA, PO-RALG, Municipal Councils	2-5 years	Normal Priority	Opposition by motor cycle operators. Politicization of the order.
Introduction of the public transport route on Pasiansi – Usagara via Nyasaka	If the route under reference is viable, introduce public transport services.	SUMATRA, PO-RALG, Municipal Councils	1 year	Normal Priority	Opposition by public transport operators if the route is non-viable.
F. Environmental sustainability					
Promotion of walking and cycling culture.	Enforcement of urban planning and transport laws and policies for provision of segregated walking and cycling infrastructure.	TANROADS, MWCT, PO-RALG, City and Municipal Councils	2-15 years	High Priority	Political constituency and planners who may deem walking and cycling not representing modernity.

Promote use of public transport	Under SUMATRA Act, No 9 of 2001, DART Agency Law, 2007, improve reliability and popularize advantages of public transport through public awareness.	SUMATRA, DART, City and Municipal Councils.	1-4 years	High Priority	Mistrust of the reliability of public transport by private vehicle uses especially those in upper-middle and upper income brackets.
Transfer the cost of pollution to car users.	Empower NEMC to enforce vehicular emission standardsas provided in the Environmental ManagementRegulations, 2004.Institute congestion pricing mechanism and fuel taxing policies in order to contain vehicle gas emissions.	NEMC, TBS, VPO & MTIM	1-2 years	High Priority	Both Induced travel demand by private vehicles and inelasticity of demand for private vehicle if roads are improved and public transport service remain unreliable.
Technological interventions: adoption of emission standards and regulations; motor vehicle inspection and maintenance; low capacity engines; and mandatory emission limits.	Under the existing Traffic Management Regulations and the Environmental Management Regulations, 2004 enforce vehicle inspection and maintenance, lower engine capacity vehicles and emission limits.	NEMC, VPO, TPF&MHA	1-5 years	High Priority	Car overdependence; rapid increase in car ownership and travel demand; car conversion out of reach of majority; and need for long term subsidies.
Mandatory age limits of in-use and imported motor vehicles	Amend either the Standards Act, 2009 or the Anti-dumping and Countervailing Measures Act, 2004 to include age limits for imported and in-use vehicles. Introduce a policy that will accelerate the retirement from roads excessively polluting vehicles.	TBS, NEMC, MTIM & VPO	5-8 years	Low Priority	Public resistance

Use of alternative vehicle fuel e.g. CNG and unleaded petrol.	Enforcement of Environmental Management Regulations, 2004	NEMC & VPO	5-8 years	Low Priority	Wider use of alternative fuels will be limited by non-availability of fuel supply, refueling stations, and appropriate vehicles.
Fiscal targeting of polluting groups i.e. fuel consumers; and motor vehicle users, operators and purchasers.	Institution of congestion pricing and fuel taxing policies to compel vehicle users and buyers to use environmentally safe fuels.	MWCT,MOF and TRA	5-8 years	Normal Priority	Short term welfare loss to low income groups; long-term switch to fuel efficient smaller vehicles and increased congestion; public and political constituency opposition.
Creation on public awareness on road safety, driving behaviours, advantages of public transport and environmental sustainability.	Undertake public awareness campaigns, education and training to change driving behaviours and to promote sustainable passenger transportation services.	SUMATRA, MWCT, MHA and TPF	1-3 years	High Priority	Socio-cultural factors e.g. hedonism, status and freedom seeking behaviours that promote private car ownership.
Empowering of NEMC	Recapitalize NEMC by providing adequate funds, equipment to measure vehicular emission levels and skilled technical HR	NEMC & VPO	1-3 years	High Priority	Government budgetary constraint
Cross-cutting issues:					
Traffic management and enforcement of institutional capacity building in terms of HR skills, technology and equipment	Mobilization to respond to inadequacies of HR skills, technology and equipment so as to respond to respective regulatory, control and management roles	SUMATRA, TPF, NEMC, TBS, City of Municipal Councils, MWCT, MHA, MITM, & VPO.	1-3 years	High Priority	Government budgetary constraint

REFERENCES

AAT 2014. Why the Traffic Jams in Dar are Here to Stay. *Feature Story Published by Automobile Association of Tanzania in The Citizen News of 14th February.*

AfDB Group 2015: Dar es Salaam Bus Rapid Transit Project, Tanzania: Environmental And Social Impact Assessment Summary.

Amani, C. 2010. Mwanza Municipal Challenges and Opportunities. Mwanza: Mwanza City Council.

Bank of Tanzania 2016. Tanzania Housing Market: Housing Market Analysis. World Bank sponsored study prepared by CPCS in collaboration with GIMCO Africa.

Barengo, N. C., Mkamba, M., Mshana, S. M. & Miettola, J. 2006. Road Traffic Accidents in Dar es Salaam, Tanzania During 1999 and 2001. *International Journal of Injury Control and Safety Promotion,* Vol. 13**,** 52-54.

Carter, N., Bryant-Lukosius, D., Dicenso, A., Blythe, J. & Neville, A. J. 2014. The use of triangulation in qualitative research. *Oncol Nurs Forum,* 41**,** 545-7.

Chao, Y. C., Zhao, Y., Kupper, L. L. & Nylander-French, L. A. 2008. Quantifying the relative importance of predictors in multiple linear regression analyses for public health studies. *J Occup Environ Hyg,* 5**,** 519-29.

CL Knet 2012. Urbanization in Tanzania: The Challenge of Planning, Access to and Use of Land. Audience Forum Report No 7, Tanzania Country Level Knowledge Network - Seminar Held at TGDLC, Ground Floor, IFM Building, Dar es Salaam on 21st March.

Dias Olvera L., Plat D,, & Pochet P. 2008: Household Transport Expenditure in Sub-Sahara African Cities: Measurement and Analysis. Journal of Transport Geography Vol. 16, No. 1, pp 1-16.

ESRF (2015) Better Urban Growth In Tanzania: A Preliminary Exploration of the Opportunities and Challenges.*Working Paper for Coalition Urban Transitions, A New Climate EconomySpecial Initiative.*

Grant-Muller S. & James Laird, J. 2006. *International Literature Review of the Costs of Road Traffic Congestion, Scottish Executive, JICA (2008)* [Online]. Available: www.scotland.gov.uk/Publications/2006/11/01103351/0.

Harpham, T., Burton, S. & Blue, I. 2001. Healthy city projects in developing countries: the first evaluation. *Health Promotion International,* 16**,** 111-125.

Haule, C.A. 2015: Air pollution: Need for Annual Inspection of Automobiles. *Tanzania Bureau of Standards (TBS)*

JICA 2008. Dar es Salaam Policy and System Development Master Plan: Traffic Control and Management. *Technical Report 2.* Dar es Salaam.

Kamukala, G. 2011: The City of Dar es Salaam Striving to Resolve Environmental Problems. *Gofrey Kamukala's Blog.*

Kanyama, A., Carlsson-Kanyama, A., Lindén, A. & Lupala, J. 2004. Public transport in Dar es Salaam, Tanzania - Institutional Challenges and Opportunities for a Sustainable Transportation System. *Royal Institute of Technology Stockholm, Sweden*.

Katala, J. N. 2012. *The Cost of Traffic Congestion and Accidents to the Economy in Tanzania* [Online]. DART Agency. Available: https://www.iekenya.org/forms/papers/Jumbe%20N.Katala%20[The%20cost%20of%20traffic%20congestion.....]DART.pdf [Accessed 25th May 2017].

Kiunsi, R. 2013. A Review of Traffic Congestion in Dar es Salaam City from the Physical Planning Perspective *Journal of Sustainable Development; ,* 6.

Mfinanga, D. A. & Fungo, E. 2013. Impact of Incidents on Traffic Congestion in Dar es Salaam City. *International Journal of Transportation Science and Technology,* Vol. 2 pp 95 - 107.

Mkalawa, C. C. & Haixiao, P. 2014. Dar es Salaam city temporal growth and its influence on transportation' Urban, Planning and Transport Research. *An Open Access Journal,* Vol. 2**,** 423-446.

Msigwa, R. E. 2013. Challenges Facing Urban Transportation in Tanzania. *Journal of Mathematical Theory and Modeling*, IISTE, www.iiste.org.

Mwanza City Council 2009. Mwanza City Profile. Mwanza, Tanzania.

NBS 2013. The 2012 population and housing census. Dar es Salaam: National Bureau of Statistics, Government of the United Republic of Tanzania.

NBS 2016. The 2016 projected population Dar es Salaam: National Bureau of Statistics, Government of the United Republic of Tanzania.

Nelson, E. 2013. *Traffic Jam and Its Social Impacts: The Case of Dar Es Salaam City.* A Dissertation Submitted to the Institute of Development Studies in Partial Fulfillment of the Requirements for Award of the Degree of Master of Science in Development Policy Mzumbe University.

Ngallaba, S. E., Makerere, D. J., Kapesa, A., Gilyoma, J. & Chalya, P. 2014. A Retrospective Study on the Unseen Epidemic of Road Traffic Injuries and Deaths Due to Accidents in Mwanza City-Tanzania. *Open Journal of Preventive Medicine*, No. 4**,** pp. 222-228.

Olagunju, K. 2015. Evaluating Traffic Congestion in Developing Countries - A Case Study of Nigeria. *A paper presented at The 2015 Chartered Institute of Logistics and Transport (Cilt) Africa Forum.* Mount Meru Hotel Arusha,Tanzania.

PMO-MRALC/TOA 2015. Participatory Service Delivery.' A Study Prepared for Tanzania Osaka Alumni (TOA), May.

RCO & NBS 2014. Dar es Salaam Region Socio-Economic Profile. Dar es Salaam: The United Republic of Tanzania: Prime Minister's Office Regional Administration and Local Government.

Pojani, D. and Stead, D. 2015 Sustainable Urban Transport in the Developing World: Beyond Megacities. *www.mdpi.com/journal/sustainability*

Popoola, M. O., Abiola, S. O. & Adeniji, W. A. 2013. Traffic Congestion on Highways in Nigeria Causes, Effects and Remedies. International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering, 7.

Rincon, N. 2014. Mwanza - Tampere Local Governance Cooperation Project: Central Business District Strategy 2015-2035.

Runyoro, A. K., Irina Zlotnikova, I. & KO, J. 2014. Towards Automated Road Information Framework: A Case Study of Tanzania. *Journal of Transport and Telecommunication*, Vol. 15**,** 12-20.

Shabbar, M. A., Adnan, M., Noman, S. M. & Baqueri, S. F. A. 2014. Estimation of Traffic Congestion Cost-A Case Study of a Major Arterial in Karachi. *Procedia Engineering* 77**,** 37-44.

SUMATRA 2011. Study on User Needs and Management of Public Transport Services in Dar es Salaam' A Study Conducted by SUMATRA, April.

Thwala, W. D., Eluwa, S. E., Ajagbe, M. A., Ojo, K. A., Edward Eric Duncan, E. E., Gafar, Y. O. & Abdullah, a. Traffic Congestion, Causes and Effect on Residents of Urban Cities in Nigeria. The Asian Conference on the Social Sciences. Official Conference Proceedings, 2012 Osaka, Japan.

UN-HABITAT 2008. The State of African Cities 2008. A framework for addressing urban challenges in Africa. Nairobi: United Nations Human Settlements Programme (UN-Habitat).
UN-HABITAT 2009. Planning Sustainable Cities: Global report on human settlements 2009. Nairobi: United Nations Human Settlements Development Programme.
UN-HABITAT 2010. Informal Settlements and Finance in Dar es Salaam, Tanzania Nairobi - Kenya: United Nations Human Settlements Programme (UN-HABITAT).
UN-HABITAT 2013. State of the World's Cities Report 2012/2013: Prosperity of Cities. Nairobi, Kenya: United Nations Human Settlements Development Programme.
UN-HABITAT. 2015. *Energy* [Online]. UN-Habitat. Available: https://unhabitat.org/urban-themes/energy/ Accessed on 28th May 2017].
UN-HABITAT 2016. World Cities Report 2016, Urbanization and Development: Emerging Futures. Nairobi, Kenya: United Nations Human Settlements Development Programme.
UN 2008. An overview of urbanization, internal migration, population distribution and development in the world New York: United Nations Population Division.
UN 2015. World Population Prospects: The 2015 revision, Key Findings and Advance Tables New York: Department of Economic and Social Affairs, Population Division.
UNFPA 2007. State of world population 2007: Unleashing the Potential of Urban Growth. New York: United Nations Fund for Population Activities.
URT 1997. The Town and Country Planning (Town Planning Space Standards) Regulations. *Government Notice No 157.* Government Printers, Dar es Salaam: United Republic of Tanzania.
URT 2000. National Human Settlements Policy, 2000. Government Printers, Dar es Salaam: United Republic of Tanzania.
URT 2003. National Transport Policy. *Ministry of Transport and Communication Dar es Salaam, Tanzania.*
URT. 2009. *National Road Safety Policy* [Online]. Dar es Salaam: United Republic of Tanzania. Available: http://www.mow.go.tz/uploads/publications/24026c0843c2198084a6fff70d176bc1.pdfAvailable
Wenban-Smith 2015. Population Growth, Internal Migration and Urbanisation in Tanzania, 1967-2012: Phase 2 (Final Report). International Growth Centre.
WHO & UN-HABITAT 2010. Hidden Cities , Unmasking and Overcoming Health Inequities in Urban Settings. Nairobi: UN-Habitat.