- Annex 6-2. IEE Final Report

15 FEBRUARY 2018
JICA STUDY TEAM

PRE-FEASIBILITY STUDY OF PROPOSED MEDIUM TERM RAILWAY DEVELOPMENTS UNDER THE REVISION OF DAR ES SALAAM URBAN TRANSPORT MASTER PLAN

INITIAL ENVIRONMENTAL EXAMINATION

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CONTENTS

Acronyms and Abbreviations

BRT	Bus Rapid Transit
CBO	Community-Based Organizations
CBD	Central Business District
DART	Dar es Salaam Rapid Transit Agency
DARTMP	Dar es salaam Transport Master Plan
DAWASA	Dar es salaam Water and Sewerage Authority
DAWASCO	Dar es salaam Water and Sewerage Company
DCC	Dar es Salaam City Council
EIS	Environmental Impact Statement
EMA	Environmental Management Act
ESMP	Environmental and Social Management Plan
GOT	Government of Tanzania
HIV	Human Immunodeficiency Virus
IBA	International Bird Area
IEE	Initial Environmental Examination
IMC	Ilala Municipal Council
JICA	Japan International Cooperation Agency
JST	JICA Study Team
KMC	Kinondoni Municipal Council
MLHHSD	Ministry Land Housing and Human Settlement Development
NEMC	National Environment Management Council
NGO	Non-Governmental Organization
OSHA	Occupational Safety and Health Authority
PO-RALG	President Office Regional Administration and Local Government
PPE	Personal Protective Equipment
RAHCO	Reli Assets Holding Company
RoW	Right of Way
SUMATRA	Surface and Marine Transport Authorities
TANESCO	Tanzania National Electrical Supply Company
TANROADS	Tanzania National Roads Agency
TAZARA	Tanzania - Zambia Railway Authority
TMA	Tanzania Meteorological Agency
TRL	Tanzania Railway Limited

UMC	Ubungo Municipal Council
URT	United Republic of Tanzania

1 Introduction

1.1 Background

Dar es Salaam, home to 4.4 million inhabitants by 2012, is Tanzania's largest City and most important industrial and commercial centre. With an annual population growth rate of 5.6 percent, Dar es Salaam is the third fastest growing city in Africa. The population is expected to reach more than 10 million by 2035. The City is undergoing rapid urbanization and also critical to the region's economy, serving export and import needs of landlocked countries of Zambia, Burundi, Rwanda and Uganda as well as large parts of eastern Democratic Republic of Congo through the Dar es Salaam port. This positions Dar es Salaam as a strategic point in the country and also for large part of East Africa.

The City's transport infrastructure has several challenges, some of which include:

- It only has about 3,500km of roads, of which only about 20 percent are in good condition
- The City's road density is barely 1.0 km/sq. km, with only four main road arteries, and the system lacks adequate paved connecting roads between them.

In 2015, the Government of Tanzania (GOT) requested the Government of Japan to implement a project in order to update the Urban Transport Master Plan for Dar es Salaam (DARTMP) with the target year 2040. In response to the request, the Japan International Cooperation Agency (JICA) dispatched a JICA Study Team (JST) to work on the project. One of the activities under the Project is to conduct Pre-Feasibility Study for the selected priority projects. JST together with the main counterparts, the President's office – Regional Administration and Local Government (PO-RALG) and Dar es Salaam City Council (DCC) will revise the master plan and select priority projects.

1.2 Objectives of the Study

The overall objective of the Study is to carry out an Initial Environmental Examination (IEE) for the Pre-Feasibility Study of railway developments proposed in the revised Dar es Salaam Urban Transport Master Plan, with particular emphasis on the environmental and socio-economic sensitivities and key issues associated with the developments. The preliminary assessment covers the following aspects:

- Description of the project characteristics and the affected environment;
- Identification of impacts on the local environment; and
- Assessment or evaluation of the significance of the impacts in terms of energy flow, transformation of matter, effects on sensitive ecosystems relative to the baseline state and socio-economic impacts.

1.3 Methodology

For the assessment, the consultant gathered information through desk-based research, field visits, high-level stakeholder consultations and GIS analysis.

1.3.1 Site visits

Field visits were conducted to several key sites within the project area were conducted in order to observe and verify various baseline environmental features such as vegetation cover, settlement patterns, hydrological conditions and land-usage.

1.3.2 Literature review

Secondary information regarding the project area and environmental receptors was also collected by means of thorough literature review. The information sources consulted include the latest municipal profiles issued by relevant Municipal Councils, national environmental reports and several publically available biodiversity publications.

1.3.3 Stakeholder consultations

Stakeholder consultations were conducted at the national, regional and municipal levels with a view to drawing specialist insights into the state of various relevant environmental and socioeconomic aspects as well as administrative and technical considerations. A detailed list of consulted stakeholders is presented in Appendix A and main concerns are presented in Chapter 5.

1.3.4 GIS analysis

GIS tools such as Google Earth Pro, ArcMap and QGIS were used to perform initial scans of various features of the natural and built-up environment[1] within the project corridor. The applications were also employed in computing estimates for land and property acquisition impacts in relation to the project footprint of the proposed railway infrastructure (i.e. railway line, train stations and depot). The estimates were generated under the assumption that the RoWs for all of the railway sections under consideration require a wayleave (from the centreline) of 15m, as mandated by the Railway Act of 2002. The RoW for each section is therefore taken to measure a total width of 30 metres, with the exception of the underground section, which is held to be exempt from the RoW requirement.

[1] Buildings were identified using OpenStreetMap data

2 Project Description

As part of the ongoing revision of the Dar es salaam Urban Transport Master plan, three staged railway developments for Dar es salaam city and its periphery are proposed, as outlined below;

I. Short term in 2025

- Upgrading the existing half loop line Central Station-Ubungo from Meter Gauge (MG) to Standard Gauge (SG).

II. Medium term in 2030

- Tegeta-Mwenge-Morocco-CBD line (half-loop);
- Tegeta-Mwenge-Morocco-Aga Khan line (half-loop);
- Tegeta-Mwenge-Ubungo-CBD line (half-loop);
- Tegeta-Mwenge diverging to both CBD and Aga Khan (half loop); and
- Existing Ubungo-CBD section + Ubungo-Mwenge-Morocco-CBD section (full-loop line)

III. Long term in 2040

- Complete the loop-Bagamoyo line to Bunju;
- Loop line extended up to CBD (Tegeta line); and
- Morogoro line between Ubungo and Kibaha.

For the purpose of this study, the consultant has examined a number of railway sections considered for five different cases (route alternatives) spanning the municipals of Kinondoni, Ilala and Ubungo (see figures below). A comprehensive case-level analysis could not be carried out at this stage, in consideration of the continuous identification and refinement of possible alternatives (i.e. number of cases). The railway sections under consideration are as follows:

- Elevated section, including (i) Tegeta-Mwenge sub-section (ii) Mwenge-CBD sub-section and (iii) Mwenge-Ubungo sub-section;
- At-grade section (Ubungo-CBD);
- Transition section; and
- Underground section.

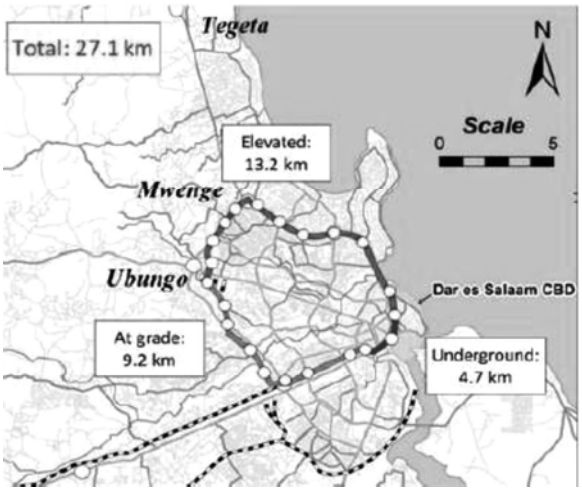


Figure 2-1 Case 1 railway route

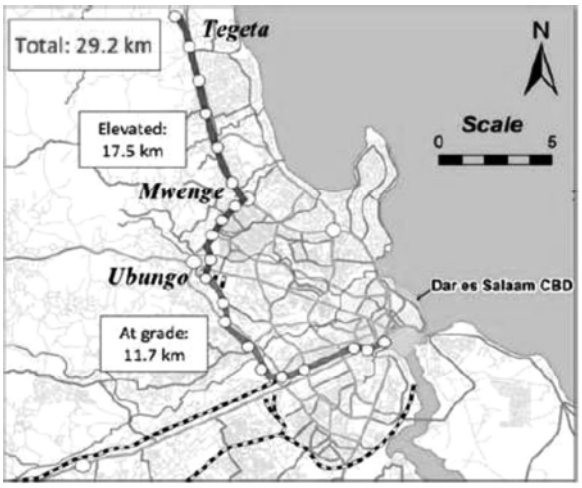


Figure 2-2 Case 2 railway route

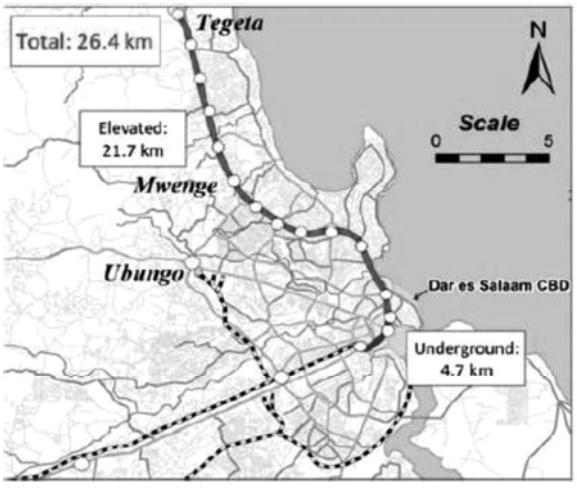


Figure 2-3 Case 3a railway route

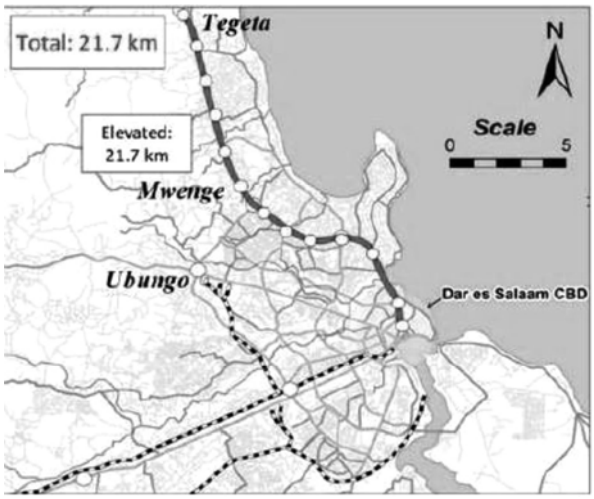


Figure 2-4 Case 3b railway route

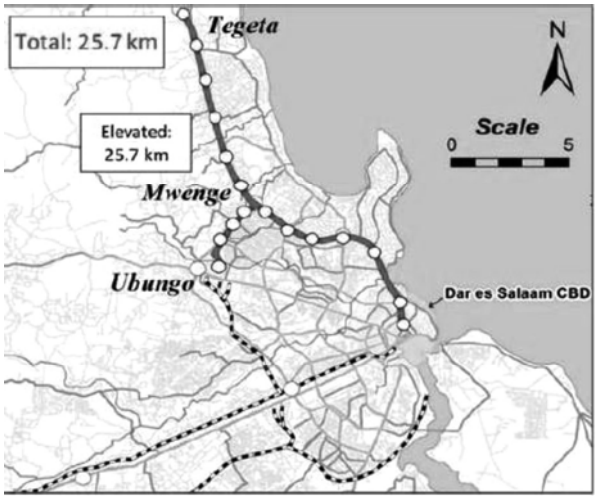


Figure 2-5 Case 4 railway route

Beyond the section-by-section assessment, Case 3b as a whole has been assessed given that it is the preferred project option at this planning stage.

2.1 Project design

The railway line for any of the five cases will comprise of a 1435 mm, SG double track containing ballast only in its depot zone, with a minimum curve radius of 200m and a maximum gradient of 3.5%. An overhead catenary system (AC 25,000 V) will power the trains, which will rely on a communication-based train control signalling system and telecommunication schemes including radio and CCTV systems. The train formation includes eight cars set to travel at a speed of 100km per hour. An automatic fare collection system will be adopted at designated train stations.

Whereas the existing, at-grade Ubungo-CBD railway line will be upgraded (MG to SG tracks), the rest of the sections will be constructed along with ancillary infrastructure including train stations and a depot. The new railway infrastructure will extend alongside the planned BRT corridor Phase 4, as depicted in the cross-section drawings below:

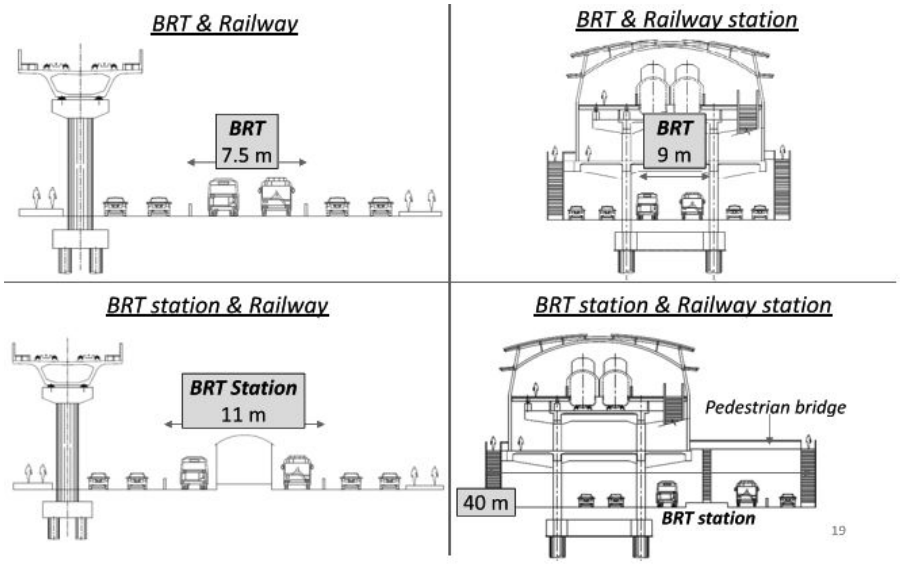


Figure 2-6 Integrated model comprising a BRT corridor and contiguous railway line infrastructure.

The dimensions of all train stations for the identified cases are 200m (length) by 25m (width), with each station (at-grade, elevated or underground) measuring an area of 5000m^2.

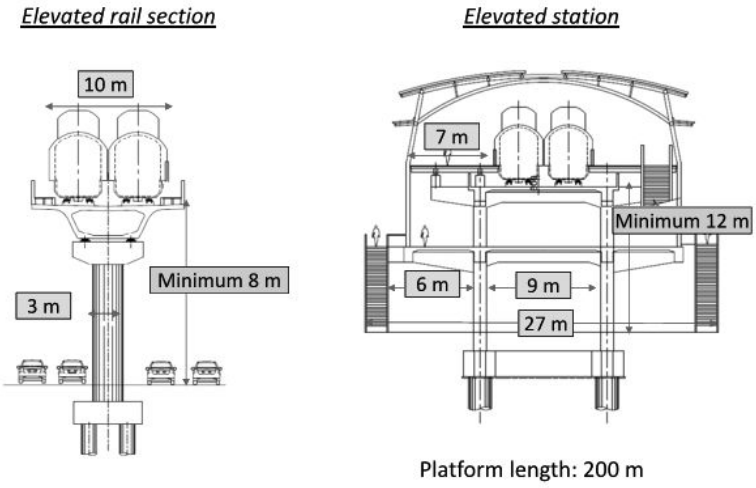


Figure 2-7 Preliminary cross-sections for elevated railway structures.

The counts and locations of the train stations for each of the proposed sections and Case 3b are presented in Table 2-1 below.

Table 2-1 Number and locations of train stations proposed for the at-grade, elevated and underground sections and Case 3b as a whole.

Railway Case or Section	*No.*	*Train Stations (Locations)*
Case 3b	1	Tegeta
	2	Kunduchi
	3	Africana
	4	Makonde
	5	Bondeni
	6	Makongo
	7	Bamaga
	8	Science Junction
	9	Victoria
	10	Morocco
	11	Oyster Bay
	12	Ali Hassan
	13	Aga Khan
Elevated Section	1	Tegeta
	2	Kunduchi
	3	Africana
	4	Makonde
	5	Bondeni
	6	Makongo
	7	Mwenge
	8	Mlimani
	9	Sam Nujoma
	10	Shopping Centre
	11	Ubungo
	12	Bamaga
	13	Science Junction
	14	Victoria
	15	Morocco
	16	Oyster Bay
	17	Ali Hassan
	18	Aga Khan
Underground Section	1	CBD
At-Grade Section	1	Mabibo
	2	Tabata Mwananchi
	3	Tabata Relini
	4	Tabata Matumbi
	5	Buguruni Mnyamani
	6	Buguruni
	7	Kigogo
	8	Kamata
	9	Central

Following an initial comparative analysis of the pre-feasibility study, Case 3b was provisionally identified as the preferred project option, in view of its relatively good score in terms of economic evaluation criteria and predicted environmental footprint. The railway line will be elevated throughout and feature a total of 13 train stations between the terminals at Tegeta and Aga Khan.

A train depot (branching off the Tegeta-Mwenge elevated section) is planned to be located in Makongo area to serve the following functions:

- Light maintenance workshop
- Heavy maintenance workshop
- Train wash track
- Test track
- Admin office
- OCC (Operation Control Center)

2.2 Project activities

Based on the design information currently available, the following general project development activities are envisaged:

2.2.1 Pre-construction phase

- Site preparation works and construction of temporary construction camps;
- Mobilization of construction workforce and machinery.

2.2.2 Construction phase

- Construction and/or upgrade of access roads;
- Grading and excavation of soils for the installation of structural track foundations and site utilities such as stations, signalling systems, electricity supply and fuelling facilities; and
- Construction of the railway infrastructure.

2.2.3 Operation phase

- Railway operationalization.

2.3 Project boundaries

The boundaries of the proposed project can be delineated on spatial, temporal and institutional dimensions, as elaborated below.

2.3.1 Spatial boundaries

The spatial extent of the project is limited to its Area of Influence (AOI). The AOI comprises of the Primary Impact Area (PIA) as well as the Secondary Impact Area (SIA). The PIA can be defined as the area where direct impacts from planned and unplanned project activities could occur. Direct impacts are defined

as changes that are caused by activities related to the project which occur at the same time and place where the activities are carried out (or within the immediate vicinity of the activities).The PIA includes all of the construction zones, transmission corridors, access roads, disposal areas etc.

The SIA refers to the areas where indirect impacts from the proposed project activities could take place. Indirect impacts are those changes that are caused by project-related activities, but are felt later in time, outside the primary impact area. The SIA includes the impact areas beyond the immediate stretches adjoining the zones of project works, such as downstream settlements, source markets, service areas associated with supporting utilities and distant beneficiary communities.

2.3.2 Temporal boundaries

Temporal boundaries refer to the project life span with regard to the duration of associated impacts. The implementation of the proposed railway development is anticipated to reach completion by 2030. Although the duration of construction is yet to be established, the operational phase of the developments is expected to last at least 100 years, this being the common life span of electric railways.

2.3.3 Institutional boundaries

Institutional boundaries refer to the institutional and sectoral jurisdictions associated with the administration of the project area and activities. These actors are discussed in Section 4.

3 Legal and Institutional Framework

3.1 National legislation

3.1.1 Environmental Management Act No. 20 of 2004

The Act provides for the legal and institutional framework for sustainable management of the environment in Tanzania; outlines principles the prevention and control of pollution, waste management, environmental quality standards, public participation, compliance and enforcement; provide the basis for implementation of international instruments on environment; and provides for implementation of the National Environmental Policy.

3.1.2 Railways Act No.4 of 2002

An Act to make better provisions for development and promotion of rail transport service, to establish RAHCO, to provide for regulatory framework of railway transport by SUMATRA and to provide for related matters. Section 44 (3 & 4) requires an applicant to seek the assistance of the Commissioner for Lands on matters of land acquisition or other property rights required and to pay appropriate compensation. The Act also outlines the right of way (RoW) to be 30m in urban areas and 60m in rural areas. The Client will meet these requirements under this Act.

3.1.3 The Land Act No. 4 of 1999

The Land Act specifies that all lands to be public land and is vested in the President as Trustee for and on behalf of all citizens of Tanzania. The Act recognizes land as property that has value. It also recognizes and regulates issues of compensation and resettlement on land. Section 156 of the Act requires compensation to be paid to any person for the use of land of which he/she is in lawful or actual occupation as a communal right of way and with respect to way leave.

Section 3(1) (f) requires those implementing the land act to take into account that an interest in land has value and the value is taken into consideration in any transaction affecting that interest. The Act under section 3(1) (g) specifically requires full, fair and prompt compensation to be paid to any person whose right of occupancy or recognized long standing occupation, or customary use of land, is revoked or interfered with by the state, or is acquired under the land acquisition act. The same section requires that the assessment of compensation of properties must take into account:

- Market value of the real property;
- Disturbance allowance;
- Transport allowance;
- Loss of profit or accommodation; and

- Any loss or capital expenditure incurred the development of the subject land.

3.1.4 The Land Acquisition Act 1967

The Land Acquisition Act 1967 is the principal legislation governing the compulsory acquisition of land in Tanzania. Sections 3-18 of the Act empower the President to acquire land in any locality provided that such land is required for public purposes.

The Act provides the procedures to be followed when doing so including: the investigation of the land to see if it is suitable for the intended purpose; notification to the landowners to inform them of the decision to acquire their land before the President takes possession; and payment of compensation to those who will be adversely affected.

If land is required for public purpose the President is required to give a six weeks' notice to those with an interest in the land in question but, if the situation so demands, the notice can be shortened without the need to give explanation. After the expiration of the notice period, the President is entitled to enter the land in question even before compensation is paid.

3.1.5 Public Health Act of 2009

The Act provides for the promotion, preservation and maintenance of public health with the view to ensuring the provision of comprehensive, functional and sustainable public health services to the public. Section 54 of the Act states that "A person shall not cause or suffer from nuisance, likely to be injurious or dangerous to health, existing on land, premises, air or water".

3.1.6 Occupational Safety and Health Act of 2003

The Act requires employers to provide a good working environment to workers in order to safeguard their health and safety. The employers need to perform medical examinations to determine fitness for work before engaging employees, provide personal protective equipment to staff, conduct fitness for work, provide first aid kits and education on health and safety. The Contractor shall observe this Act during project implementation.

3.1.7 The Urban Planning Act (2007)

The Act provides for the orderly and sustainable development of land in urban areas, to preserve and improve amenities; to provide for the grant of consent to develop land and powers of control over the use of land and to provide for other related matters. Under Section 3, among others, the law seeks to improve level of the provision of infrastructure and social services for sustainable human settlement development. Therefore, the upgrading of the proposed railway lines will meet the objectives of this Act.

3.1.8 Graves (Removal) Act, No. 9 (1969)

The Graves Removal Act sets out the procedures and authorities for removal of graves. It gives power to the Minister of Lands, Housing and Human Settlement Development (MLHHSD) to manage the removal of a grave and any dead body found therein. It stipulates steps required or measures to be taken to reinstate the grave and the reinternment of the body. It also covers aspects including the requirement for notice to be given for the intention to remove the graves, the contents of such notice, the right for the Minister to authorise the removal of graves, the conditions under which the graves must be removed and the requirements for approval of the location of the place to which the grave will be moved. The Act also covers the payment of compensation, being limited to the reasonable expenses incurred in the removal, transportation, reinstatement, and re-interment of the grave or dead body and any placatory or expiatory rites or other ceremony accompanying such removal and re-internment. It further covers penalties for obstruction of graves removal.

3.1.9 The Standards Act No. 2 of 2009

The Act provides for the promotion of the standardization of specifications of commodities and services in the country. For the project, the Act is relevant in ensuring that the quality of the Bitumen/Asphalt and other products to be imported by Contractor during construction will have to abide to the standards set by the Tanzania Bureau of Standards.

3.1.10 The Water Supply and Sanitation Act, 2009

The Water Supply and Management Act established the legal framework to the management and adequate operation and transparent regulation for water supply and sanitation services with a view to give effect to the National Water Policy, 2002.

The Act outlines the responsibilities of government authorities involved in the water sector, establishes Water Supply and Sanitation Authorities as commercial entities and allows for their clustering where this leads to improved commercial viability. It also provides for the registration and operation of Community Owned Water Supply Organisations and regulates the appointment of board members.

The design and implementation of the project will take into consideration the provisions of water supply and sanitation especially those which relate to the potential interruption of utility services for water and sanitation.

3.1.11 Employment and Labour Relations Act No. 6 of 2004

The Act makes provisions for core labour rights; establishes basic employment standards, provides a framework for collective bargaining; and provides for the prevention and settlement of disputes. The Contractor will adhere to employment standards as provided for by the Act.

3.1.12 The Workers Compensation No. 20 of 2008

The law established a Fund for administration and regulation of workers compensation for disablement of death caused by or resulting from injuries or diseases sustained or contracted in the course of employment.

3.1.13 Engineers Registration Act and its Amendments of 1997 and 2007

The Acts regulate the engineering practice in Tanzania by registering engineers and monitoring their conduct. It establishes the Engineering Registration Board (ERB). The Act requires that any foreign engineer to register with ERB before practicing in the country. Foreign engineers working in the project shall comply with the law requirement.

3.1.14 Contractors Registration Act of 1997

The Contractors Registration Act requires contractors to be registered by the Contractors Registration Board (CRB) before engaging in practice. It requires foreign contractors to be registered by the Board before gaining contracts in Tanzania. The contractor shall comply with the Act requirement.

3.1.15 The HIV and AIDS (Prevention and Control) Act of 2008

The law provides for public education and programmes on HIV and AIDS. Section 8(1) of the law states that "The Ministry (Health), health practitioners, workers in the public and private sectors and NGOs shall for the purpose of providing HIV and AIDS education to the public, disseminate information regarding HIV and AIDS to the public". Furthermore, Section 9 states that "Every employer in consultation with the Ministry (Health) shall establish and coordinate a workplace programme on HIV and AIDS for employees under his control and such programmes shall include provision of gender responsive HIV and AIDS education".

3.1.16 The Industrial and Consumer Chemical (Management and Control) Act of 2002

The Act regulates the importation, transportation, storage, use and disposal of chemicals in Tanzania. The Contractor is required by law to have a certificate from the Chief Government Chemist for importation, storage or disposal of any chemicals (Asphalt, Lime etc.).

3.1.17 The Road Act, 2007

For purposes of this project, the Road Act 2007 serves as a guide to the use of the road reserve. Contrary to previous informal understanding, the reserve is exclusive to road related activities that do not include other utilities. However clause 29 (2) does give provision for the request and terms of approval for use

of the road reserve by utilities such as power lines and water pipes. On land acquisition the Act clearly states in part III, Section 16 that *'where it becomes necessary for the road authority to acquire a land owned by any person, the owner of such land shall be entitled to compensation for any development on such land in accordance with the Land Act and any other written law'*.

3.2 National regulations

3.2.1 The Land (Assessment of the Value of Land for Compensation) Regulations, 2001

These regulations provides guidance in determining compensation, providing the basis for assessment of the value of any land taking into consideration unexhausted improvements. Unexhausted improvements are defined under the Land Act, 1999 as:

"anything or any quality permanently attached to the land directly resulting from the expenditure of capital or labour by an occupier or any person acting on his behalf and increasing the productive capacity, the utility, the sustainability of its environmental quality and includes trees, standing crops and growing produce whether of an agricultural or horticultural nature".

The assessment basis shall be the market value of the land, undertaken by a qualified Valuer. Section 7 of these regulations states that compensation for land shall include the value of unexhausted improvement, disturbance allowance, transport allowance, accommodation allowance, and loss of profits, all of which are defined as follows:

- Accommodation allowance: The market rent for the building shall be assessed and multiplied by thirty-six months in order to arrive at the accommodation allowance;
- Loss of Profit: The net monthly profit of the business carried out on the land shall be assessed, with evidence provided by audited accounts where necessary and applicable, and multiplied by thirty-six months in order to arrive at the loss of profits payable;
- Disturbance Allowance: The disturbance allowance shall be calculated by multiplying value of the land by average percentage rate of interest offered by commercial banks on fixed deposits for twelve months at the time of loss of interest in land; and
- Transport Allowance: Transport allowance shall be the actual costs of transporting twelve tons of luggage by rail or road (whichever is cheaper) within twenty kilometres from the point of displacement.

The above is applicable in all instances, except with regard to unaccompanied land.

Section 13 requires that interest shall be paid on any compensation by the Government or local authority where there is no prompt payment of compensation.

3.2.2 The Land (Compensation Claims) Regulations (2001)

These regulations outlines who can claim compensation for loss of land, along with outlining the role of the Commissioner of land in publishing a public notice notifying the land occupant of their right to claim compensation. Section 7 of the regulation states that the Commissioner must also initiate the valuation process for compensation.

Section 10 goes on to state that compensation must take two forms: monetary compensation, or at the option of the government, compensation shall form all or a combination of the following:

- A plot of land of comparable quality, extent and productive potential to the land lost;
- A building or buildings of comparable quality extent and use comparable to the building or buildings lost;
- Plants and seedlings; and
- Regular supplies of grain and other basic foodstuffs for a specified time.

3.2.3 Environmental Impact Assessment and Audit Regulations, 2005

These regulations provides for the implementation of the EMA (2004). In accordance with the regulations, the project proponent (in this case the GoT) is required to first register the project, by submitting the Form EA1 to the National Environmental Management Council (NEMC), which outlines details of the project and its likely impacts.

The regulations advocate for periodic and independent re-assessment of development projects and that the outcome of such assessments should serve to provide instructive feedback into the environmental management process. The Environmental Impact Statement (EIS) that is a key outcome of the EIA process is submitted to the Technical Advisory Committee (TAC) coordinated by NEMC for review. By submitting this EIS the proponent has complied with the requirements of the regulations.

3.2.4 Environmental (Registration of Environmental Experts) Regulations, 2005

These regulations establish a system for registration of environmental experts (individual expert or firm) to conduct environmental impact assessment and environmental audits. It ensures that the registered experts conduct environmental impact assessment and environmental audits in an independent, impartial, objective and competent manner. As such, any person or firm procured to conduct environmental impact assessment and/or environmental audit must be registered with NEMC as an environmental expert.

3.2.5 The Environmental Management (Solid Waste Management) Regulations, 2009

These documents regulate the implementation of the EMA (2004). The regulations are guided by three principles: the precaution principle, the polluter pays principle and the producer extended responsibility principle. Therefore, manufactures or any person exercising jurisdiction under this Act shall, in relation to any decision, order, exercise of any power or performance of any function, be guided by these principles of environment and sustainable development relevant to waste disposal and management.

Local governments implement the regulations and Schedule 1 of the regulations highlight the types of waste and recommended modes of treatment for the same. The contractor and proponent for the drainage project will be expected to comply with these regulations when dealing with solid waste.

3.2.6 The Environmental Management (Soil Quality Standards) Regulations, 2007

The Soil Quality Standards regulations provides a framework for environmental protection considerations by different sectors into the mainstream of decision making to ensure minimum environmental negative impacts due to agricultural practices and use of external inputs. It requires the agriculture sector to ensure food security and eradication of rural poverty through the promotion of production systems, technologies and practices that are environmentally sound, with emphasis on strengthening of environmentally sound use, monitoring, registration and management of agro-chemicals use.

There is a risk for soil pollution at the construction sites generally limited to accidental spillages of hydraulic oil, fuel oil and petroleum at individual work sites and along the drainage routes. The contractor shall comply with these regulations concerning the control and abatement of soil pollution.

3.2.7 The Environmental Management (Standards for the Control of Noise and Vibration Pollution) Regulations, 2011

These regulations aim to ensure that a healthy environment is maintained for all people, tranquillity of their surrounding and their psychological wellbeing by regulating noise and vibration levels. Amongst other things, the regulation, prescribes and enforces the maximum permissible noise and vibration levels from a facility or activity to which a person may be exposed; ensures control of noise and vibration and provides for mitigating measures for the reduction of noise and vibration. In addition, the regulation establish appropriate measures to ensure the abatement and control of noise from sources.

3.2.8 The Environmental Management (Air Quality Standards) Regulations, 2007

These regulations aims to set baseline parameters on air quality and emissions based on a number of practical considerations and acceptable limits and enforce minimum air quality standards prescribed by the National Environmental Standards Committee.

It helps developers such as industrialists to keep abreast with environmentally friendly technologies aiming to ensure the protection of human health and the environment from various sources of pollution.

The relevance of this standard to the project is reflected in section 1(3)(d) where it states the objectives of this standard among others, is "to ensure protection of human health and the environment from various sources of pollution".

3.2.9 The Environmental Management (Water Quality Standards) Regulations, 2007

The object of these regulations is to protect human health and to promote the conservation of the environment, enforcing minimum water quality standards prescribed by the National Environmental Standards Committee. At the same time, the water quality standards enable the National Environmental Standards Committee to determine water usages for purposes of establishing environmental quality standards and values for each usage and ensure that all discharges of pollutants take into account the ability of the receiving waters to accommodate contaminants without detriment to the uses specified for the waters concerned.

Since the interventions shall take place close to water bodies, the risk of water contamination during construction phase is high, particularly in regard to accidental spillages of oil and fuel from the vehicles and machinery allocated to works. The Contractor shall comply with all applicable regulations concerning the control and abatement of water pollution.

4 Environmental and Socio-economic Baseline Conditions

4.1 Biophysical Baseline

4.1.1 General biophysical baseline

Topography

The City of Dar es Salaam is broadly divided into three main topographical zones, which are the upland zone comprising of hilly areas to the west and north of the city, the middle plateau, and the lowlands, which include Msimbazi Valley, Jangwani, Mtoni, Africana and Ununio areas. With an elevation peaking at around 150m above sea level, the coastal city is generally flat, sloping gently from its westward extremity towards the sea.

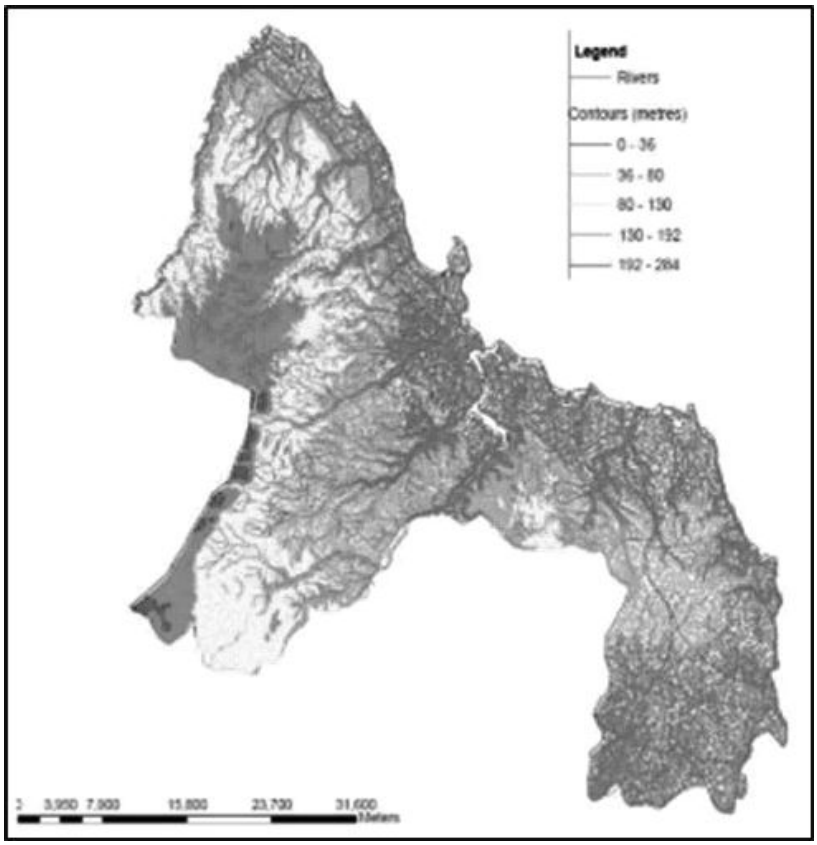


Figure 1 Dar es Salaam Region topographical map. Source: Procesl/COWI, 2014

Hydrology

Resting within the Wami/Ruvu Basin, the City encompasses a total of four watersheds drained by the four major rivers of Mpiji, Msimbazi, Kizinga and Mzinga. In addition to tributaries feeding into the rivers, a number of natural streams separate the four sub-catchments. Growing urbanization and land

transformation within the hydrological zone have influenced the pre-existing hydrological regimes of the rivers, particularly for River Msimbazi, which has suffered significant upstream deforestation and anthropogenic wastewater inflows rendering it an unnaturally perennial waterway. The urban modification and intrusion of the downstream floodplain of the River has created a major flooding vulnerability that is biannually inundated during the wet seasons. The groundwater is largely salty, with electrical conductivity values exceeding 2,000 µS/cm in certain areas.

Wildlife and Habitats

The vegetation of Dar es Salaam can be broadly categorized as remnant Miombo woodland, eastuarine mangroves (concentrated at the mouth of Msimbazi River), coastal swamps and open grasslands and shrublands. Eight mangrove species are established along the coastline, namely; *Rhizophora mucronata* ('Mkoko' in Kiswahili), *Sonneratia alba* ('Mlilana' or 'Mpira'), *Avicennia marina* ('Mchu'), *Ceriops tagal* ('Mkandaa'), *Bruguiera gymnorrhiza* ('Msinzi' or 'mshinzi'), *Heritiera littoralis* ('Msikundazi or Mkungu'), *Lumnitzera racemosa* ('*Kikandaa* or '*Mkandaa dume*') and *Xylocarpus granatum* ('Mkomafi'). Common terrestrial tree species include Neem trees (*Azadirachta indica*) and Ashoka trees (*Polyalthia longifolia*), which are among the most commonly planted trees in Tanzania, and a few African teaks (*Milicia excelsa*). The vegetation is comparatively dense in the city outskirts and peripheries, where small populations of medium-sized animals such as monkeys, squirrels and mongooses prevail. More wildlife, including mammals, reptiles and birds are found in the Pande Game Reserve located in Kinondoni Municipal, as well as in the Kigamboni Zoo in Kigamboni Municipal, both areas being relatively remote from the developed reaches of the city. Though highly disturbed in its developed parts, Dar es Salaam is still home to a few endemic species such as the Dar-es-Salaam Pipistreslle (an insect eating bat), the Tanzania Mouse Shrew and the Swynnerton's Bush Squirrel.

The city is fringed by about 88 species of hard coral species belonging to 34 genera. There are around 12 species of seagrasses in the coastal waters occupying much of the shallow lagoon between the islands and the mainland along the entire coast. The city coast shelters a number of endangered species such as marine turtles, hawksbills (*Eretmochely imbricata*), green turtles *(Chelonia mydas*), dolphins, humpback whales and whale sharks. Dar es Salaam is also known for its marine reserves, which have been designated for recreation, aesthetic, education and research activities. These are the fairly pristine islands of Mbudya, Bongoyo, Pangavini, and Fungu Yasini.

Part of the coastal expanse of Dar es Salaam is also recognized as an Important Bird Area (IBA), running from the open bay of Ras Kiramoni in the north, up to and including Ndege Beach, to Ras Ndege, east of Mbwamaji Village and measuring a total length of 40 km. The inland limit of the site is the high-tide mark, but this is extended in places to include mangroves and salt-workings. To the seaward side the site extends out to the 12 km international limit. This allows inclusion of important feeding grounds for several seabirds, which rarely venture inshore of the coral reef. Within the IBA are tidal mudflats, river inlets,

saltpans, extensive mangroves, coastal thicket and several offshore islands which create a remarkably diverse coastal environment. A total of 457 species have been recorded from the site. The area is of major importance to migratory waders from northern Eurasia, supporting about 30,000 birds. This includes large numbers of *Calidris ferruginea, Calidris minuta* and *Pluvialis squatarola*. Large flocks of some species, notably *Tringa nebularia* and *Charadrius mongolus*, are a feature of the return migration to northern latitudes during March and April. The only local population of *Egretta ardesiaca* feeds at Msasani Bay and probably breed in the freshwater swamps adjacent to the now defunct Msasani saltpans, an area of low-lying land unsuitable for building. Records of *Acrocephalus griseldis* suggest that several winter in coastal scrub near Mbezi Beach and Jangwani Beach wherever there is thick cover and a source of fresh water.

Environmental Challenges

Amongst the key environmental challenges facing Dar es Salaam city is the widespread mismanagement of solid and liquid waste, flooding within the Msimbazi plain and coastal pollution. Pollution originating form discharge of untreated water from sewer systems, pit latrines, soak pits and garbage dumps has permeated the coastal waters. Furthermore, heavy blooms of micro-algae are a regular feature of near shore waters especially in the vicinity of the northern end of Ocean Road beach in Dar es Salaam. Manufacturing industries are a major source of surface water pollution. Various industrial wastes from Keko, Chang'ombe, Kurasini, Mtoni and Temeke in Dar es Salaam have been discharging untreated wastes into the shore via the Msimbazi creek. These pollutants include chemicals from textile industries such as dyes, paint wastes and strong alkalis. The principal threat to water quality in the city's coastal waters issues from untreated municipal wastes. The water quality outside urban areas, though largely free from the impact of domestic and industrial wastes, is under threat from agricultural run-off and leachate contaminated with pesticides and fertilizers.

The city's waste management facilities are becoming increasingly limited, with only seven oxidation ponds and an overburdened dumpsite. Nevertheless, there are plans to establish three modern, large-capacity wastewater treatment plants in Jangwani, Mbezi Beach and Kurasini, and two engineered landfills in Kisarawe and Ubungo.

Current Climate Change Projections

According to the Climate Change Projection for Tanzania Report (2015), the temperature of Dar es Salaam and the North coast at large will rise by 1.5°C by the year 2050 and by 2.81°C by 2100. Further, precipitation levels in the area will increase by 13.9 mm for the December-January wet season and decrease by -5.6 mm in the March-May rain season by 2050. By 2100, these changes will grow escalate to 26 mm and -11mm respectively.

4.1.2 Ilala Municipal

Topography

Ilala Municipality has an altitude that ranges between 0 to 90 meters above sea level (asl). Most of the Municipality lies in the lowlands and a small part forms the upland zone. The lowlands begin at the border with Indian Ocean in Kivukoni Ward extending up to Segerea, Ukonga and Kitunda Wards. Most of the lowland areas constitute the urban part of the Municipality (over 75% of the Municipality). The smaller portion of the upland zone comprises small hills and/or plateaus of Pugu, Kinyerezi, Chanika and Msongola Wards. These areas are predominantly rural in character and dominated by agricultural activities.

Climate

The municipality is relatively humid and experiences a temperature regime ranging from 26°C in August to 35°C in December and February each year. The long rain season (March – May), receives an average monthly rainfall of 150mm – 300mm. The short rain season is between November and December with monthly average rainfall ranging from 75mm – 100mm.

Geology

Ilala Municipality has two major geological units: (i) the underlying substratum of (semi-) consolidated formations and outcropping rocks that consist of Neogene clay-bound sands to hard sandstone; and (ii) the superficial mainly loose sediments of the Quaternary System which are more extensive in the central and southern parts of Dar es Salaam Region and consist of less consolidated terrace sands and sandstones and recent alluvium.

Hydrology

Of the Municipal's total area of 210km^2, approximately 3.1 km^2 is occupied by water. The Hydrology of Ilala Municipal is dominated by Msimbazi River, which originates from Pugu Hills, flowing down to the sea just North of the city centre. River Sinza is the main tributary to the river. The hydrological regime of Msimbazi River has been heavily altered by the urban developments within the basin. The stormwater drainage system serving the city center, and various waterways loaded with industrial effluents and domestic sewage from unplanned settlements and other establishments around the central business district all discharge into the river. The river channel has shallowed markedly, with flow impediment in its lower reaches, particularly on its estuarine end, where the mangrove strip is heavily congested with accumulated solid waste. The transformed and built up environments within the river's basin have led to flash floods and extensive inundation during the biannual wet seasons.

Forestry

An overall 17.5 km^2 of Ilala Municipal's total area is covered by forest. A notable fraction of the forested land is the Mangrove Forest Reserve stretching over an area of 20 hectares. Though the mangrove habitats are protected from threatening processes such as land-use intrusion and vegetation clearance, they are significantly degraded by the accumulation of solid waste drained from the urban catchment of Msimbazi River. The mangroves ecosystem provides a high-

nutrient estuarine environment that is of immense ecological value to the marine and avifaunal communities dependent on it. Parts of Pugu Forest Reserve and Kazimzumbwi Forest Reserve also extend into Ilala. Zingiziwa Forest Reserve, which is situated south-west of the Municipal harbors and features a natural lake which encourages development of a wildlife zone. Ilala Municipal also features non-natural forests, with nearly 899,638 seedlings planted between 2010 and 2013.

Environmental Challenges

Ilala is confronted with an exponential population growth, which has overtaken the development of public utility infrastructure and services, resulting in unprecedented pressure on the existing natural resources and environmental degradation. Unplanned settlements are widespread in parts of the municipal, as a result of both poverty and poor urban planning and land-use monitoring, which represents a contributing factor to the misdistribution of basic utility services including solid waste collection, sewerage and water supply. Waste mismanagement and land conversion are amongst the leading environmental challenges sustained by the municipality. Nonetheless, conservation efforts are on the rise in the wake of responsive collaboration between the Council and environmental Non-Governmental Organizations (NGOs) and Community-Based Organizations (CBOs). In terms of secondary conservation, six botanical gardens are being planned for establishment, namely Karimjee Botanical Garden, Umoja wa Vijana, Mnazi Mmoja II, Palm Beach, India and Samora, alongside plans to upgrade existing recreational areas.

4.1.3 Kinondoni Municipal

Topography

The municipal is characterized by the following landforms:

- Sand dunes and tidal swamps along the shoreline;
- Hills are characterized by weathered sloped and well drained with unconsolidated clay bond sands;
- Limestone coastal plain at Kawe rises in the North and descends to eight km at Mpiji River. Lakes and ponds are spread across the plain, where clay soils and the natural gradient impede natural drainage;
- River valleys stretch across the coastal plain with a series of steep-sided, U-shaped valley culminating in in cracks and the mangrove strip before entering the Indian Ocean; The valley soils are generally poorly drained silt clay soils enriched with clay matter;
- Natural and man-made forests. The natural forests are merely the natural vegetations of low land forest with scattered dominant trees bushes; tall grasses and mangrove forests especially along the coast and river estuaries while the man-made forests are trees planted by the Forest

Department and managed by *Mtaa* governments. Pande Game Reserve, measuring 3,030 Acres and harbouring wild animals such as monkeys and birds, is located about 15 km off Bagamoyo Road.

Climate

With an equatorial climate and intermittent influence by monsoon winds, Kinondoni Municipal is generally hot and humid all year round with an average temperature of 29°C. The hot season runs from October to March, while the cool season sets in between May and August. The average precipitation of the municipal is 1300mm and humidity ranges from 67% and 96%, with the shorter spell of rains between October and December and the wet season between March and May.

Geology

Like the rest of Dar es Salaam, the geological composition of Kinondoni Municipal consists of clay-bound sands and gravels (Mio Pliocene), alluvial and river terraces (Pleistocene) and white-buff sands (Pleistocene). The outcropping sediments in the area vary from the semi-consolidated clay-bound sands and gravel of Mio-Pliocene age in the uplands in the northwest and to the southeast, to the far more unconsolidated suite of recent times, consisting of less consolidated terrace sands and sandstones and recent alluvium. Coarse-grained soils are dominant and are situated on the coastal terraces. An alternation of fine and coarse-grained sands occurs within the valleys, creeks, deltas and mangrove sites. The mouths of Kizinga, Mzinga and Msimbazi rivers form the main deltas. In the river valleys, recent alluvial deposits are covering the terrace sediments. Upland soils are situated on uplands and are the result of weathering of upland sandstone and siltstone of varying lithological composition (Mtoni Y. et al 2012).

Hydrology

The municipality features a number of rivers and streams, known as Tegeta River, Mbezi River, Mlalakuwa River, Kijitonyama Stream, Sinza River and Tabata Stream.

Vegetation and Wildlife

The Kinondoni Municipal vegetation is constituted of various species of disturbed bushland and woodland species comprising of coastal shrubs along the beach areas in Mbezi Beach, Kunduchi, and Mbweni, and Miombo woodland, vegetation in coastal swamps and mangrove trees. Part of the municipal land is cultivated with different kinds of crops, comprising of mixed cropping; cultivation with tree, shade, bushy and herbaceous crops. The most common vegetation type in the study area include Neem trees, Coconut trees, Mango trees, ashoks and a few other indigenous plants. Pande Game Reserve harbours around 448 species of animals and plants, of which 60 species are endemic. The reserve has two endangered, one vulnerable and four near-threatened animal species based on IUCN threat classifications. The resident vegetation types include Eastern African coastal dry forest – Legume dominated dry forest, Eastern African coastal scrub forest, woodland, wooded grassland, induced weedy communities and thickets. Animal species resident in the reserve include (but are not limited to) baboons,

vervet monkeys, galagos, shrews, mongooses, hares, squirrels, bush pigs and dwarf antelopes.

4.1.4 Ubungo Municipality

Topography

Ubungo Municipal covers coastal hills and plateaus with altitudes ranging from 40m to 200m and flatlands in the seashore area.

Climate

Ubungo is generally hot and humid throughout the year with an average temperature of 290C. The hottest season lapses from October to March while it is relatively cool between May and August with temperature around 25°C. There are two rain seasons: - short rain from October to December and long rain season between March and May. The average annual rainfall is 1300mm. Humidity is around 96% in the mornings and 67% in the afternoons. The climate is also influenced by the Southwest monsoon winds from April to October and Northeast monsoon winds between November and March.

Geology

The project area is covered by Neogene semi-consolidated clay-bound sands possibly unconformable upon the Pugu Sandstones. Both geomorphology and geological maps show a normal block faulting, which is trending North – South cross through Ubungo starting from Kawe (Mbezi) passing along University of Dar es salaam, Ubungo, Kinyerezi to Ukonga Prison. There are two different soil types; the top soil layer of about 30cm thick consists of manmade soil (filled materials), well compacted and levelled. The second layer is generally dump, dark grey, firm sandy clay.

Vegetation

The municipal does not feature extensive vegetation cover but has patches of sparse trees, shrubs and grasslands that are common to the rest of Dar es Salaam. There are no forest reserves in Ubungo, and only a few vegetated parks within the university area.

Hydrology

The mean water table lies at a depth of approximately 3m. The prominent surface water resources are two rivers which are Kibangu River and Ng'ombe River. Both the rivers are seasonal.

4.2 Socio economic baseline

4.2.1 Ilala Municipality

Administrative structures

Ilala is one of the five municipalities that make up Dar es Salaam City. The municipality lies between longitude 39°C and 40°C East and between latitude 60°C and 70°C South of the Equator. The Municipality covers an area of about 210 km², and comprises three Divisions – Ilala, Kariakoo and Ukonga – with a total of 26 Wards and 102 Mitaa (streets/neighbourhood)

The Municipality borders Indian Ocean to the east, Temeke Municipality to the south, Kinondoni Municipality to the north and Kisarawe District in the Coast Region to the west.

Demography

According to 2012 population and housing census, Ilala Municipal Council has a total population of 1,220,611 persons. In Ilala females constitute 51.2% of the population, and the average household size is 4.0.

Education

There are 113 Pre-primary schools, 134 Primary schools and 85 Secondary schools in the Municipality.

Economic activities

Economic activities in the municipal include industries mainly privately owned and government institutions, business, petty traders, fishing, livestock keeping and agricultural activities.

Road and transport network

In order to facilitate urban mobility and the smooth flow of passengers, goods and services internally, the Municipality has 428.9 km road network of which 132.9 km is tarmac, 80.0 km is gravel, and the remaining 216 km is earth. In addition, there is 20 km of railway in the Municipality that facilitates the transfer of goods and people to and from Dar es Salaam.

Health facilities

The Municipal's Health Department is responsible for monitoring 171 health facilities that are found in the Municipal and owned by government, private entities, parastatals, and faith-based organisations.

Water supply

The main sources of water for Ilala municipality are boreholes and part of the Central Business District (CBD) receives water from lower Ruvu. The water from lower Ruvu is managed by DAWASA.

Waste management

Ilala Municipality produces about 1,088 tons of solid waste per day. Solid waste generated are collected in the skip container and transported to dumping site at Pugu Kinyamwezi.

4.2.2 Kinondoni Municipality

Administrative structure

Kinondoni is one of the five municipalities that make up Dar es Salaam City. The Municipality covers an area totalling 321 km². The Municipality has a size and a population density of 1179 people per square km.

Demography

According to the 2012 housing and population census, the Municipality accommodates a population of 929,681, of which 451,653 are men and 478,028 are women. An average household size is 4. The population density of the municipality was 2,896 people per square kilometre by 2012 and projected to increase to 3,533/km² in 2016.

Education

The municipal has 142 pre-primary schools, of which 76 are government-owned and 140 primary schools, of which 77 are public.

Economic activities

Economic activities in the municipal include industries mainly privately owned and government institutions, business, petty traders, fishing, livestock keeping and agricultural activities.

Road and transport networks

The road network established across the municipal totals 475.59 km, of which 134.4 km are tarmac roads, 221.79 km are gravel roads and 119.4 km are earth roads and 26 km are bridges/ box culverts. 17.65 km, 116.46 km and 30.75 km of the paved roads, gravel roads and earth roads respectively are in poor working condition.

Health facilities

There are a total of 126 health facilities in the municipality, of which 27 are government-run. The health centres serve an average of 2 million patients per annum, the major prevalent diseases being Malaria, HIV/AIDS and acute respiratory infections.

Water supply

The municipality received water mainly from Dar es Salaam Water and Sewerage Authority (DAWASA) distribution scheme, which accounts for 75% of consumption. Other sources are private and community-owned wells and boreholes.

Waste management

Kinondoni generate about 1223.6 tons of waste per day, (equalling 446,614 tonnes per year). The Municipal council, contractors, community-based organizations and informal sectors collect solid waste. All wastes are transported to Pugu Kinyamwezi dumping site.

4.2.3 Ubungo Municipality

Administrative structure

Ubungo is one of the five municipalities that make up Dar es Salaam City. The Municipality has a total area of 260.40 square kilometres. The Municipality is bordered by the Kibaha District to the North, Kinondoni District to the Southeast, and Kisarawe District, Coast Region to the West.

Demography

According to 2012 population Census, the Municipality had a population of 845,368 people of which 436,219 were female and 409,149 were male. Growth rate is 5.0% per annum. The average household size is 4 persons per household.

Economic activities

Economic activities in the municipal include industries mainly privately owned and government institutions, business, petty traders, livestock keeping and agricultural activities.

Road and transport network

The municipality is well linked by roads and other communication networks to the rest of the city and other parts of the country. Major road links are: - Morogoro Road, Mandela Road and Sam Nujoma Road.

Health facilities

The council currently has 68 health facilities of which 17 are government owned, while Private Organizations own the remaining 51.

Water supply

The main source of water for Ubungo residents is from Lower and Upper Ruvu which managed by Dar-es-salaam Water and Sewerage Authority (DAWASA). The water from DAWASA systems contributes 68% of water being consumed daily and the rest is contributed by shallow and deep wells which owned by both private and community.

Waste management

Solid waste generation per year is estimated to be 302,001 tonnes per year. There is no municipal wastes in the area, solid waste collected are transported to Pugu Kinyamwezi dumping site.

5 Stakeholder Consultations

5.1 Stakeholders consulted

Stakeholder consultations were conducted at national, regional and municipal level in order to understand the current project footprint. The consultations allowed stakeholders to present their views concerning the proposed project. Recording stakeholders' views and preferences was essential to inform the identification of impacts and drawing effective mitigation measures that are presented in this report.

Consultations were carried out from late December 2017 to early January 2018. Table 5-1 below presents a list of consulted stakeholders.

Table 5-1 List of Stakeholders Consulted

Level	Institution
National	› Ministry of Works, Transport and Communications; › Ministry of Lands, Housing and Human Settlements Development (MLHHSD); › President's Office – Regional Administration and Local Government (PO-RALG); › Surface and Marine Transport Authorities (SUMATRA); › Tanzania National Roads Authority (TANROADS); › Tanzania Railways Limited (TRL); › Railway Assets Holding Company (RAHCO); › Tanzania - Zambia Railway Authority (TAZARA); › Dar es Salaam Rapid Transit Agency (DART); › Tanzania Meteorological Agency (TMA); › Dar es Salaam Water and Sewerage Corporation (DAWASCO); › Dar es Salaam Water and Sanitation Authority (DAWASA); and › Tanzania Electricity Supply Company (TANESCO).
Regional	› Dar es Salaam Regional office
Municipal	› Dar es salaam City Council; › Ubungo Municipal Council; and › Kinondoni Municipal Council.

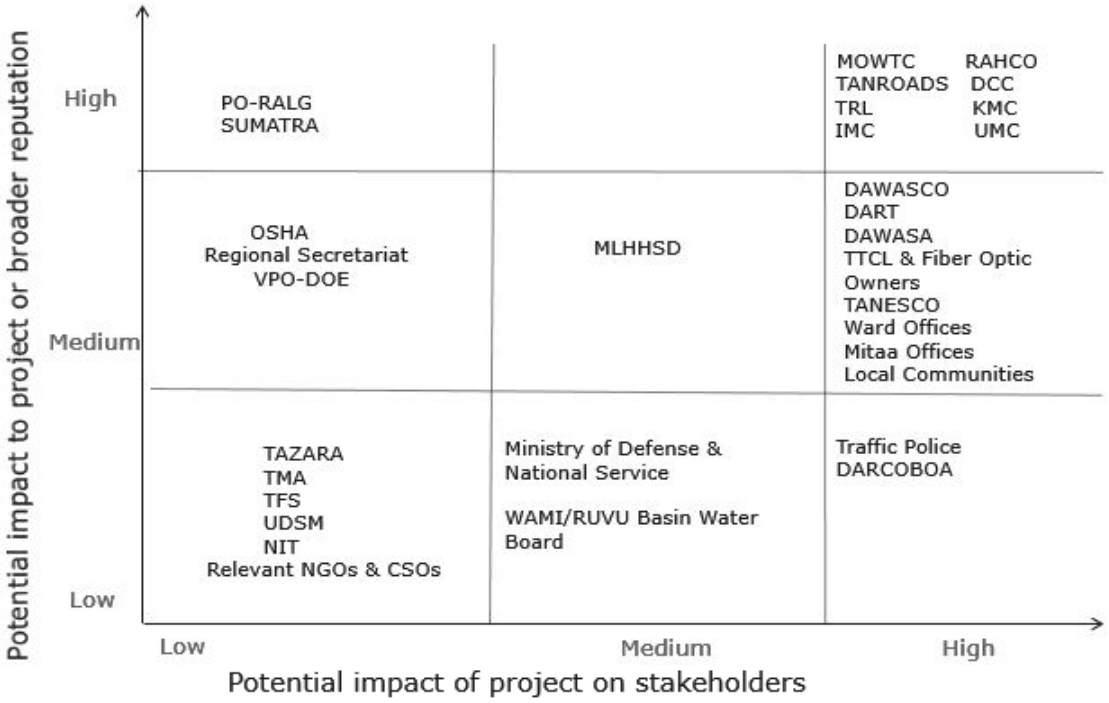
5.2 Stakeholder mapping

The consulted stakeholders were mapped depending on their likelihood of being impacted by the Project and/or of impacting the Project or its broader reputation. The mapping included the key stakeholders consulted as part of this assignment and other stakeholders, which will be key for the Client to engage throughout the project. The mapping exercise was based on desk review, brainstorming and consultant's previous experience.

The mapping tool has been divided between the x-axis which ranks stakeholders according to the degree in which the project will potentially impact them (low, medium, high) while the y-axis ranks stakeholders according to their potential

impact to the Project (low, medium, high). The outcome is a grouping of stakeholders into four squares as indicated in Figure 5-1 below.

Figure 5-1 Stakeholders Mapping



5.3 Issues raised

Stakeholders' issues raised highlights both positive and negative socio-economic and environmental impacts anticipated by consulted stakeholders. The stakeholders have also suggested mitigation measures that the developer should incorporate in order to minimise anticipated environmental and social impacts. Table 5-2 below presents issues raised and corresponding responses. A full list of issues raised by each stakeholder is provided in Annex B.

Table 5-2 Stakeholders issues and response

Issue	Response
The construction of new railway lines (Ubungo-Mwenge-Tegeta-CBD) will result into demolition of structures/assets along the proposed route(s) and resettlement of people and businesses. This will result to physical and economic displacement (loss of/or access to income sources or means of livelihood)	In case of involuntary resettlement, the law requires compensation to be paid to project affected persons (PAPs). Before compensation, a qualified and registered Valuer will conduct a valuation assessment of all affected properties/assets and prepare a valuation report for approval by the MLHHSD before compensation is paid. In addition, a Resettlement Action Plan (RAP) will be prepared to guide compensation payment and resettlement of people
The proposed project will be implemented in urban and congested areas – the railway lines are close to people's residential structures and businesses.	An environmental and social management plan (ESMP) will be prepared, as part of an Environmental Impact Assessment (EIA) for the project, to guide the contractor in

Construction will impact their daily livelihood activities and businesses and cause other nuisance/disturbances and safety concerns	ensuring construction activities that impact people's daily livelihood activities are minimised as much as possible
During construction there will be noise pollution and dust generation	› It will be the Contractor's responsibility to ensure that dust and noise pollution are suppressed. Dust pollution can be controlled by sprinkling debris with water before it is carried and it should be covered when transported › Noise pollution can be controlled by Contractor's vehicle and machinery operations will be properly serviced and within best standards
Construction activities should not affect land stability and result into soil erosion and flooding	Special considerations will be identified in the ESMP prepared before project implementation
Provision of employment opportunities	Unskilled workers will be sourced locally. For skilled workers they will be sourced locally as much as possible supported by expatriates
Project proponent should provide details of project implementation beforehand in order to avoid discontents and problems with the project in the future. If the project is to take place, project impact areas should be earmarked for development	The project proponent will handle all project planning activities which, amongst other things, include provision of project information to stakeholders
Urban hydrology has to be carefully considered during detail design – there should be plans to avoid floods and construct railway lines in flood prone areas	Hydrological investigations as part of the design are part of the feasibility study and subsequent detail design
During construction there will be disruption of services – currently TRL conducts daily trips from CBD to Ubungo	Special considerations will be identified in the ESMP prepared before project implementation
Proposed plans have been delayed – medium term plan should be short term plan because Dar es Salaam is a rapid growing city both in human population and car population. Population of cars is growing at 20% per annum and people at 2.7% per annum	The review process will identify optimal and feasible plans, which will address current and pending challenges brought by a growing human and car population
The City does not have a Land Use Masterplan to guide land use plans	The preparation of the land use masterplan is coordinated by the Ministry of Lands, Housing, and Human Settlement Development
All-important stakeholders such as Municipal Councils should be made aware and fully participate in revising the DARTMP	Stakeholder consultation are part and parcel of the review process
There is little knowledge/awareness on climate change and measures on how to combat it from community members along the project area	Provision of education on climate change is cross-cutting thus require a broader stakeholder engagement and coordination
There should be capacity building to decision makers such as ward councillors so that they educate their community members on the proposed project and its impacts	The project might include a component for capacity building
Very few people are aware of the Urban Transport Masterplan of 2008	The project proponent should ensure more awareness through broad stakeholder consultation and involvement

Relocation of public utilities infrastructure is going to be an issue. This will result into losses to utilities agencies due to disruption of services especially during construction phase	Contractor will consult relevant authorities whom will be responsible for relocating their infrastructure
Transportation of materials might result in increased traffic and potentially in accidents	Special considerations will be identified in the ESMP prepared before project implementation
Increased people's interaction in the project area is going to increase chances of spread of diseases such as HIV/AIDS, communicable diseases, etc. and other social ills such as crimes, unwanted pregnancies, etc.	Special considerations will be identified in the ESMP prepared before project implementation
There will be potential issues such as oil spills from vehicles and machinery, which might pollute water sources	Special considerations will be identified in the ESMP prepared before project implementation
Waste generation (solid, liquid, etc.) is going to be an issue. There should be a proper waste management plan	› Special considerations will be identified in the ESMP prepared before project implementation › Waste is to be disposed of according to guidelines set by the respective local government authority
There should be proper health and safety considerations for the employees and adjacent communities. All employees should be provided with proper Personal Protective Equipment (PPE) and there should be proper health and awareness programs to community members	› The Contractor is responsible for providing PPE to workers and first aid facilities at the construction site › Education on safety considerations will be provided to workers during construction › The project will have to be registered with OSHA and comply with all requirements set by OSHA Act › Project area should be properly fenced to avoid any construction materials to harm neighbours and/or by-standers › Other special health and safety considerations will be provided in the ESMP
There will be accidents if the railways lines are not fenced. There should be proper level crossings for people, motorcycles and vehicles. People should be educated on their importance and respect them	Health and safety concerns will be incorporated into the detailed design of the proposed railways
If the project wants to use TANROADS right of way, then there might be collision with other agency plans such as the expansion of Bus Rapid Transit (BRT) project	Institutional coordination will be key in ensuring that the implementing entity does not affect the other institution's plans
There needs to be stable electricity supply including the availability of standby electrical lines for power supply and there should be a proper risk management plan to address emergencies during operation Underground viaduct are expensive to build and they should have proper ventilation, reliable electricity and drainage system	Project proponent needs to consider this in feasibility study and during detailed design Detail design will consider all the aspects

Morogoro road is the route with more demand in terms of passengers, if possible a commuter train be established in this route. TANROADS has already demolished properties to clear its ROW therefore, it will be ideal for RAHCO to use TANROADS's way leave in the future to set up its railway infrastructure. Ubungo-Mwenge section (along Sam Nujoma road) is well built up area, therefore, whatever plans to develop a railway corridor need to integrate with other existing developments, which are under way such as construction of Ubungo interchange, etc. Railway project will increase competition with other transport operators such as BRT. This will improve efficiency in the transport sector. Currently, the BRT system is overwhelmed with passengers, thus introduction of the railway transport is an optimal solution for transport issues in the city	The relevant authorities will be informed and this will depend on fund availability and prioritised routes. This will also need different studies to justify if the route is more feasible than the other This will be justified through different studies that will be conducted at later stages
Mangroves at the Salender Bridge need to be conserved and not destroyed Utilize the existing structures such as Ubungo interchange and BRT system when connecting the loop from Ubungo to Mwenge. There are several rivers crossings namely river Msimbazi, Sinza, Mbezi and Mlalakuwa which need to be considered during construction and avoid pollution.	This will be considered during a detailed environmental impact assessment study as part of the project Relevant authorities will be informed

6 Impact Identification and Assessment

This section overviews the identification and evaluation of potential environmental and socioeconomic impacts associated with the development of the proposed railway sections and the preferred collective option (Case 3b) as a whole. For each development, the vulnerable environmental components (receptors) and the respective potential impacts are outlined in form of a summary matrix. The matrices also specify a significance rating for each predicted impact and attempt to quantify these on the basis of survey and research findings. The framework applied in deducing significance evaluation ratings is outlined subsequently.

6.1 Tegeta-Aga Khan Railway Line (Case 3b)

The potential impacts associated with the preferred case (Case 3b) are presented in Table 6-1 below.

Table 6-1 Identification and evaluation of potential impacts for Case 3b (Tegeta to Aga-Khan Railway Line).

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Pollution control / public nuisances				
Air quality	C-	C-	Pre-Co and Co: Air pollution due to exhaust emissions from construction machinery and dust generation from earthworks. This potential effect is provisionally characterized as a direct, site-specific, short-term and very small magnitude impact. Op: Reduction of projected air pollution associated with motorway traffic due to the availability of the railway service and a consequently lower demand for road transit. This potential outcome is provisionally characterized as a direct, local, long-term and small magnitude impact.	Standard emissions per kilometre of railway construction are as follows: ▪ CO – 0.005 tonnes/km ▪ NMVOC – 0.002 tonnes/km ▪ NO_x – 0.019 tonnes/km ▪ N_2O – 0.001 tonnes/km ▪ CO_2 – 0.239 tonnes/km ▪ Particulates – 0.001 tonnes/km This impact will affect the airshed of the entire railway corridor.
Water quality	B-	D	Co: Water pollution at the estuary of Msimbazi River due to sediment loading and re-suspension as well as resultant turbidity and remobilization of contaminants, as a result of expected dredging and excavation works for the construction of viaduct pier foundations. This potential effect is provisionally characterized as a direct, site-specific, short-term and medium-magnitude impact.	n/a
	C-	D	Co: Water pollution at the crossing sites of four other rivers[2] due to soil erosion and sedimentation associated with construction works. This potential effect is provisionally characterized as a direct, site-specific, short-term and small-magnitude impact.	Turbidity > 100g/L

[2] Namely, Sinza River, Mlalakua River, Mbezi River and Tegeta River

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
	C-	D	Co: Contamination of surface flow (or and/or water bodies) due to mishandling of chemical materials (e.g. fuels, lubricants, hydraulic fluids, coolants etc.). This potential effect is provisionally characterized as a direct, site-specific, short-term and very-small magnitude impact. Op: Trace contamination of surface runoff along the railway line through sprays, leakages and spillages of contaminants (i.e. heavy metals and toxic organics) from maintenance and upgrade of operationalized railway infrastructure. This potential effect is provisionally characterized as a direct, site-specific, long-term and very-small magnitude impact.	n/a
Soil quality	C-	C-	Co: Land littering from the generation of solid waste (such as spoils, packaging materials, fugitive solid/fluid contaminants) during construction works, from domestic waste generated in and round temporary construction camps and from excavation spoils. This potential effect is provisionally characterized as a direct, site-specific, short-term and very small magnitude impact. Op: Generation of waste (organic scraps from food establishments and commercial packaging refuse from retail facilities) within passenger facilities on trains and train terminals. This potential effect is provisionally characterized as a direct, site-specific, long-term and very-small magnitude impact.	n/a
	C-	D	Co: Trace contamination of topsoil due to mishandling of chemical materials (e.g. fuels, lubricants, hydraulic fluids, coolants etc.). This potential effect is provisionally characterized as a direct, site-specific, short-term and very-small magnitude impact. Op: Trace contamination of topsoil within the depot through sprays, leakages and spillages of contaminants (i.e. heavy metals, toxic organics, wood and steel from rails and rail ties) from maintenance and	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
			of operationalized railway infrastructure. This potential effect is provisionally characterized as a direct, site-specific, long-term and very-small magnitude impact.	
	C-	D	Co: Land destabilization and soil erosion from site preparation and construction works, particularly on sloping terrain and poorly consolidated substrate. This potential effect is provisionally characterized as a direct, site-specific, short-term and medium-magnitude impact.	n/a
Ambient noise and vibration	B-	A-	Co: Noise and vibration pollution from construction works such pile-driving, blasting, drilling and welding etc. This potential effect is provisionally characterized as a direct, site-specific, short-term and large-magnitude impact. Op: Operational acoustic emissions from frictional, aerodynamic and traction effects. This potential effect is provisionally characterized as a direct, site-specific, long-term and large-magnitude impact.	80 – 120 dB
Odour	D	D	Co: Foul odour emissions from the exposure of anoxic soils of the mangrove mudflats within the estuary of Msimbazi River during excavation works for the construction of the elevated crossing. This potential effect is provisionally characterized as a direct, site-specific, short-term and very small magnitude impact.	n/a
Natural Environment				
Protected Areas	A-	D	Co: Disturbance of the mangrove habitats within the mouth of Msimbazi River through small-scale deforestation, excavation and the installation of permanent structures during construction. This potential effect is provisionally characterized as a direct, site-specific, short-term and large-magnitude impact.	n/a
Ecosystems	C-	D	Pre-Co: Clearance of terrestrial vegetation as part of site preparation works. This potential effect is characterized as direct, site-specific, short-term and medium-magnitude impact.	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
	C-	C-	Co: Disturbance of the Dar es Salaam Coast Important Bird Area (stretching from the open bay of Ras Kiramoni in the North, up to and including Ndege Beach, to Ras Ndege, east of Mbwamaji village—a total length of 40 km) through noise-generating construction works within the mangrove belt intercepting Msimbazi River. This potential effect is provisionally characterized as a direct, site-specific, short-term and small magnitude impact. Op: Acoustic disturbance of the Dar es Salaam Coast Important Bird Area (stretching from the open bay of Ras Kiramoni in the North, up to and including Ndege Beach, to Ras Ndege, east of Mbwamaji village—a total length of 40 km) due to operational noise and vibrations. This potential effect is provisionally characterized as a direct, long-term site-specific and small-magnitude impact.	n/a
Hydrology	D	D	Pre-Co: Change in drainage patterns and the hydrological regime of natural streams due to the clearance of vegetation as part of site preparation and soil erosion across river crossings. This potential effect is provisionally characterized as a direct, site-specific, short-term and very-small-magnitude impact. NB: The IEE survey has established that the proposed depot area is not flood-prone as previously indicated, thus no flooding impacts are foreseen to occur upon its development.	n/a
Topography	D	D	No expected impacts.	n/a
Geology	D	D	No expected impacts	n/a
Social Environment				
Human settlements	A-	D	Pre-Co: The establishment of the railway route will necessitate the physical displacement of human settlements along the 30m Right of Way (RoW) as well as the train station and depot footprints of the proposed railway route. This outcome is provisionally characterized as a direct, local, long-term and large-magnitude impact.	› Property count within main line RoW – 72 buildings (both residential and non-residential) › Property count within depot – 423 buildings (both residential and non-residential) › Property count within depot line RoW – 32 buildings (both residential and non-residential)

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
				› Occupied area within main line RoW – 5,419 m² › Occupied area within the depot – 51,539 m² › Occupied area within the depot line RoW – 2,353 m² › Total area of main line RoW – 667,679 m² › Total depot area – 89,676 m² › Total area of depot line RoW – 74,038 m²
Low-income population	A-	A+	Pre-Co: The involuntary resettlement and economic displacement of residents along the RoW as well as the train station and depot footprints of the proposed railway route will result in the impoverishment of the low-income communities. This outcome is provisionally characterized as an indirect, local, long-term and large-magnitude impact. Op: The introduction of an affordable and efficient railway transit system will advantage the low-income population utilizing the transport corridor in that they will be unburdened from motorway traffic time wastages and more expensive, less reliable and/or less safe transport options (e.g. motorcycles, auto rickshaws, cars etc.). This is provisionally characterized as a direct, local, long-term and high-magnitude impact.	n/a
Ethnic minorities and indigenous people	D	D	Co and Op: The IFAD (2012) Country Technical Note on Indigenous Peoples' Issues recognizes a few vulnerable tribes in Tanzania, which are restricted to certain parts of the country, outside of Dar es Salaam. While it cannot be excluded that people representative of these tribes are present in Dar es Salaam as part of their livelihood strategy, Dar es Salaam as a City does not have indigenous entities as such. Thus, no particular impacts are envisioned for these groups with the implementation of the project.	n/a
Local economies (employment,				

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
livelihood, industry etc.)	A-	D	Pre-Co: Economic displacement of land-users established within the RoW and loss of access to livelihood resources. This outcome is provisionally characterized as a direct, local, short-term and large-magnitude impact.	n/a
	A+	B+	Pre-Co and Co: The project, in its mobilization and construction phases, will create employment and income-generation opportunities for a range of formal, informal, skilled and semi-skilled labour and construction industries. This outcome is provisionally characterized as a direct, local, short-term and large-magnitude impact. Op: The train system, once operationalized, will create employment through the operator agency. This outcome is provisionally characterized as a direct, local, long-term and large-magnitude impact.	n/a
Land use	A-	D	Pre-Co: The establishment of the railway line will necessitate the displacement of the existing (physical) commercial, industrial and institutional land-uses, to accommodate the railway RoW, train stations and depot. This outcome is provisionally characterized as a direct, local, long-term and large-magnitude impact.	› Property count within main line RoW – 72 buildings (both residential and non-residential) › Property count within depot – 423 buildings (both residential and non-residential) › Property count within depot line RoW – 32 buildings (both residential and non-residential) › Occupied area within main line RoW – 5,419 m² › Occupied area within the depot – 51,539 m² › Occupied area within the depot line RoW – 2,353 m² › Total area of main line RoW – 667,679 m² › Total depot area – 89,676 m² › Total area of depot line RoW – 74,038 m²
Public infrastructure and utilities	A-	D	Pre-Co: The construction of the railway will entail the realignment and/or re-installation of water (DAWASCO), electricity (TANESCO), optical fibre	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
			cables and gas (SONGAS) distribution infrastructure as well as the disruption of supply regimes. This is provisionally characterized as a direct, local, long-term and large-magnitude impact.	
	B-	D	Co: Increased pressure on public utilities such as water sources, electrical supply and social infrastructure due to heightened demand from construction activities. This outcome is provisionally characterized as a direct, local, short-term and medium-magnitude impact.	n/a
		A+	Op: Reduction of the overburden on the BRT system and commuter bus network with the advent of the low-cost, safe and agile rail transit service. This outcome is provisionally characterized as a direct, local, long-term and large-magnitude impact.	n/a
Cultural heritage	D	D	There are no cultural receptors along the potential project footprint and thus there are no associated impacts.	n/a
Landscape	C-	C-	Co: The construction-associated traffic, structures and marring will bear an impact on the viewshed. This is provisionally characterized as a direct, local, long-term and small-magnitude impact. Op: The new railway infrastructure, particularly the elevated section, will likely reduce the aesthetic value of the landscapes. This is provisionally characterized as a direct, local, long-term and small-magnitude impact.	n/a
Vulnerable groups (women and children)	A-	D	Pre-Co: The physical and economic displacement along the railway RoW will negatively impact on the income level, access to social services and general welfare of the vulnerable demographics (i.e. women-headed households, children, the disabled and the elderly). This is provisionally characterized as a direct, local, short-term and large-magnitude impact.	n/a
	C-	D	Co: Risk of child labour relating to construction works within the project area. This is provisionally characterized as a direct, local, short-term and medium-magnitude impact.	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
	D	A+	Op: The introduction of an affordable and efficient railway transit system will advantage the low-income communities utilizing the transport corridor in that they will be unburdened from motorway traffic time wastages and more expensive, less reliable and/or less safe transport options (e.g. motorcycles, auto rickshaws, cars etc.). This is provisionally characterized as a direct, local, long-term and high-magnitude impact.	n/a
Occupational health and safety	B-	B-	Co: Construction works for the railway establishment pose numerous occupational health and safety hazards (e.g. falls, cuts, electrocution etc.) This is provisionally characterized as a direct, local and medium-magnitude impact. Op: Certain operation and maintenance activities also pose occupational health and safety hazards (e.g. collisions, electrical shocks etc.) This is provisionally characterized as a direct, local, long-term and medium-magnitude impacts.	n/a
	B-	D	Co: The influx of migrant workers for into the construction labour raises increased risk of the spread of HIV/AIDS, especially in the low-income communities associated with the project area. This is provisionally characterized as a direct, local, short-term and medium-magnitude impact.	n/a
Public health and safety	C-	C-	Co: Construction works for the railway establishment pose numerous public health safety hazards (i.e. traffic accidents). This is provisionally characterized as a direct, local, short-term and large-magnitude impact. Op: The operationalization of the railway system will likely alleviate the current prevalence of motorway accidents resulting from heavy congestion and use of faulty/overburdened vehicles. This is provisionally characterized as a direct, local, long-term and medium-magnitude impact.	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
	C-	D	Co: Upswing in crime rates due to the mobilization of resources into the project area and increased business activity within the project area. This is provisionally characterized as a direct, local, short-term-term and medium-magnitude impact.	n/a
Urban traffic	B-	A+	Co: Increased motorway congestion due to traffic associated with construction transit and restricted access to road sections in the course of mobilization and construction works. This outcome is provisionally characterized as a direct, local, short-term-term and medium-magnitude impact.	n/a
			Op: Easement of urban traffic congestion owing to the establishment of an efficient railway transit system. This outcome is provisionally characterized as a direct, local, long-term and medium-magnitude impact.	
Suburbs	D	A+	Op: Economic development, densification and expansion of the suburban reaches of Tegeta resulting from increased access to the Central Business District and the urban development corridors. This outcome is provisionally characterized as a direct, local, long-term and large-magnitude impact.	n/a
Climate Change	D	D	Pre-Co and Co: The construction works will involve the operation of vehicles and construction machinery which will result in greenhouse emissions. This is provisionally characterized as a direct, regional, short-term and very-small magnitude impact.	n/a
			Op: Although the railway system is anticipated to be electricity-powered, it will be indirectly dependant on a gas-based power grid and thereby contribute to the national carbon footprint. This is provisionally characterized as an indirect, regional, long-term and a very small-magnitude impact.	

Note) *1: A+/-: Significant positive/negative impact is expected. B+/-: Positive/negative impact is expected to some extent. C+/-: Extent of positive/negative impact is slight or unknown. (A further examination is needed, and the impact could be clarified as the study progresses) D: No impact is expected or expected impact is negligible.

*2: Pre-Co: Pre Construction Phase, Co: Construction Phase, and Op: Operation Phase (Post Construction)

6.2 Elevated Sections

Table 6-2 below summarizes the potential impacts associated with the elevated section and the sub-sections, which are proposed (in different combinations) for Case 1, Case 2, Case 3a, Case 3b and Case 4:

- Tegeta-Mwenge Sub-Section;
- Mwenge-Aga Khan Sub-Section; and
- Mwenge-Ubungo Sub-Section.

Table 6-2 Identification and evaluation of potential impacts of the construction of the elevated sub-sections.

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Pollution control / public nuisances				
Air quality	C-	C-	Pre-Co and Co: Air pollution due to exhaust emissions from construction machinery and dust generation from earthworks. This potential effect is provisionally characterized as a direct, site-specific, short-term and very small magnitude impact. Op: Reduction of projected air pollution associated with motorway traffic due to the availability of the railway service and a consequently lower demand for road transit. This potential outcome is provisionally characterized as a direct, local, long-term and small magnitude impact.	Standard emissions per kilometre of railway construction are as follows: ▪ CO – 0.005 tonnes/km ▪ NMVOC – 0.002 tonnes/km ▪ NO_x – 0.019 tonnes/km ▪ N_2O – 0.001 tonnes/km ▪ CO_2 – 0.239 tonnes/km ▪ Particulates – 0.001 tonnes/km This impact will affect the airshed of the entire railway corridor.
Water quality	B-	D	Co *(relevant only to the Mwenge-Aga Khan Section)*: Water pollution at the estuary of Msimbazi River due to sediment loading and re-suspension as well as resultant turbidity and remobilization of contaminants, as a result of expected dredging and excavation works for the construction of viaduct pier foundations. This	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
			potential effect is provisionally characterized as a direct, site-specific, short-term and medium-magnitude impact.	
	C-	D	Co: Water pollution at the crossing sites of four other rivers[3] due to soil erosion and sedimentation associated with construction works. This potential effect is provisionally characterized as a direct, site-specific, short-term and small-magnitude impact.	Turbidity > 100g/L
	C-	D	Co: Contamination of surface flow (or and/or water bodies) due to mishandling of chemical materials (e.g. fuels, lubricants, hydraulic fluids, coolants etc.). This potential effect is provisionally characterized as a direct, site-specific, short-term and very-small magnitude impact. Op: Trace contamination of surface runoff along the railway line through sprays, leakages and spillages of contaminants (i.e. heavy metals and toxic organics) from maintenance and upgrade of operationalized railway infrastructure. This potential effect is provisionally characterized as a direct, site-specific, long-term and very-small magnitude impact.	n/a

[3] Namely, Sinza River, Mlalakua River, Mbezi River and Tegeta River

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Soil quality	C-	C-	Co: Land littering from the generation of solid waste (such as spoils, packaging materials, fugitive solid/fluid contaminants) during construction works, from domestic waste generated in and round temporary construction camps and from excavation spoils. This potential effect is provisionally characterized as a direct, site-specific, short-term and very small magnitude impact. Op: Generation of waste (organic scraps from food establishments and commercial packaging refuse from retail facilities) within passenger facilities on trains and train terminals. This potential effect is provisionally characterized as a direct, site-specific, long-term and very-small magnitude impact.	n/a
	C-	D	Co: Trace contamination of topsoil due to mishandling of chemical materials (e.g. fuels, lubricants, hydraulic fluids, coolants etc.). This potential effect is provisionally characterized as a direct, site-specific, short-term and very-small magnitude impact. Op: Trace contamination of topsoil within the depot through sprays, leakages and spillages of contaminants (i.e. heavy metals, toxic organics, wood and steel from rails and rail ties) from maintenance and upgrade of operationalized railway infrastructure. This potential effect is provisionally characterized as a direct, site-specific, long-term and very-small magnitude impact.	n/a
	C-	D	Co: Land destabilization and soil erosion from site preparation and construction works, particularly on sloping terrain and poorly consolidated substrate. This potential effect is provisionally characterized as a direct, site-specific, short-term and medium-magnitude impact.	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Ambient noise and vibration	B-	A-	Co: Noise and vibration pollution from construction works such pile-driving, blasting, drilling and welding etc. This potential effect is provisionally characterized as a direct, site-specific, short-term and large-magnitude impact. Op: Operational acoustic emissions from frictional, aerodynamic and traction effects. This potential effect is provisionally characterized as a direct, site-specific, long-term and large-magnitude impact.	80 – 120 dB
Odour	D	D	Co *(relevant only to the Mwenge-Aga Khan Section)*: Foul odour emissions from the exposure of anoxic soils of the mangrove mudflats within the estuary of Msimbazi River during excavation works for the construction of the elevated crossing. This potential effect is provisionally characterized as a direct, site-specific, short-term and very small magnitude impact.	n/a
Natural Environment				
Protected Areas	A-	D	Co *(relevant only to the Mwenge-Aga Khan Section)*: Disturbance of the mangrove habitats within the mouth of Msimbazi River through small-scale deforestation, excavation and the installation of permanent structures during construction. This potential effect is provisionally characterized as a direct, site-specific, short-term and large-magnitude impact.	n/a
Ecosystems	C-	D	Pre-Co: Clearance of terrestrial vegetation as part of site preparation works. This potential effect is characterized as direct, site-specific, short-term and medium-magnitude impact.	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
	C-	C-	Co *(relevant only to the Mwenge-Aga Khan Section)*: Disturbance of the Dar es Salaam Coast Important Bird Area (stretching from the open bay of Ras Kiramoni in the North, up to and including Ndege Beach, to Ras Ndege, east of Mbwamaji village—a total length of 40 km) through noise-generating construction works within the mangrove belt intercepting Msimbazi River. This potential effect is provisionally characterized as a direct, site-specific, short-term and medium-magnitude impact. Op *(relevant only to the Mwenge-Aga Khan Section)*: Acoustic disturbance of the Dar es Salaam Coast Important Bird Area (stretching from the open bay of Ras Kiramoni in the North, up to and including Ndege Beach, to Ras Ndege, east of Mbwamaji village—a total length of 40 km) due to operational noise and vibrations. This potential effect is provisionally characterized as a direct, long-term site-specific and medium-magnitude impact.	n/a
Hydrology	D	D	Pre-Co: Change in drainage patterns and the hydrological regime of natural streams due to the clearance of vegetation as part of site preparation and soil erosion across river crossings. This potential effect is provisionally characterized as a direct, site-specific, short-term and very-small-magnitude impact. NB: The IEE survey has established that the proposed depot area is not flood-prone as previously indicated, thus no flooding impacts are foreseen to occur upon its development.	n/a
Topography	D	D	No expected impacts.	n/a
Geology	D	D	No expected impacts.	n/a
Social Environment				
Human settlements	A-	D	Pre-Co: The establishment of the railway route will necessitate the physical displacement of human settlements along the 30-m Right of Way (RoW) as well as the train station and depot footprints of the proposed railway route. This outcome is provisionally characterized as a direct, local, long-term and large-magnitude impact.	Tegeta-Mwenge Sub-Section: › Property count within main line RoW – 35 buildings (both residential and non-residential) › Property count within depot – 423 buildings (both residential and non-residential)

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
				› Property count within depot line RoW – 32 buildings (both residential and non-residential) › Occupied area within main line RoW – 3,011 m² › Occupied area within the depot – 51,539 m² › Occupied area within the depot line RoW – 2,353 m² › Total area of main line RoW – 399,944 m² › Total depot area – 89,676 m² › Total area of the depot line RoW – 74,038 m²
				Mwenge-Aga Khan Sub-Section: › Property count within RoW – 78 buildings (both residential and non-residential) › Occupied area within RoW – 5,639 m² › Total RoW area – 273,711 m²
				Mwenge-Ubungo Sub-Section: › Property count within RoW – 79 buildings (both residential and non-residential) › Occupied area within RoW – 5,254 m² › Total RoW area – 144,805 m²

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Low-income population	A-	A+	Pre-Co: The involuntary resettlement and economic displacement of residents along the RoW as well as the train station and depot footprints of the proposed railway route will result in the impoverishment of the low-income communities. This outcome is provisionally characterized as an indirect, local, long-term and large-magnitude impact. Op: The introduction of an affordable and efficient railway transit system will advantage the low-income population utilizing the transport corridor in that they will be unburdened from motorway traffic time wastages and more expensive, less reliable and/or less safe transport options (e.g. motorcycles, auto rickshaws, cars etc.). This is provisionally characterized as a direct, local, long-term and high-magnitude impact.	n/a
Ethnic minorities and indigenous people	D	D	Co and Op: The IFAD (2012) Country Technical Note on Indigenous Peoples' Issues recognizes a few vulnerable tribes in Tanzania, which are restricted to certain parts of the country, outside of Dar es Salaam. While it cannot be excluded that people representative of these tribes are present in Dar es Salaam as part of their livelihood strategy, Dar es Salaam as a City does not have indigenous entities as such. Thus, no particular impacts are envisioned for these groups with the implementation of the project.	n/a
Local economies (employment, livelihood, industry etc.)	A-	D	Pre-Co: Economic displacement of land-users established within the RoW and loss of access to livelihood resources. This outcome is provisionally characterized as a direct, local, short-term and large-magnitude impact.	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
	A+	B+	Pre-Co and Co: The project, in its mobilization and construction phases, will create employment and income-generation opportunities for a range of formal, informal, skilled and semi-skilled labour and construction industries. This outcome is provisionally characterized as a direct, local, short-term and large-magnitude impact. Op: The train system, once operationalized, will create employment through the operator agency. This outcome is provisionally characterized as a direct, local, long-term and large-magnitude impact.	n/a
Land use	A-	D	Pre-Co: The establishment of the railway line will necessitate the displacement of the existing commercial, industrial and institutional land-uses, to accommodate the railway RoW, train stations and depot. This outcome is provisionally characterized as a direct, local, long-term and large-magnitude impact.	Tegeta-Mwenge Sub-Section: › Property count within main line RoW – 35 buildings (both residential and non-residential) › Property count within depot – 423 buildings (both residential and non-residential) › Property count within depot line RoW – 32 buildings (both residential and non-residential) › Occupied area within main line RoW – 3,011 m² › Occupied area within the depot – 51,539 m² › Occupied area within the depot line RoW – 2,353 m² › Total area of main line RoW – 399,944 m² › Total depot area – 89,676 m² › Total area of the depot line RoW – 74,038 m²
				Mwenge-Aga Khan Sub-Section: › Property count within RoW – 78 buildings (both residential and non-residential) › Occupied area within RoW – 5,639 m² › Total RoW area – 273,711 m²

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
				Mwenge-Ubungo Sub-Section: › Property count within RoW – 79 buildings (both residential and non-residential) › Occupied area within RoW – 5,254 m² › Total RoW area – 144,805 m²
Public infrastructures and utilities	A-	D	Pre-Co: The construction of the railway will entail the realignment and/or re-installation of water (DAWASCO), electricity (TANESCO), optical fibre cables and gas (SONGAS) distribution infrastructure as well as the disruption of supply regimes. This is provisionally characterized as a direct, local, long-term and large-magnitude impact.	n/a
	B-	D	Co: Increased pressure on public utilities such as water sources, electrical supply and social infrastructure due to heightened demand from construction activities. This outcome is provisionally characterized as a direct, local, short-term and medium-magnitude impact.	n/a
		A+	Op: Reduction of the overburden on the BRT system and commuter bus network with the advent of the low-cost, safe and agile rail transit service. This outcome is provisionally characterized as a direct, local, long-term and large-magnitude impact.	n/a
Cultural heritage	D	D	There are no cultural receptors along the potential project footprint and thus there are no associated impacts.	n/a
Landscape	C-	C-	Co: The construction-associated traffic, structures and marring will bear an impact on the viewshed. This is provisionally characterized as a direct, local, long-term and small-magnitude impact. Op: The new railway infrastructure, particularly the elevated section, will likely reduce the aesthetic value of the landscapes. This is provisionally characterized as a direct, local, long-term and small-magnitude impact.	n/a
	A-	D	Pre-Co:	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Vulnerable groups (women and children)			The physical and economic displacement along the railway RoW will negatively impact on the income level, access to social services and general welfare of the vulnerable demographics (i.e. women-headed households, children, the disabled and the elderly). This is provisionally characterized as a direct, local, short-term and large-magnitude impact.	
	C-	D	Co: Risk of child labour relating to construction works within the project area. This is provisionally characterized as a direct, local, short-term and medium-magnitude impact.	n/a
	D	A+	Op: The introduction of an affordable and efficient railway transit system will advantage the low-income communities utilizing the transport corridor in that they will be unburdened from motorway traffic time wastages and more expensive, less reliable and/or less safe transport options (e.g. motorcycles, auto rickshaws, cars etc.). This is provisionally characterized as a direct, local, long-term and high-magnitude impact.	n/a
Occupational health and safety	B-	B-	Co: Construction works for the railway establishment pose numerous occupational health and safety hazards (e.g. falls, cuts, electrocution etc.) This is provisionally characterized as a direct, local and medium-magnitude impact. Op: Certain operation and maintenance activities also pose occupational health and safety hazards (e.g. collisions, electrical shocks etc.) This is provisionally characterized as a direct, local, long-term and medium-magnitude impacts.	n/a
	B-	D	Co: The influx of migrant workers for into the construction labour raises increased risk of the spread of HIV/AIDS, especially in the low-income communities associated with the project area. This is provisionally characterized as a direct, local, short-term and medium-magnitude impact.	n/a
	C-	C-	Co:	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Public health and safety			Construction works for the railway establishment pose numerous public health safety hazards (i.e. traffic accidents). This is provisionally characterized as a direct, local, short-term and large-magnitude impact. Op: The operationalization of the railway system will likely alleviate the current prevalence of motorway accidents resulting from heavy congestion and use of faulty/overburdened vehicles. This is provisionally characterized as a direct, local, long-term and medium-magnitude impact.	
	C-	D	Co: Upswing in crime rates due to the mobilization of resources into the project area and increased business activity within the project area. This is provisionally characterized as a direct, local, short-term-term and medium-magnitude impact.	n/a
Urban traffic	B-	A+	Co: Increased motorway congestion due to traffic associated with construction transit and restricted access to road sections in the course of mobilization and construction works. This outcome is provisionally characterized as a direct, local, short-term-term and medium-magnitude impact. Op: Easement of urban traffic congestion owing to the establishment of an efficient railway transit system. This outcome is provisionally characterized as a direct, local, long-term and medium-magnitude impact.	n/a
Suburbs	D	A+	Op: Economic development, densification and expansion of the suburban reaches of Tegeta resulting from increased access to the Central Business District and the urban development corridors. This outcome is provisionally characterized as a direct, local, long-term and large-magnitude impact.	n/a
Climate Change	D	D	Pre-Co and Co: The construction works will involve the operation of vehicles and construction machinery which will result in greenhouse emissions. This	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
			is provisionally characterized as a direct, regional, short-term and very-small magnitude impact.	
			Op: Although the railway system is anticipated to be electricity-powered, it will be indirectly dependant on a gas-based power grid and thereby contribute to the national carbon footprint. This is provisionally characterized as an indirect, regional, long-term and a very small-magnitude impact.	

Note) *1: A+/-: Significant positive/negative impact is expected. B+/-: Positive/negative impact is expected to some extent. C+/-: Extent of positive/negative impact is slight or unknown. (A further examination is needed, and the impact could be clarified as the study progresses) D: No impact is expected or expected impact is negligible.

*2: Pre-Co: Pre Construction Phase, Co: Construction Phase, and Op: Operation Phase (Post Construction.

6.3 At-Grade Section (Ubungo-CBD)

The potential impacts associated with the proposed upgrading of the existing at-grade section (Ubungo-CBD).

Table 6-3 Identification and evaluation of potential impacts for the proposed upgrading of the at-grade section.

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Pollution control / public nuisances				
Air quality	C-	C-	Pre-Co and Co: Air pollution due to exhaust emissions from construction machinery and dust generation from earthworks. This potential effect is provisionally characterized as a direct, site-specific, short-term and very small magnitude impact. Op: Reduction of projected air pollution associated with motorway traffic due to the availability of the railway service and a consequently lower demand for road transit. This potential outcome is provisionally characterized as a direct, local, long-term and small magnitude impact.	Standard emissions per kilometre of railway construction are as follows: ▪ CO – 0.005 tonnes/km ▪ NMVOC – 0.002 tonnes/km ▪ NO_x – 0.019 tonnes/km ▪ N_2O – 0.001 tonnes/km ▪ CO_2 – 0.239 tonnes/km ▪ Particulates – 0.001 tonnes/km This impact will affect the airshed of the entire railway corridor.
Water quality	D	D	Co: Increased water turbidity at the crossing site of Msimbazi River due to soil erosion and sedimentation associated with construction/upgrading works. This potential effect is provisionally characterized as a direct, site-specific, short-term and very small-magnitude impact.	Turbidity > 100g/L

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
	C-	D	Co: Contamination of surface flow (or and/or water bodies) due to mishandling of chemical materials (e.g. fuels, lubricants, hydraulic fluids, coolants etc.). This potential effect is provisionally characterized as a direct, site-specific, short-term and very-small magnitude impact. Op: Trace contamination of surface runoff along the railway line through sprays, leakages and spillages of contaminants (i.e. heavy metals and toxic organics) from maintenance and upgrade of operationalized railway infrastructure. This potential effect is provisionally characterized as a direct, site-specific, long-term and very-small magnitude impact.	n/a
Soil quality	C-	C-	Co: Land littering from the generation of solid waste (such as spoils, packaging materials, fugitive solid/fluid contaminants) during construction works and that from domestic waste generated in and round temporary construction camps. This potential effect is provisionally characterized as a direct, site-specific, short-term and very small magnitude impact. Op: Generation of waste (organic scraps from food establishments and commercial packaging refuse from retail facilities) within passenger facilities on trains and train terminals. This potential effect is provisionally characterized as a direct, site-specific, long-term and very-small magnitude impact.	n/a
	C-	D	Co: Trace contamination of topsoil due to mishandling of chemical materials (e.g. fuels, lubricants, hydraulic fluids, coolants etc.). This potential effect is provisionally characterized as a direct, site-specific, short-term and very-small magnitude impact. Op: Trace contamination of topsoil along the railway line and within the depot through sprays, leakages and spillages of contaminants (i.e. heavy metals, toxic organics, wood and steel from rails and rail ties)	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
			from maintenance and upgrade of operationalized railway infrastructure. This potential effect is provisionally characterized as a direct, site-specific, long-term and very-small magnitude impact.	
Ambient noise and vibration	B-	A-	Co: Noise and vibration pollution from construction works such pile-driving, blasting, drilling and welding etc. This potential effect is provisionally characterized as a direct, site-specific, short-term and large-magnitude impact. Op: Operational acoustic emissions from frictional, aerodynamic and traction effects. This potential effect is provisionally characterized as a direct, site-specific, long-term and large-magnitude impact.	80 – 120 dB
Odour	D	D	No expected impacts.	n/a
Natural Environment				
Ecosystems	D	D	Pre-Co: Clearing of terrestrial vegetation as part of site preparation works. This potential effect is characterized as direct, site-specific, short-term and very small-magnitude impact.	n/a
Hydrology	D	D	Op: Non-significant hydrological impacts associated with the drainage system to be established for the railway line.	n/a
Topography	D	D	No expected impacts.	n/a
Geology	D	D	No expected impacts.	n/a
Social Environment				
Human settlements	D	D	No expected impacts as the RoW for the existing railway line is not occupied.	No property or land is to be displaced/ acquired as the designated RoW is already in place for the existing railway section.

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Low-income population	A+	A+	Pre-Co and Co: Income generation opportunities (i.e. informal labour and ancillary services) during the pre-construction and construction phase. This is provisionally characterized as a direct, local, short-term and large-magnitude impact. Op: The introduction of an affordable and efficient railway transit system will advantage the low-income communities utilizing the transport corridor in that they will be unburdened from motorway traffic time wastages and more expensive, less reliable and/or less safe transport options (e.g. motorcycles, auto rickshaws, cars etc.). This is provisionally characterized as a direct, local, long-term and high-magnitude impact.	n/a
Ethnic minorities and indigenous people	D	D	Co and Op: The IFAD (2012) Country Technical Note on Indigenous Peoples' Issues recognizes a few vulnerable tribes in Tanzania, which are restricted to certain parts of the country, outside of Dar es Salaam. While it cannot be excluded that people representative of these tribes are present in Dar es Salaam as part of their livelihood strategy, Dar es Salaam as a City does not have indigenous entities as such. Thus, no particular impacts are envisioned for these groups with the implementation of the project.	n/a
Local economies (employment, livelihood, industry etc.)	A+	B+	Pre-Co and Co: The project, in its mobilization and construction phases, will create employment and income-generation opportunities for a range of formal, informal, skilled and semi-skilled labour and construction industries. This outcome is provisionally characterized as a direct, local, short-term and large-magnitude impact. Op: The train system, once operationalized, may create additional employment opportunities through the operator agency. This outcome is provisionally characterized as a direct, local, long-term and small-magnitude impact.	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Land use	D	D	No expected impacts as the RoW for the existing railway line is not occupied.	No property or land is to be displaced/ acquired as the designated RoW is already in place for the existing railway section.
Public infrastructure and utilities	B-	D	Co: Increased pressure on public utilities such as water sources, electrical supply and social infrastructure due to heightened demand from construction activities. This outcome is provisionally characterized as a direct, local, short-term and medium-magnitude impact.	n/a
	D	A+	Op: Reduction of the overburden on the BRT system and commuter bus network with the advent of the low-cost, safe and agile rail transit service. This outcome is provisionally characterized as a direct, local, long-term and large-magnitude impact.	n/a
Cultural heritage	D	D	There are no cultural receptors along the potential project footprint and thus there are no associated impacts.	n/a
Landscape	C-	D	Co: The construction-associated traffic, structures and marring will bear an impact on the viewshed. This is provisionally characterized as a direct, local, long-term and small-magnitude impact.	n/a
Vulnerable groups	C-	D	Co: Risk of child labour relating to upgrading works within the project area. This is provisionally characterized as a direct, local, short-term and medium-magnitude impact.	n/a
	D	A+	Op: The introduction of an affordable and efficient railway transit system will advantage the low-income communities utilizing the transport corridor in that they will be unburdened from motorway traffic time wastages and more expensive, less reliable and/or less safe transport options (e.g. motorcycles, auto rickshaws, cars etc.). This is provisionally characterized as a direct, local, long-term and high-magnitude impact.	n/a
Occupational health and safety	B-	B-	Co: Construction works for the railway establishment pose numerous occupational health and safety hazards (e.g. falls, cuts, electrocution	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
			etc.) This is provisionally characterized as a direct, local and medium-magnitude impact. Op: Certain operation and maintenance activities also pose occupational health and safety hazards (e.g. collisions, electrical shocks etc.) This is provisionally characterized as a direct, local, long-term and medium-magnitude impacts.	
	B-	D	Co: The influx of migrant workers for into the construction labour raises increased risk of the spread of HIV/AIDS, especially in the low-income communities associated with the project area. This is provisionally characterized as a direct, local, short-term and medium-magnitude impact.	n/a
Public health and safety	C-	C-	Co: Construction works for the railway establishment pose numerous public health safety hazards (i.e. traffic accidents). This is provisionally characterized as a direct, local, short-term and large-magnitude impact. Op: The operationalization of the railway system will likely alleviate the current prevalence of motorway accidents resulting from heavy congestion and use of faulty/overburdened vehicles. This is provisionally characterized as a direct, local, long-term and medium-magnitude impact.	n/a
	D	A-	Op: Increased risk of accidental collisions at the crossings of the railway with motorways. This is provisionally characterized as a direct, local, long-term and large-magnitude impact.	
	C-	D	Co: Upswing in crime rates due to the mobilization of resources into the project area and increased business activity within the project area. This is provisionally characterized as a direct, local, short-term-term and medium-magnitude impact.	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Urban traffic	B-	A+	Co: Increased motorway congestion due to traffic associated with construction transit and restricted access to road sections in the course of mobilization and construction works. This outcome is provisionally characterized as a direct, local, short-term-term and medium-magnitude impact. Op: Easement of urban traffic congestion owing to the establishment of an efficient railway transit system. This outcome is provisionally characterized as a direct, local, long-term and medium-magnitude impact.	n/a
Suburbs	D	D	No significant impacts expected.	n/a
Climate Change	D	D	Pre-Co and Co: The construction works will involve the operation of vehicles and construction machinery which will result in greenhouse emissions. This is provisionally characterized as a direct, regional, short-term and very-small magnitude impact.	n/a
			Op: Although the railway system is anticipated to be electricity-powered, it will be indirectly dependant on a gas-based power grid and thereby contribute to the national carbon footprint. This is provisionally characterized as an indirect, regional, long-term and a very small-magnitude impact.	

Note) *1: A+/-: Significant positive/negative impact is expected. B+/-: Positive/negative impact is expected to some extent. C+/-: Extent of positive/negative impact is slight or unknown. (A further examination is needed, and the impact could be clarified as the study progresses) D: No impact is expected or expected impact is negligible.

*2: Pre-Co: Pre Construction Phase, Co: Construction Phase, and Op: Operation Phase (Post Construction.

6.4 Transition and Underground Sections (Aga Khan-CBD)

Table 6-4 overviews the potential impacts associated with the proposed transition and underground railway sections leading to the city centre.

Table 6-4 Identification and evaluation of potential impacts for the construction of the transition and underground sections.

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Pollution control / public nuisances				
Air quality	C-	C-	Pre-Co and Co: Air pollution due to exhaust emissions from construction machinery and dust generation from earthworks. This potential effect is provisionally characterized as a direct, site-specific, short-term and very small magnitude impact. Op: Reduction of projected air pollution associated with motorway traffic due to the availability of the railway service and a consequently lower demand for road transit. This potential outcome is provisionally characterized as a direct, local, long-term and small magnitude impact.	Standard emissions per kilometre of railway construction are as follows: ▪ CO – 0.005 tonnes/km ▪ NMVOC – 0.002 tonnes/km ▪ NO_x – 0.019 tonnes/km ▪ N_2O – 0.001 tonnes/km ▪ CO_2 – 0.239 tonnes/km ▪ Particulates – 0.001 tonnes/km This impact will affect the airshed of the entire railway corridor.
Water quality	C-	D	Co: Contamination of groundwater flow (and overflow for the transition section) due to mishandling of chemical materials (e.g. fuels, lubricants, hydraulic fluids, coolants etc.). This potential effect is provisionally characterized as a direct, site-specific, short-term and very-small magnitude impact.	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Soil quality	B-	C-	Co: Land littering from the generation of solid waste (such as spoils, packaging materials, fugitive solid/fluid contaminants) during construction works, from domestic waste generated in and round temporary construction camps as well as from excavated spoils. This potential effect is provisionally characterized as a direct, site-specific, short-term and very small magnitude impact. Op: Generation of waste (organic scraps from food establishments and commercial packaging refuse from retail facilities) within passenger facilities on trains and train terminals. This potential effect is provisionally characterized as a direct, site-specific, long-term and very-small magnitude impact.	n/a
	C-	D	Co: Trace contamination of topsoil due to mishandling of chemical materials (e.g. fuels, lubricants, hydraulic fluids, coolants etc.). This potential effect is provisionally characterized as a direct, site-specific, short-term and very-small magnitude impact.	n/a
Ambient noise and vibration	B-	D	Co: Noise and vibration pollution from construction works such pile-driving, blasting, drilling and welding etc. This potential effect is provisionally characterized as a direct, site-specific, short-term and large-magnitude impact. Op: Operational acoustic emissions from frictional, aerodynamic and traction effects. This potential effect is provisionally characterized as a direct, site-specific, long-term and very small-magnitude impact.	n/a
Odour	D	D	No expected impacts.	n/a
Natural Environment				
Ecosystems	D	D	No expected impacts.	n/a
Hydrology	D	D	Co and Op: The construction of an underground railway passage (shield tunnel) will affect the groundwater flow pattern in the area. This potential	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
			effect is provisionally characterized as a direct, local, long-term and very small-magnitude impact.	
Topography	D	D	No expected impacts.	n/a
Geology	D	D	Co and Op: The construction of the sub-surface shield tunnel will involve excavations that will permanently alter the existing bed-rock and aquifers. This potential effect is provisionally characterized as a direct, local, long-term and very-small magnitude impact.	n/a
Social Environment				
Human settlements	A-	D	The underground railway section will require a confined and temporary (construction phase) RoW whereas the transition section will cut across an uninhabited golf course. However, the underground CBD train section will render physical displacement as its development will involve cut-and-cover construction. This is provisionally characterized as a direct, site-specific, long-term and high-magnitude impact.	Transition Section: › Property count within RoW – 1 golf course › Occupied area within RoW – NIL › Total RoW area – 15,988 m² Underground Section: › Property count within RoW[4] – NIL › Property count within train station footprint[5] – 25 buildings › Occupied area of train station footprint – 2,609 m² › Total area of train station footprint – 7,428 m²

[4] No physical displacement is expected as a minimal RoW is foreseen to be exacted for the horizontal unidirectional drilling modality for the railway construction works.

[5] The underground train station will necessitate physical displacement on account of cut-and-cover construction.

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Low-income population	A+	A+	Pre-Co and Co: Income generation opportunities (i.e. informal labour and ancillary services) during the pre-construction and construction phase. This is provisionally characterized as a direct, local, short-term and large-magnitude impact. Op: The introduction of an affordable and efficient railway transit system will advantage the low-income communities utilizing the transport corridor in that they will be unburdened from motorway traffic time wastages and more expensive, less reliable and/or less safe transport options (e.g. motorcycles, auto rickshaws, cars etc.) to access the CBD. This is provisionally characterized as a direct, local, long-term and high-magnitude impact.	n/a
Ethnic minorities and indigenous people	D	D	Co and Op: The IFAD (2012) Country Technical Note on Indigenous Peoples' Issues recognizes a few vulnerable tribes in Tanzania, which are restricted to certain parts of the country, outside of Dar es Salaam. While it cannot be excluded that people representative of these tribes are present in Dar es Salaam as part of their livelihood strategy, Dar es Salaam as a City does not have indigenous entities as such. Thus, no particular impacts are envisioned for these groups with the implementation of the project.	n/a
Local economies (employment, livelihood, industry etc.)	A+	B+	Pre-Co and Co: The project, in its mobilization and construction phases, will create employment and income-generation opportunities for a range of formal, informal, skilled and semi-skilled labour and construction industries. This outcome is provisionally characterized as a direct, local, short-term and large-magnitude impact. Op: The train system, once operationalized, may create additional employment opportunities through its operating agency. This outcome is provisionally characterized as a direct, local, long-term and small-magnitude impact.	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Land use	A-	D	Pre-Co and Co: The construction activities for the transition and underground sections will render the displacement and disruption of both residential and commercial land use, particularly within the CBD. This outcome is provisionally characterized as a direct, site-specific, long-term and large-magnitude impact.	Transition Section: › Property count within RoW – 1 golf course › Occupied area within RoW – NIL › Total RoW area – 15,988 m²
				Underground Section: › Property count within RoW[6] – NIL › Property count within train station footprint[7] – 25 buildings › Occupied area of train station footprint – 2,609 m² › Total area of train station footprint – 7,428 m²
Public infrastructure and utilities	B-	D	Co: Increased pressure on public utilities such as water sources, electrical supply and social infrastructure due to heightened demand from construction activities. This outcome is provisionally characterized as a direct, local, short-term and medium-magnitude impact.	n/a
	A-	D	Pre-Co: The construction of the railway may entail the realignment and/or re-installation of water (DAWASCO), optical fibre cables and electricity (TANESCO) distribution infrastructure and the consequent disruption of supply regimes. This is provisionally characterized as a direct, local, long-term and large-magnitude impact.	n/a
	D	A+	Op: Reduction of the overburden on the BRT system and commuter bus network with the advent of the low-cost, safe and agile rail transit service extending to the CBD. This outcome is provisionally characterized as a direct, local, long-term and large-magnitude impact.	n/a
Cultural heritage	D	D	No cultural impacts are expected as there are no cultural receptors along the potential project footprint.	n/a

[6] No physical displacement is expected as a minimal RoW is foreseen to be exacted for the horizontal unidirectional drilling modality for the railway construction works.

[7] The underground train station will necessitate physical displacement on account of cut-and-cover construction.

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
Landscape	C-	C-	Co: The construction-associated traffic, structures and marring will bear an impact on the viewshed. This is provisionally characterized as a direct, local, long-term and small-magnitude impact. Op: The railway infrastructure comprising the transition section will likely reduce the aesthetic value of the surrounding landscape. This is provisionally characterized as a direct, local, long-term and small-magnitude impact.	n/a
Vulnerable groups	C-	D	Co: Risk of child labour relating to upgrading works within the project area. This is provisionally characterized as a direct, local, short-term and medium-magnitude impact.	n/a
	D	A+	Op: The introduction of an affordable and efficient railway transit system will advantage the low-income communities utilizing the transport corridor in that they will be unburdened from motorway traffic time wastages and more expensive, less reliable and/or less safe transport options (e.g. motorcycles, auto rickshaws, cars etc.) in accessing the CBD. This is provisionally characterized as a direct, local, long-term and high-magnitude impact.	n/a
Occupational health and safety	B-	B-	Co: Construction works for the railway establishment pose numerous occupational health and safety hazards (e.g. falls, cuts, electrocution etc.) This is provisionally characterized as a direct, local and medium-magnitude impact. Op: Certain operation and maintenance activities also pose occupational health and safety hazards (e.g. collisions, electrical shocks etc.) This is provisionally characterized as a direct, local, long-term and medium-magnitude impacts.	n/a
	B-	D	Co: The influx of migrant workers for into the construction labour raises increased risk of the spread of HIV/AIDS, especially in the low-income communities associated with the project area. This is provisionally	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
			characterized as a direct, local, short-term and medium-magnitude impact.	
Public health and safety	C-	C-	Co: Construction works for the railway establishment pose numerous public health safety hazards (i.e. traffic accidents). This is provisionally characterized as a direct, local, short-term and large-magnitude impact. Op: The operationalization of the railway system will likely alleviate the current prevalence of motorway accidents resulting from heavy congestion and use of faulty/overburdened vehicles. This is provisionally characterized as a direct, local, long-term and medium-magnitude impact.	n/a
	C-	D	Co: Upswing in crime rates due to the mobilization of resources into the project area and increased business activity within the project area. This is provisionally characterized as a direct, local, short-term-term and medium-magnitude impact.	n/a
Urban traffic	B-	A+	Co: Increased motorway congestion due to traffic associated with construction transit and restricted access to road sections in the course of mobilization and construction works. This outcome is provisionally characterized as a direct, local, short-term-term and medium-magnitude impact. Op: Easement of traffic congestion in and around the CBD owing to the establishment of an efficient railway transit system. This outcome is provisionally characterized as a direct, local, long-term and medium-magnitude impact.	n/a
Suburbs	D	D	No significant impacts expected.	n/a
Climate Change	D	D	Pre-Co and Co: The construction works will involve the operation of vehicles and construction machinery which will result in greenhouse emissions. This	n/a

Environmental component/receptor	Significance rating for each phase		Potential impact and basis for significance rating for each phase	Impact quantification based on survey results
	Pre-Co/Co	Op		
			is provisionally characterized as a direct, regional, short-term and very-small magnitude impact.	
			Op: Although the railway system is anticipated to be electricity-powered, it will be indirectly dependant on a gas-based power grid and thereby contribute to the national carbon footprint. This is provisionally characterized as an indirect, regional, long-term and a very small-magnitude impact.	

Note) *1: A+/-: Significant positive/negative impact is expected. B+/-: Positive/negative impact is expected to some extent. C+/-: Extent of positive/negative impact is slight or unknown. (A further examination is needed, and the impact could be clarified as the study progresses) D: No impact is expected or expected impact is negligible.

*2: Pre-Co: Pre Construction Phase, Co: Construction Phase, and Op: Operation Phase (Post Construction.

Table 6-5 Criteria for assessment of nature, extension, duration and magnitude of impacts

Criterion	Description
Nature	**Nature of the environmental change**
Positive	Beneficial environmental change
Negative	Adverse environmental change
Reversible	Impact temporary. Impacted features will recover
Irreversible	Impact permanent Impacted features will not recover
Direct	Impact a direct effect of project
Indirect	Impact a secondary effect of project
Extent	**The geographical area that may affected by the impact**
Regional	Beyond 10 km of the site boundary
Local	Within 10 km of the site boundary
Site specific	On site
Duration	**Period along which the impact is expected to occur***
Short-term	Construction period
Medium-term	Between 0 and 5 (five) years after construction
Long-term	More than 5 years after construction
Magnitude	**Effects on environment and on social conditions**
Large	*Environment* Natural functions and processes are ***severely altered.*** Sensitive/protected species or habitats severely affected *Social conditions* Social conditions are ***severely affected***
Medium	*Environment* Natural functions and processes are ***notably altered.*** Sensitive/protected species or habitats not affected *Social conditions* Social conditions are ***notably affected***
Small	*Environment* Natural functions and processes are ***slightly altered.*** Sensitive/protected species or habitats affected *Social conditions* Social conditions are ***slightly affected***
Very small	*Environment* Natural functions and processes are ***negligibly altered***. *Social conditions* Social conditions are ***negligibly affected***
Zero	*Environment* Natural functions and processes remain unaltered. *Social conditions* Social conditions not affected

Table 6-6 Definitions of significance ratings

Significance rating	**Definition**
A+/-	Significant positive/negative impact is expected.
B+/-	Positive/negative impact is expected to some extent.
C+/-	Extent of positive/negative impact is slight or unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D	No impact is expected or expected impact is negligible.

7 Impact Mitigation Measures

This section presents the mitigation measures for the environmental and socioeconomic impacts expected to occur with the implementation of any of the proposed railway development cases. The impacts and their respective mitigation requirements are listed by implementation phase.

7.1 Pre-construction Phase

7.1.1 Clearance of vegetation as part of site preparation works

Mitigation of this impact will require the restriction of clearing works to the 30m Right of Way (RoW) of the railways.

7.1.2 Air pollution due to exhaust emissions from construction machinery and dust generation from earthworks

Mitigation measures to address air pollution are as follows:

- Powering off of idle construction machinery including all heavy equipment and vehicles;
- Non-usage of malfunctioning and fuel-inefficient machinery to reduce exhaust and fugitive output;
- Enforcement of routine maintenance checks and servicing for motorized construction machinery;
- Usage of dust suppressing agents such as water (wetting) and compaction of exposed site surfaces and unpaved roads, particularly during dry and/or weather;
- Side enclosure and covering of any aggregate or dusty material storage piles to for dust abatement;
- Minimization of aggregates dropping height;
- Coverage of aggregate hauling vehicles with tarpaulins or other impervious sheeting; and
- Provision of not less than 2.4m high hoarding from ground level along site boundaries adjoining publically accessible zones (e.g. roads, streets etc.).

7.1.3 The establishment of the railway route will necessitate the physical displacement of settlements and other establishments along the 30m Right of Way (RoW) of the proposed railways

The adverse implications associated with resettlement can be precluded, alleviated and minimized as follows:

- Participatory planning and engagement of the local communities in planning for best alignment alternatives;
- Provision of full and timely compensation to displaced property holders following proper property count and valuation survey within the Row; and
- Institution of grievance redress mechanisms.

7.1.4 The involuntary resettlement of residents along the Right of Way will result in the impoverishment of the low-income communities and vulnerable groups

This impact can be addressed through:

- Conduct of livelihoods restoration planning as part of resettlement planning;
- Participatory planning and engagement of the local communities in planning for best alignment alternatives;
- Provision of full and timely compensation to displaced property holders following proper property count and valuation survey within the RoW;
- Institution of grievance redress mechanisms;
- Prohibition and monitoring of child labour.

7.1.5 Economic displacement of land-users established within the Right of Way and loss of access to livelihood resources

This impact can be managed by the conduct of vulnerability assessments and livelihoods restoration planning as part of resettlement planning.

7.1.6 Realignment and/or re-installation of water (DAWASCO), electricity (TANESCO), optical fibre and gas (SONGAS) distribution infrastructure

Participatory planning and the engagement of utility management authorities in planning for the alignment alternatives, and the relocation and/or re-installation of utility infrastructure will be required to the effect of mitigate the displacement and/or modification of the utility infrastructure.

7.2 Construction phase

7.2.1 Air pollution due to exhaust emissions from construction machinery and dust generation from earthworks

Mitigation measures to address air pollution are as follows:

- Powering off of idle construction machinery including all heavy equipment and vehicles;
- Non-usage of malfunctioning and fuel-inefficient machinery to reduce exhaust and fugitive output;
- Enforcement of routine maintenance checks and servicing for motorized construction machinery;
- Usage of dust suppressing agents such as water (wetting) and compaction of exposed site surfaces and unpaved roads, particularly during dry and/or weather;
- Side enclosure and covering of any aggregate or dusty material storage piles to for dust abatement;
- Minimization of aggregates dropping height;
- Coverage of aggregate hauling vehicles with tarpaulins or other impervious sheeting; and
- Provision of not less than 2.4m high hoarding from ground level along site boundaries adjoining publically accessible zones (e.g. roads, streets etc.).

7.2.2 Water pollution in the estuary of Msimbazi River due to sediment loading and re-suspension, resultant turbidity and remobilization of contaminants from dredging and excavation works for the construction of foundations for the viaduct columns

This impact can be abated as follows:

- Minimization of mangroves clearance at excavations sites;
- At the dredging sites, adverse effects on water quality can be minimized by employment of hydraulic dredges, use of clamshell buckets (for mechanical dredges), installation of silt curtains, proper maintenance of dredging equipment and restriction of the dredging time/rate; and

- At the disposal site(s), sediment dispersal can be curtailed by constraining the timing/rate of disposal, using submerged diffusers and placing dredged material in geotextile bags to reduce water column exposure during dumping.

7.2.3 Water pollution at river crossings sites due to soil erosion and sedimentation associated with construction works

Mitigation measures are to include:

- Implementation of erosion control measures to minimize sediment influx and resulting in-stream turbidity upon the construction of bridges (e.g. retaining barriers, grassing and consolidation with rock fill)
- Minimization of vegetation clearance along the crossing site.

7.2.4 Contamination of surface flow due to mishandling of chemical materials (e.g. fuels, lubricants, hydraulic fluids, coolants etc.) during construction

For this impact, the requisite mitigation requirements are:

- Observation of proper handling practices and procedures for chemical input materials and wastes;
- Construction of hard standings or impervious surfaces for fluid transfer facilities;
- Adequate containment facilities for mass storage of liquid chemicals; and
- Development of a spill response plan.

7.2.5 Land destabilization and soil erosion from site preparation and construction works, particularly on sloping terrain and poorly consolidated substrate

Mitigation measures to be considered are as follows:

- Backfilling of borrow pits and reuse of outstanding spoil and aggregate piles;
- Compaction where necessary;
- Scheduling to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical;

- Contouring and minimizing length and steepness of slopes;
- Mulching to stabilize exposed areas;
- Re-vegetating areas promptly;
- Designing channels and ditches for post-construction flows;
- Lining steep channel and slopes (e.g. use jute matting).

7.2.6 Land littering from the generation of solid waste (such as spoils, packaging materials, fugitive solid/fluid contaminants) during construction works and that from domestic waste generated in and round temporary construction camps

Mitigation for this impact is to involve:

- Removal of all construction waste as part demobilization activities within the project sites;
- Management of waste streams to isolate recyclable debris and any hazardous waste and compost organic waste;
- Placement of litter restriction signage where appropriate;
- Installation of waste storage receptacles are resistant as possible to storm water runoff and scavenger animals.

7.2.7 Noise and vibration pollution from construction works such pile-driving, blasting, drilling and welding etc. This impact applies to both the full-loop line and the half-loop line

The following mitigation requirements are to be considered:

- Selecting equipment with lower sound power levels;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment casing radiating noise;
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective;

- Installing vibration isolation for mechanical equipment;
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile; sources operating through community areas;
- Reducing project traffic routing through community.

7.2.8 Foul odour emissions from the exposure of anoxic soils of the mangrove mudflats in the Msimbazi river estuary during excavation works for the construction of the river crossing

Mitigation for this should involve the installation of containment systems as required.

7.2.9 Disturbance of the mangrove forest habitats within the Msimbazi estuary through vegetation clearing, excavation and the establishment of permanent structures during construction

The impact can be controlled by design and monitoring efforts to minimize the clearance of mangroves and earthworks within the estuarine ecosystem.

7.2.10 Disturbance of the Dar es Salaam Coast Important Bird Area through noise-generating construction works within the mangrove belt intercepting Msimbazi River

This impact is will require ablation by means of:

- Noise and vibration control measures in proximity to key avifauna habitats and other sensitive faunal communities;
- Maintenance or creation of vegetation screens to reduce illumination of adjacent habitats.

7.2.11 Change in drainage patterns and the hydrological regime of natural streams due to the clearance of vegetation as part of site preparation and soil erosion across river crossings

Mitigation measures for this impact include:

- Compaction where necessary;
- Scheduling to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical;

- Contouring and minimizing length and steepness of slopes;
- Mulching to stabilize exposed areas;
- Re-vegetating areas promptly, especially around the rivers/streams;
- Designing proper channels and ditches for post-construction flows; and
- Lining steep channel and slopes (e.g. use jute matting).

7.2.12 The project, in its construction phase, will create employment and income-generation opportunities for a range of skilled and semi-skilled labour

This impact can be enhanced through:

- Prioritization capable locals in the recruitment of construction and operational labour;
- Sourcing of products and ancillary services from local providers;
- Promotion of equal and non-discriminatory opportunities in local employment;
- Prohibition of child labor and follow-up monitoring.

7.2.13 Landscape depreciation due to construction-associated traffic, structures and marring

The potential loss in the aesthetic value of the view sheds of the project area, and construction eyesore can be minimized by:

- Hoarding to reduce public visibility of construction infrastructure and management of construction traffic;
- Post-construction landscaping and site rehabilitation.

7.2.14 Increased risk of HIV/AIDS transmission due to the influx of construction workers into the project area and their anticipated interface with the surrounding communities

This risk can be minimized by the mobilization of awareness creation campaigns for HIV/AIDS for the construction recruits stationed around service-providing communities.

7.2.15 Occupational hazards (i.e. falls, cuts, electrocution etc.) and risk of occupational injury and/or disability

Mitigation for this impact is to include:

- Provision of Health, Safety, Security and Environment (HSSE) induction for all construction labor;
- Provision of Personal Protective Equipment (PPE) and safety measures to safeguard workers from hazards.
- Mobilization of awareness creation campaigns for HIV/AIDS for the construction labor and nearby service-providing communities.

7.2.16 Increased motorway congestion due to restriction of access to road sections and the existing Ubungo-CBD railway transit in the course of construction and upgrading works

The traffic bottlenecks can be reduced by scheduling construction and upgrading activities and traffic during times of the day when public traffic is low.

7.2.17 Increased pressure on public utilities such as water sources, electrical supply and social infrastructure due to added demand from construction activities

This impact can be mitigated through consultation with Local Government Authorities (LGAs) in planning for construction-related utility usages and dedicated infrastructure establishments.

7.2.18 Risk of child labor associated with construction works within the project area

Mitigation for this includes the prohibition of child labour practices and due diligence and regular monitoring to ensure the non-employment of minors in the supply chain and supporting services.

7.2.19 Upturn in crime rates due to increased business activities within the project area

Mitigation of this risk will entail the monitoring of crime rates and collaboration with local authorities to ensure security measures are put in place where necessary (e.g. stationing of guards etc.).

7.3 Operational phase

7.3.1 Trace contamination of surface runoff along the railway line through sprays, leakages and spillages of contaminants (i.e. heavy metals and toxic organics) from maintenance and upgrade of operationalized railway infrastructure

The contamination of topsoil and surface water can be mitigated by ensuring:

- Conduct of routine maintenance checks and servicing for operating train systems;
- Use of side track mats to retain wayside grease;
- Proper chemical handling during maintenance activities and clean-up in the event of noxious spillages or deposits.

7.3.2 Generation of waste (organic scraps from food establishments and commercial packaging refuse from retail facilities) within passenger facilities on trains and train terminals

Mitigation actions to control this aspect of waste production include:

- Institution of a solid waste recycling program providing for the use of labelled waste containers in passenger terminals;
- Sensitizing passenger train operators and cleaning contractors to collect and segregate waste for proper disposal and possible reuse and recycling.

7.3.3 Generation of hazardous and non-hazardous waste (e.g. oils, wood and steel from rails and rail ties) from the maintenance and upgrade of railway infrastructure

Mitigation measures to be taken are as follows:

- Adequate secondary containment for the transit and designated disposal of hazardous wastes;
- Proper handling of maintenance chemicals and routine machinery checks and repairs to minimize fugitive releases;

- Where feasible, substitution of cross-ties treated with chromated copper arsenate with copper azote for wood treatment, or with the adoption of concrete cross-ties.

7.3.4 Operational acoustic emissions from frictional, aerodynamic and traction effects.

The noise emissions can be minimized as follows:

- Increase of the elasticity of the track superstructure;
- Use of wooden sleepers, rail dampers, or embedded rail systems;
- Elimination of running surface discontinuities;
- Regular maintenance of the rail running surface;
- Regular wheel re-profiling;
- Reduction of the speed of rail vehicles;
- Construction of barriers and/or tunnels.

7.3.5 Creation of employment in the operational phase of the railways

This impact can be optimized by promulgating equal and non-discriminatory employment policies for human resource procurement.

7.3.6 Loss in the aesthetic value of the existing landscaped as a result of the erection of new railway infrastructure

Mitigation measures for this effect include:

- Incorporate landscape factors into the design of railway associated buildings;
- Creation of a vegetation strip buffer along the railway lines where appropriate.

7.3.7 Occupational health and safety hazards (e.g. collisions, electrical shocks etc.) from operation and maintenance activities

Mitigation requirements include:

- Provision of Health, Safety, Security and Environment (HSSE) induction for all operation labour;

- Provision of Personal Protective Equipment (PPE) and safety measures to safeguard maintenance workers from hazards.

7.3.8 Public health and safety hazards from the operation of the railways (i.e. collisions at intersections/ crossings between the railway and roads)

This risk can be managed through the establishment of traffic management controls (e.g. signaling systems) and road-railway intersection safeguards (e.g. fencing) to reduce the risk of railway collisions with road traffic.

7.3.9 Economic development, densification and expansion of the suburb reaches of Tegeta due to increased access to the Central Business District (CBD) and the urban development corridors.

This potential advantage can be intensified through the promotion of high-capacity and high-speed technological alternatives to boost transport efficiency and intensify connectivity benefits.

7.3.10 Easement of urban traffic congestion owing to the establishment of an efficient railway transit system

This benefit can be intensified by the promotion of high-capacity and high-speed technological options.

7.3.11 Reduction of the overburden on the BRT system and commuter network with the advent of the alternative low-cost, safe and agile rail transit system

The enhancement of this outcome would necessitate the promotion of high-capacity and high-speed technological options.

7.3.12 Although the railway system is expected to be electricity-powered, it will be indirectly reliant on a gas-based power supply and thereby contribute to a continued carbon footprint

Mitigation measures to curb related greenhouse emissions include:

- Maximization of passenger space utilization within safety standards to minimize specific fuel consumption;

- Improvement of driving economy through staff training, incentive programs, driving advice systems and improved traffic flows to minimize unnecessary acceleration and deceleration;

- Use of regenerative braking systems to recycle energy for use by other locomotives.

8 Environmental and Social Monitoring Plan

The Environmental and Social Monitoring Plan (ESMP) describes the monitoring activities to be undertaken in order to ensure that adverse environmental and social impacts are minimised while the positive impacts are enhanced during the project implementation. The plan describes how, when and where the monitoring activities will be undertaken and who will carry them out. It entails compliance for carrying out the plan, and outlines mechanisms for checking environmental and social performance during the operational life of the project. The purpose of environmental and social monitoring is to measure the effectiveness of mitigation measures proposed during design stage.

The typical environmental Monitoring Plan entails the following parameters as shown in Table 8-1 below:

- Aspect/parameter to be monitored;
- Monitoring frequency;
- Monitoring site/sample area;
- Measurement Unit/Method;
- Target Level/Standard; and
- Responsibility for Monitoring.

Table 8-1 Environmental and social monitoring plan for the potential impacts expected to occur with implementation of the proposed railway lines.

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
Co: Air pollution due to exhaust emissions from construction machinery and dust generation from earthworks.	▪ Powering off of idle construction machinery including all heavy equipment and vehicles; ▪ Non-usage of malfunctioning and fuel-inefficient machinery to reduce exhaust and fugitive output; ▪ Enforcement of routine maintenance checks and servicing for motorized construction machinery; ▪ Usage of dust suppressing agents such as water (wetting) and compaction of exposed site surfaces and unpaved roads, particularly during dry and/or weather; ▪ Side enclosure and covering of any aggregate or dusty material storage piles to for dust abatement; ▪ Minimization of aggregates dropping height; ▪ Coverage of aggregate hauling vehicles with tarpaulins or other impervious sheeting; ▪ Provision of not less than 2.4m high hoarding from ground level along site boundaries adjoining publically accessible zones (e.g. roads, streets etc.).	Concentration of particulates (dust)	Biannually	All construction sites and designated access roads	TZS 845:2005 Air Quality Specifications in the National Environmental Standards Compendium	Contractor and supervision consultant	2,000 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
Co: Water pollution at the Msimbazi River estuary due to sediment loading and re-suspension, resultant turbidity and remobilization of contaminants from expected dredging and excavation works for the construction of viaduct column foundations.	▪ Minimization of mangroves clearance at excavations sites; ▪ At the dredging sites, adverse effects on water quality can be minimized by employment of hydraulic dredges, use of clamshell buckets (for mechanical dredges), installation of silt curtains, proper maintenance of dredging equipment and restriction of the dredging time/rate; ▪ At the disposal site(s), sediment dispersal can be curtailed by constraining the timing/rate of disposal, using submerged diffusers and placing dredged material in geotextile bags to reduce water column exposure during dumping.	Water quality and sediment quality	Biannually	Excavation sites in the mangrove forest	TBS TZS 860:2005 Limits for municipal and industrial wastewaters	Contractor and supervision and supervision consultant	2,000 per year
Co: Water pollution at the crossing site along Sinza River due to soil erosion and sedimentation associated with construction works.	▪ Implementation of erosion control measures to minimize sediment influx and resulting in-stream turbidity upon the construction of bridges (e.g. retaining barriers, grassing and consolidation with rock fill). ▪ Minimization of vegetation clearance along the crossing site.	Water quality	Biannually	Excavation sites in the mangrove forest	TBS TZS 860:2005 Limits for municipal and industrial wastewaters	Contractor and supervision and supervision consultant	1,500 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
Co: Contamination of surface flow (or and/or water bodies) due to mishandling of chemical materials (e.g. fuels, lubricants, hydraulic fluids, coolants etc.).	▪ Observation of proper handling practices and procedures for chemical input materials and wastes; ▪ Construction of hard standings or impervious surfaces for fluid transfer facilities; ▪ Adequate containment facilities for mass storage of liquid chemicals; ▪ Development of a spill response plan.	Water quality	Biannually	Construction sites neighbouring water bodies	TBS TZS 860:2005 Limits for municipal and industrial wastewaters	Contractor and supervision and supervision consultant	1,000 per year
Op: Trace contamination of topsoil surface runoff along the railway line through sprays, leakages and spillages of contaminants (i.e. heavy metals and toxic organics) from maintenance and upgrade of operationalized railway infrastructure.	▪ Conduct of routine maintenance checks and servicing for operating train systems; ▪ Use of side track mats to retain wayside grease; ▪ Proper chemical handling during maintenance activities and clean-up in the event of noxious spillages or deposits	Water and soil quality	Biannually	Land strips along railway tracks	TBS TZS 860:2005 Limits for municipal and industrial wastewaters; TZS 972: 2007 Soil quality – Limits for soil contaminants in habitat and agriculture	Operating authority	1,000 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
Co: Land littering from the generation of solid waste (such as spoils, packaging materials, fugitive solid/fluid contaminants) during construction works and that from domestic waste generated in and round temporary construction camps.	▪ Removal of all construction waste as part demobilization activities within the project sites; ▪ Management of waste streams to isolate recyclable debris and any hazardous waste and compost organic waste; ▪ Placement of litter restriction signage where appropriate; ▪ Installation of waste storage receptacles are resistant as possible to storm water runoff and scavenger animals.	Litter/ solid waste cover	Twice a week	All construction sites	No waste	Contractor and supervision and supervision consultant	1,000 per year
Co: Land destabilization and soil erosion from site preparation and construction works, particularly on sloping terrain and poorly consolidated substrate.	▪ Backfilling of borrow pits and reuse of outstanding spoil and aggregate piles; ▪ Compaction where necessary; ▪ Scheduling to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical; ▪ Contouring and minimizing length and steepness of slopes; ▪ Mulching to stabilize exposed areas;	Erosion indicators streambank erosion, gully erosion, scalding and sheet and rill erosion	Twice a week	All erosion-prone construction sites (steep sandy slopes and bare land)	No significant forms of soil erosion	Contractor and supervision consultant	2,000 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
	▪ Re-vegetating areas promptly; ▪ Designing channels and ditches for post-construction flows; ▪ Lining steep channel and slopes (e.g. use jute matting).						
Op: Generation of waste (organic scraps from food establishments and commercial packaging refuse from retail facilities) within passenger facilities on trains and train terminals.	▪ Institution of a solid waste recycling program providing for the use of labelled waste containers in passenger terminals; ▪ Sensitizing passenger train operators and cleaning contractors to collect and segregate waste for proper disposal and possible reuse and recycling.	Litter/ solid waste cover	Daily	All construction sites	No waste	Operating authority	1000 per year
Op: Generation of hazardous and non-hazardous waste (e.g. oils, wood and steel from rails and rail ties) from the	▪ Adequate secondary containment for the transit and designated disposal of hazardous wastes; ▪ Proper handling of maintenance chemicals and routine machinery checks and repairs to minimize fugitive releases;	Water and soil quality	Biannually	Land strips along railway tracks	TBS TZS 860:2005 Limits for municipal and industrial wastewaters; TZS 972: 2007 Soil quality – Limits for soil contaminants in	Operating authority	1000 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
maintenance and upgrade of railway infrastructure.	▪ Where feasible, substitution of cross-ties treated with chromated copper arsenate with copper azote for wood treatment, or with the adoption of concrete cross-ties.				habitat and agriculture		
Co: Noise and vibration pollution from construction works such pile-driving, blasting, drilling and welding etc.	▪ Selecting equipment with lower sound power levels; ▪ Installing silencers for fans; ▪ Installing suitable mufflers on engine exhausts and compressor components; ▪ Installing acoustic enclosures for equipment casing radiating noise; ▪ Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m^2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective; ▪ Installing vibration isolation for mechanical equipment; ▪ Limiting the hours of operation for specific pieces of equipment or operations, especially mobile; sources operating through community areas; ▪ Reducing project traffic routing through community.	Ambient noise and vibration	Twice a week	All construction sites	TBS EMDC 6 (1733) P3: ACOUSTICS - General Tolerance Limits for Environmental Noise	Contractor and supervision consultant	2,000 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
Op: Operational acoustic emissions from frictional, aerodynamic and traction effects.	▪ Increase of the elasticity of the track superstructure; ▪ Use of wooden sleepers, rail dampers, or embedded rail systems; ▪ Elimination of running surface discontinuities; ▪ Regular maintenance of the rail running surface; ▪ Regular wheel re-profiling; ▪ Reduction of the speed of rail vehicles; ▪ Construction of barriers and/or tunnels.	Ambient noise and vibration	Annually	Along the railway line	TBS EMDC 6 (1733) P3: ACOUSTICS - General Tolerance Limits for Environmental Noise	Contractor and supervision consultant	1,000 per year
Co: Foul odour emissions from the exposure of anoxic soils of the mangrove mudflats in the Msimbazi river estuary during excavation works for the construction of the river crossing.	▪ Installation of containment systems as required.	Odour	Daily	Excavation and dredging sites in the mangrove forest/ estuarine sites	No discernible foul smell	Contractor and supervision consultant	1,000 per year
Co: Disturbance of the mangrove forest within the Msimbazi river mouth through small-scale	▪ Design and monitoring efforts to minimize the clearance of mangroves and earthworks within the estuarine ecosystem.	Vegetation cover	Biannually	Excavation and dredging sites in the mangrove forest/ estuarine sites	Regeneration of cleared mangrove species	Contractor and supervision consultant	1,000 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
deforestation, excavation and the establishment of permanent structures during construction.							
Co: Clearance of vegetation as part of site preparation works.	▪ Restriction of clearing works to the 30m Right of Way (RoW) of the railways.	Vegetation cover adjoining the RoW	Daily	All construction sites	No vegetation loss beyond the RoW	Contractor, supervision consultant and Municipal Environmental Officer	1,000 per year
Co: Disturbance of the Dar es Salaam Coast Important Bird Area through noise-generating construction works within the mangrove belt intercepting Msimbazi River.	▪ Noise and vibration control measures in proximity to key avifauna habitats and other sensitive faunal communities; ▪ Maintenance or creation of vegetation screens to reduce illumination of adjacent habitats.	Population of less dominant and vulnerable/threatened bird species	Biannually	All construction sites	Temporary depopulation not exceeding 50% of the original population	Contractor, supervision consultant, Municipal Wildlife Officer	1,000 per year
Op: Disturbance of the Dar es Salaam Coast Important Bird Area through noise-	▪ Noise and vibration control measures in proximity to key avifauna habitats and other sensitive faunal communities; ▪ Maintenance or creation of vegetation screens to	Population of less dominant and vulnerable/threatened bird species	Annually	All construction sites	Depopulation not exceeding 50% of the original population	Contractor, supervision consultant, Municipal Wildlife Officer	1000 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
generating construction works within the mangrove belt intercepting Msimbazi River.	reduce illumination of adjacent habitats.						
Co: Change in drainage patterns and the hydrological regime of natural streams due to the clearance of vegetation as part of site preparation and soil erosion across river crossings.	▪ Compaction where necessary; ▪ Scheduling to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical; ▪ Contouring and minimizing length and steepness of slopes; ▪ Mulching to stabilize exposed areas; ▪ Re-vegetating areas promptly, especially around the rivers/streams; ▪ Designing proper channels and ditches for post-construction flows; ▪ Lining steep channel and slopes (e.g. use jute matting).	Depth and/or flow rate of river and stream channels	Monthly	All erosion-prone and riparian construction sites	Temporary change in depth and flow rate not exceeding 50% of the original value	Contractor, supervision consultant	1,000
Co: The establishment of the railway route will necessitate the physical displacement of settlements and other	▪ Participatory planning and engagement of the local communities in planning for best alignment alternatives; ▪ Provision of full and timely compensation to displaced property holders following proper property count and valuation survey within the RoW;	Number of compensated household owners in the RoW	Monthly	All inhabited/occupied zones within the RoW	Full and prompt compensation to the registered occupants within the RoW	Client, Municipal Valuer, Ministry of Lands, Housing and Human Settlements authorities	RAP implementation budget

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
establishments along the 30-m Right of Way (RoW) of the proposed railway route.	▪ Institution of grievance redress mechanisms						
Co: The involuntary resettlement of residents along the RoW will result in the impoverishment of the low-income communities.	▪ Conduct of livelihoods restoration planning as part of resettlement planning; ▪ Participatory planning and engagement of the local communities in planning for best alignment alternatives;	Number of compensated household owners in the RoW	Monthly	All inhabited/occupied zones within the RoW	Full and prompt compensation to the registered household owners within the RoW	Client, Municipal Community Development Officer, Ministry of Lands, Housing and Human Settlements authorities	RAP implementation budget
Co: The project, in its construction phase, will create employment and income-generation opportunities for a range of formal, informal, skilled and semi-skilled labour.	▪ Prioritization capable locals in the recruitment of construction and operational labor; ▪ Sourcing of products and ancillary services from local providers; ▪ Promotion of equal and non-discriminatory opportunities in local employment; ▪ Prohibition of child labor and follow-up monitoring.	Number of employed nationals and locally based recruits	Once-off (prior to mobilization)	All construction-associated facilities	At least 70% of workforce to be nationals and 10% of semi-skilled/ informal labour to be sourced from the local communities	Client, contractor, Municipal Community Development Officer(s)	1,000 per year
Co: Economic displacement of land-users	▪ Conduct of vulnerability assessments and livelihoods restoration planning as part of resettlement planning.	Number of fully and promptly uncompensated vulnerable entities	Monthly	All inhabited/occupied zones within the RoW	No uncompensated vulnerable entities	Client, Municipal Ministry of Lands, Housing and Human	RAP implementation budget

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
established within the RoW and loss of access to livelihood resources.		dispossessed of establishments within the RoW			dispossessed of establishments within the RoW	Settlements authorities, Municipal Community Development Officer	
Op: The train system, once operationalized, will create employment through the operator agency.	▪ Promulgation equal and non-discriminatory employment policies for human resource procurement.	Number of employed nationals	Monthly	All construction-associated facilities	All of the employees to be Tanzanian nationals	Client, contractor, Municipal Community Development Officer(s)	1,000 per year
Co: The establishment of the railway, in either the at-grade or elevated modality, will necessitate the displacement of the existing residential, commercial, industrial and institutional land-uses, and the loss access to livelihoods resources.	▪ Conduct of livelihoods restoration planning as part of resettlement planning; ▪ Participatory planning and engagement of the local communities in planning for best alignment alternatives; ▪ Provision of full and timely compensation to displaced property holders following proper property count and valuation survey within the RoW; ▪ Institution of grievance redress mechanisms; ▪ Prohibition and monitoring of child labour.	Number of compensated property/establishment owners in the RoW	Monthly	All inhabited/occupied zones within the RoW	Full and prompt compensation to the registered occupants within the RoW	Client, Municipal Valuer, Ministry of Lands, Housing and Human Settlements authorities	1,000 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
Co: The construction of the railway will entail the realignment and/or re-installation of water (DAWASCO), electricity (TANESCO), optical fibre cable and gas (SONGAS) distribution infrastructure.	▪ Participatory planning and the engagement of utility management authorities in planning for the alignment alternatives; ▪ Relocation and/or re-installation of utility infrastructure	Early (pre-construction) coordination with utility authorities	Weekly	All utility corridors associated with the project area	Frequent coordination between the Client, Contractor and utility authorities	Client, Contractor and utility authorities	1,000 per year
Co: Increased pressure on public utilities such as water sources, electrical supply and social infrastructure due to added demand from construction activities.	▪ Consultation with relevant Local Government Authorities (LGAs) and utility authorities in planning for construction-related utility usages and dedicated infrastructure establishments.	Coordination with LGAs on	Once-off (prior to construction)	All construction sites	Agreement on delivery of utility services prior to construction	Client, contractor and utility authorities	500 per year
Op: Reduction of the overburden on the BRT system and commuter	▪ Promotion of high-capacity and high-speed technological options.	BRT bus loading statistics in relation to passenger capacity	Annually	BRT Phase 4 and Phase 5 network	Reduced strain on the BRT buses (ideal loading)	Client and DART	500 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
network with the advent of the alternative low-cost, safe and agile rail transit system.							
Co: The construction-associated traffic, structures and marring will bear an impact on the viewshed.	▪ Hoarding to reduce public visibility of construction infrastructure and management of construction traffic; ▪ Post-construction landscaping and site rehabilitation.	Locals' aesthetic appeal of the project area	Once prior to construction and after post-construction landscaping	All construction sites	No significant visual nuisances and eyesore for residents	Client and contractor	500 per year
Op: The new railway infrastructure, particularly the elevated section, will likely reduce the aesthetic value of the landscapes.	▪ Incorporate landscape factors into the design of railway associated buildings; ▪ Creation of a vegetation strip buffer along the railway lines where appropriate.	Locals' aesthetic appeal of the project area	Once prior to construction and after operationalization	All construction sites	No significant visual nuisances and eyesore for residents	Client	500 per year
Co: The physical and economic displacement along the railway RoW will negatively impact on the income level,	▪ Conduct of livelihoods restoration planning as part of resettlement planning; ▪ Participatory planning and engagement of the local communities in planning for best alignment alternatives; ▪ Provision of full and timely compensation to displaced	Number of compensated property/establishment owners in the RoW	Monthly	All inhabited/occupied zones within the RoW	Full and prompt compensation to the registered occupants within the RoW	Client, Municipal Valuer, Ministry of Lands, Housing and Human Settlements authorities	RAP implementation budget

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
access to social services and general welfare of the vulnerable demographics (i.e. women-headed households, children, the disabled and the elderly).	property holders following proper property count and valuation survey within the RoW; ▪ Institution of grievance redress mechanisms; ▪ Prohibition and monitoring of child labour.						
Co: Risk of child labour relating to construction works within the project area.	▪ Prohibition of child labor practices and due diligence and regular monitoring to ensure the non-employment of minors in the supply chain and supporting services.	Number of minors employed in construction labour and/or supporting services	Weekly	All project areas	No minors to be employed	Client, contractor and supervision contractor	500 per year
Co: Construction works for the railway establishment pose numerous occupational health and safety hazards (e.g. falls, cuts, electrocution etc.)	▪ Provision of Health, Safety, Security and Environment (HSSE) induction for all construction labor; ▪ Provision of Personal Protective Equipment (PPE) and safety measures to safeguard workers from hazards. ▪ Mobilization of awareness creation campaigns for HIV/AIDS for the construction labor and nearby service-providing communities.	Number of significant HSSE incidents (daily or monthly) and number of hazard-predisposed workers equipped with PPE.	Daily	All construction sites	No significant/severe HSSE incidents (daily or monthly) and no of hazard-predisposed workers equipped with PPE.	Client, contractor and supervision contractor	1000 per year
Co: The influx of migrant	▪ Mobilization of awareness creation campaigns for HIV/AIDS for the	HIV/AIDS incidence	Annual	All construction sites	No significant increase in	Community Medical Officer, Community	15,000 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
workers for into the construction labour raises increased risk of the spread of HIV/AIDS, especially in the low-income communities associated with the project area.	construction recruits stationed around service-providing communities.				HIV/AIDS incidence	Development Officer and Resident Engineer	
Op: Certain operation and maintenance activities also pose occupational health and safety hazards (e.g. collisions, electrical shocks etc.).	▪ Provision of Health, Safety, Security and Environment (HSSE) induction for all operation labour; ▪ Provision of Personal Protective Equipment (PPE) and safety measures to safeguard maintenance workers from hazards.	Number of significant HSSE incidents (daily or monthly) and number of hazard-predisposed workers equipped with PPE.	Daily	Operation and maintenance sites/ centres	No significant/severe HSSE incidents (daily or monthly) and no of hazard-predisposed workers equipped with PPE.	Operating authority	1000 per year
Co: Construction works for the railway establishment pose numerous public health safety hazards (i.e. traffic accidents).	▪ Demarcation of construction sites and erection of barriers where necessary for restricted access and confinement of on-site pollution; ▪ Traffic management for construction traffic.	Number of significant HSSE incidents (daily or monthly)	Daily	All construction sites	No significant/severe HSSE incidents (daily or monthly)	Operating authority	1,000 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
Op: The operation of the railway poses public health and safety hazards such as traffic accidents (i.e. collisions at intersections/ crossings between the railway and roads).	▪ Establishment of traffic management controls (e.g. signaling systems) and road-railway intersection safeguards (e.g. fencing) to reduce the risk of railway collisions with road traffic.	Number of significant HSSE incidents (daily or monthly)	Daily	All railway crossings and stations	No significant/severe HSSE incidents (daily or monthly)	Operating authority	500 per year
Co: Upturn in crime rates due to increased business activities within the project area.	▪ Monitoring of crime rates and collaboration with local authorities to ensure security measures are put in place where necessary (e.g. stationing of guards etc.).	Frequency of criminal activity	Monthly	The project area	No significant increase in the crime rates	Police and Mtaa leadership	500 per year
Co: Increased motorway congestion due to restriction of access to road sections and the existing Ubungo-CBD railway transit in the course of construction	▪ Scheduling construction and upgrading activities and traffic during times of the day when public traffic is low.	Traffic congestion duration	Daily	Road sections between the Ubungo station and CBD	No significant increase in traffic congestion duration	Locally stationed traffic police and contractor	500 per year

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
and upgrading works.							
Op: Easement of urban traffic congestion owing to the establishment of an efficient railway transit system.	▪ Promotion of high-capacity and high-speed technological options.	Traffic congestion duration	Annually	Road sections between the railway terminals and the CBD terminal.	No significant increase in traffic congestion duration	Locally stationed traffic police and contractor	500
Co: The construction works will involve the operation of vehicles and construction machinery which will result in greenhouse emissions.	▪ Powering off of idle construction machinery including all heavy equipment and vehicles; ▪ Non-usage of malfunctioning and fuel-inefficient machinery to reduce exhaust and fugitive output; ▪ Enforcement of routine maintenance checks and servicing for motorized construction machinery;	Concentration of particulate matter and greenhouse oxides	Quarterly	All construction sites	TBS TZS 845:2005 Air Quality Specifications	Contractor and supervision consultant	500
Op: Although the railway system is anticipated to be electricity-powered, it will be indirectly dependant on a gas-based power grid and thereby contribute to	▪ Maximization of passenger space utilization within safety standards to minimize specific fuel consumption; ▪ Improvement of driving economy through staff training, incentive programs, driving advice systems and improved traffic flows to minimize unnecessary acceleration and deceleration;	n/a	n/a	n/a	n/a	n/a	n/a

Potential impact	Mitigation measure(s)	Monitoring parameter	Monitoring frequency	Sampling area	Target standard	Responsibility	Cost estimates USD
the national carbon footprint.	▪ Use of regenerative braking systems to recycle energy for use by other locomotives.						
Economic development, densification and expansion of the suburb reaches of Tegeta due to increased access to the Central Business District and the urban development corridors.	▪ Promotion of high capacity and high-speed technological alternatives to boost transport efficiency and intensify connectivity benefits.	Population/ settlements density and the local economy	Annual	The Tegeta suburb	Increase in the local economy and social infrastructure	Relevant LGAs	n/a
Total Monitoring Costs (USD)							**48,500 USD per year**

9 Conclusion and Recommendation

The implementation of the proposed railway developments is expected to trigger several major environmental and socioeconomic impacts, most notably the potential resettlement associated with land acquisition for the establishment of the Right of Way, train stations and depot. The main environmental sensitivity identified for the preferred project option (and one of the proposed sections) is the mangrove forest situated on the estuarine end of Msimbazi River. The Lugalo Military Base also represents a classified land-use.

While this examination provides a preliminary understanding of the potential impacts and the requisite mitigation approaches, a detailed Environmental and Social Impact Assessment (ESIA) is required to provide a more in-depth assessment and detailed mitigatory planning. Further institutional coordination is also integral to establishing an appropriate and practicable project design that is congruent with other infrastructural developments being framed as part of the urban transport master plan and other master plans for Dar es Salaam city.

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Appendices

Appendix A List of Stakeholders Consulted

Stakeholders Consultation

Initial Environmental Examination (IEE) for Pre-Feasibility Study of Full Loop Line and Half Loop with Tegeta Line under the Project for Revision of Dar es Salaam Urban Transport Master Plan (DARTMP)

Date	Name	Institution	Position	Phone Number	Signature
18/12/2017		MOWTC	Ag. Director of Transport Environment & Safety		
19/12/2017		TAZARA	Senior Civil Engineer		
21/12/2017		SUMATRA	Manager Roads, Transport		
02/01/2018		Dar City Council	Ag City Engineer		
— 11 —		— 11 —	CITY PLANNER		
02/1/2018		RAHCO	ESIA - Officer		
03/01/2018		MLHHSD	ADMP		
05/01/18		TANROADS	Environmentalist		
09/01/18		DAWASCO	ESHS		
09/01/2018		DAWASCO	Environmental Engineer		
09/01/2018		TRL	Chief of Rail safety Ag and Security		
04.01.2018		DAWASA	PCT.		
05/01/2018		DART	Town Planner		
05/01/2018		DART	Sociologist		
8/1/2018		DAWASA	ASSET MANAGER		
9/1/2018		TMA	METEOROLOGIST		
10/01/2018		KMC	ENVIRONMENT OFFICER		
20/12/2017		UBUNGO MC	AgME		

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* Personal information such as name of participants, phone number and e-mail address were removed from the list of participants to protect personal information.

Appendix B Stakeholders Consultation Minutes

Stakeholder	Issues raised
18.12.2017 Stella Katondo, Ag. Director of Transport Environment & Safety – MOWTC	› There will be potential demolition of structures/assets along the proposed route(s). This will impact the neighbours and the project affected persons (PAPs) › The green development project – construction of new railway lines will result into resettlement of people along the proposed project area. This is because the project requires a lot of land for implementation. › The project will have a lot of impact because it is in urban areas, which are heavily congested. › During construction there will be significant impacts such as noise pollution and dust generation › The construction of SGR from Dar es Salaam to Morogoro already has its challenges. The proposed areas are congested and are used for business activities. The project will cause nuisance and other challenges. This will result into increased people's resentment that the government is only after destroying their properties and resulting to resettlement › Transport development should not cause impact on the environment. The construction should not affect issues like land stability and have other consequences for the future such as soil erosion and flooding. › During implementation the railway lines are close to people's residential structures, how will that impact their daily livelihood? Construction will cause disturbances and safety concerns, also since the railway line passes through on land and not underground › Project proponent should provide details of project implementation on time and beforehand in order to avoid discontents and problems in the future. If the project is to take place, project impact areas should be identified and all areas set for development. People around the area should be informed about the project so that they should not make further developments in the area and become psychologically prepared to allow for smooth implementation. This is because 2025 to 2040 is a long time ahead.
19.12.2018 Eng. Ferdinand K. Hugo, Senior Civil Engineer – TAZARA	› Improving the railway lines as part of the urban transport masterplan is a good plan. It is a best intermodal way of transportation. It will ease traffic movement and congestion. The proposed transport needs to be synchronised with TAZARA's railway timetable. TAZARA has two trips in the morning and two trips in the evening. The current plan is helps ease traffic congestion in Vingunguti, Airport and Banana vicinity. TAZARA station is the last station, after dropping off the commuters disperse and grab transport to other destinations, mostly CBD › The proposed project will result into land acquisition especially for green development (Ubungo-Mwenge-Tegeta-CBD). › Technical considerations needs to be paid particularly attention during design to avoid unnecessary costs during implementation. Issues of drainage, disruption of utilities and businesses, livelihoods and people's daily activities. Drainage should be well taken care off and how they interact with the existing ones. Drainage issue should be focused, especially on how surface run-off is disposed. If not properly managed it might lead to severe erosion. There has been infrastructure improvement elsewhere but they have directed storm water into TAZARA drainage system leading to overcrowding resulting into destruction of railway infrastructure. Flooding has been predominant because natural vegetation has been removed to make way for infrastructure improvement – water does not soak anymore as the grounds are paved, the water percolates and finds the lowest point. This has led to change of catchment behaviour › There should be safety considerations especially in the road crossings and other railway crossings › Underground storm water management channels are outdated and under capacity › There is poor control of solid waste management – there is no proper infrastructure of managing waste. People are throwing waste anywhere. Some of these wastes end up blocking storm water drainage systems › There is theft of drainage infrastructure

	› There should be a pilot study to look at how to address solid waste management and its impact on drainage systems. There should be proper and enough waste collection points and there should be personnel responsible for collection › During construction there will be disruption of services – TRL conducts daily trips from CBD to Ubungo. › People are throwing solid waste along TAZARA right of way – the waste end up blocking its drainage channels
21.12.2017 Leo J. Ngowi, Manager Roads Transport – SUMATRA	› The Ubungo – Mwenge area has been surveyed › Due to congestion, most people prefer to use motorcycles and bajaj in order to save time. However, they are 20 to 30% more pollutant than the cars. Railway improvement will bring benefits by reducing air pollution › Health and safety – accidents are less in railway transportation compared to other modes of transportation › During construction, costs will be incurred to relocate infrastructure and subsequent disruption of services › Proposed plans have been delayed – medium term plan should be short term plan because Dar es Salaam is growing rapid both in human population and cars population. By the time medium plan takes shape, it will not be able to address the current growth projections. Population of cars in Dar es Salaam is growing at an annual rate of 20%. The Consultant should consider expanding railway link to Bunju near border with Bagamoyo. If the plans delay to take shape, JICA's value for money for the project will not be realised › The motorcycles and bajajs are expensive compared to mass transit systems like railway. For example, motocycles and bajaj cost around TZS 500 to TZS 2,000 for a very short trip while for a railway transport TZS 500 can go all the way to 20km or more › In order to update the masterplan, JICA should ensure that the masterplan integrates with other plans – all the other plans should tap into the general masterplan. In addition, the masterplan should be vibrant capable of addressing the complexity and diversity of people's interactions and livelihood.
02.01.2018 Philip Mwakyusa, City Planner – Dar es Salaam City Council (DCC)	› The biggest challenge is – there is no land use Masterplan. The masterplan is under preparation under the supervision of the Ministry of Lands, Housing and Human Settlement Development (MLHHSD). The plan will guide other plans on land use. › The Consultant should be close to the City Council as an important stakeholder for land use planning. The Consultant needs to make a close follow-up on what is going on as far as the Land Use Masterplan in order to ensure that the DARTMP matches with the plan › The Consultant should use a participatory approach in preparing the plan – all important stakeholders, eg. Municipal Councils should be made aware and fully participate. This is because, in other planning process, some of the Municipals are aware while others are not. This is important since the Municipals are the major implementing entities thus they should be fully aware. The approach will also help the LGAs establish a coordinating entity for clear implementation. In addition, the approach should also include involving key figures in the development process such as politicians, notably, the ward councillors. › There is little knowledge/awareness on climate change from community members. It is not regarded as an important issue. There are a lot of NGOs that educate on the matter but there is little impact. Community members along the project area should be made aware of the matter and measures on how to combat it. It also very important to be an understanding of climate change on the study area › There should be special and careful consideration of construction of railway lines in flood prone areas. Measures to combat the issue including having elevated structures. There should also be special studies on floods in the areas such as use of locals to provide information about the water behaviour in the ares › Compensation is not avoidable – the proposed new routes (Ubungo-Mwenge-Tegeta-CBD) will involve involuntary resettlement. There is a report which shows that there is a route to Tegeta, however, it was not developed. People along the route have made developments and have title deeds so the Government should consider them in compensation. If there is a route to Tegeta, it should be known in advance so that the Government can zone the project corridor – this will prevent people from making further developments, even if the project will take a long time to be implemented

	› There should be capacity building to decision makers such as ward councillors so that they educate their community members on the proposed project and its impacts. The capacity building should include examples of similar project on countries with similar development trajectories as Tanzania. This will provide them with more exposure. The local decision-makers/leaders are in a better position to influence the community members to support the project and ensure its sustainability. › When the Urban Transport Masterplan was first prepared in 2008, a lot of areas were vacant, however, most of these are now developed. This is because when the areas were earmarked they were not identified as development areas and were thus not zoned. This is partly due to implementation not being given a priority and it is due to beaucratic challenges of priorities getting transferred from the lower levels to high levels of decision making. High level decision makers are in better position to influence project implementation. It is very important to earmark areas for project implementation – project corridors for implementation should be set up.
02.01.2018 Eng. Reuben Elisante, City Engineer – Dar es Salaam City Council	› The roads are congested, compensation will be an issue. The Government has often avoided compensation by reducing the road width. › Underground system is not recommended due to amongst other things is unreliable network › There are very few people who are aware of the Urban Transport Masterplan of 2008 › Relocation of public utilities is an issue. Another issue is drainage system. This will result into losses to utilities agencies due to disruption of services especially during construction phase › There should be careful considerations of sensitive areas such as flood prone areas and the design should be adequate to address the matter
02.01.2018 Magdalena Kitila, ESIA Officer – RAHCO	› There is a feasibility study conducted which amongst other things include Tegeta route and Morocco route. The title of the study is Dar es Salaam Commuter Rail Project Feasibility Report. › Compensation is going to be an issue › Relocation of public utilities is an issue. This will result into losses to utilities agencies due to disruption of services especially during construction phase. › There will disturbance of people's livelihood due to increased traffic, noise and air pollution. › There will be occupational health and safety issues › Transportation of materials might result into traffic and potential accidents. There should be proper mitigation measures › There should be proper access roads. › Considerations should be placed on where site camps will be placed › HIV/AIDS issue due to increased interactions which will also cause other social ills such as crimes › There will be potential issues such as oil spills from vehicles and machinery which might pollute water sources › Waste generation (solid, liquid, etc) is going to be an issue. There should be a proper waste management plan › There should be proper HSE considerations for the employees and adjacent communities and how this will impact the project negatively or positively – eg. accidents, diseases, unwanted pregnancies. There should be a proper health and awareness programs › All employees should be provided with proper PPE › There should be more community awareness and involvement
03.01.2018	› There will be accidents if the railways are not fenced – there should not be direct access to the railway but only at designated access points/areas. › There are no demarcated areas for constructing the railway lines, as such involuntary resettlement is going to be an issue and unavoidable

Amulike A. Mahenge, Assistant Director of Master Planning – Ministry of Lands, Housing and Human Settlement Development (MLHHSD)	› If the project wants to use TANROADS right of way, then there might be collision with other plans such as the Bus Rapid Transit (BRT). Instead of having the railway and BRT on the same route, it will be wise if the railway lines pass through areas BRT does not go and vice-versa in order to avoid competition › Underground passes are expensive to build › The Dar es Salaam Land Use Masterplan is on preparation but will likely incorporate the JICA's revised DARTMP › Re-design will be conducted in order to incorporate site-specific issues such as avoiding areas for compensation, community resistance, etc › There will be limited air pollution – it will be an electric train › HSE considerations to staff should be important. Considerations should also be placed to people near the vicinity and passengers during operation
05.01.2018 Akonda Mwangunga, Environmentalist – TANROADS	› There is a plan of constructing a media from Morocco to Mwenge (the project is under design review). The project is financed by JICA › There is plan of upgrading the Tegeta – Bagamoyo road to dual carriageway. The project is under detail design. Makofia – Mlandizi road is also at detail design stage. › Ubungo interchange is currently under construction. › Kimara mwisho – Kibaha road is planned to be constructed – six lanes › The use of the agency's right of way is a challenge since it is very sensitive and the agency has other plans for it › There are several roads planned for upgrading of roads under the decongestion of urban roads in Dar es Salaam involving a total of 44.1km roads: Tegeta – Kibaoni – Wazo Hill – Goba – Mbezi (12km); Tangibovu – (Samaki Wabichi) – Goba (9km); Mbezi – Malambamawili – Kifuru – Kinyerezi – Banana; Ardhi – Makongo – Goba; Kimara – Kilungule – External/Mandela; Kimara – Baruti – Msewe – Changanyikeni (2.6km); Kigogo roundabout – Msimbazi – Jangwani (2.7km); and Gerezani road (1.3km)
09.01.2018 Joseph M. Kubena, Environmental, Safety, and Health Officer – DAWASCO Edson Robert, Environmental Engineer – DAWASCO	› The proposed railways will not be compatible with other road users due to their speed. In developed countries, there are underpasses and special crossing sections or overpasses. If possible, the railways should use the median like the BRT. However, this presents use other challenges, BRT scares side road users due to the inconveniences caused such as special cross sections. The same arrangements will be applied with the railway › DAWASCO infrastructure is along TANROADS and other roads reserves. On top of that, the agency has plan of setting up a sewage system in the same reserves. Therefore, DARTMP should consider DAWASCO plans. In addition, the infrastructure need routine maintenance and upgrading thus the area should be left open to allow for such activities. In case railway infrastructure is constructed, it will make it impossible to do so. Due to population increase, it results into design considerations such as increase water system pipes thus revamp the system and install water pipes with large diameter such as the expansion of lower and upper Ruvu treatment plant. Design changes depending on population increase thus DAWASCO constantly revamps its system. › Natural hydrology changes due to infrastructure development. Urban hydrology has to be carefully considered during detail design – there should be plans of avoid floods around the proposed project area in order to avoid the railway routes to be river course. › There is electricity infrastructure along the road reserve – the infrastructure will merge perfectly with the railway electrical infrastructure. There needs to be stable electricity supply including the availability of standby electrical lines for power, if one system fails, another picks up. › There needs to be a proper risk management plan to address emergencies eg. in case of electrical failure doors will open, train will be able to stop, etc › In case of underground viaduct – in Tanzania there should be proper ventilation, reliable electricity and drainage system. Dar es Salaam's coastal line has shallow aquifer and high temperature.

	› The DARTMP can change the City's settlement pattern – due to availability of reliable public transport. This will in turn allow DAWASCO to spread its infrastructure to areas outside CBD rather than revamping the current ones and install larger ones › There should be ring roads close to railway lines in order to ease the pressure of getting to CBD › The Masterplan must be coordinated with other plans to allow for establishment of satellite towns and ease congestion in CBD › DAWASCO has plans to improve water supply system from Makongo to Bagamoyo under 2B and 2F water supply distribution network. The project is at the procurement of Consultant and Contractor. This will change the future development/settlement pattern in the area. This is important to consider since there are plans of having a railway line from Mwenge to Bunju as a long term plan
09.01.2018 Eng. Adolphina Ndyetabula, Ag. Chief of Rail Safety and Security – Tanzania Railways Limited (TRL)	› Resettlement is an issue – demolition of people's properties will be unavoidable › During construction phase, there will be air pollution as a result of construction of access roads and transportation of construction materials › Health and safety issues – eg. lorries carrying equipment which are taller than their specifications › PPE should be provided to all staff › There will be employment opportunities › Equipment used for controlling noise and dust should be at an acceptable standard › Construction of railway using concrete sleepers might result into establishment of an industry thus creating more employment opportunities › There will be more opportunities eg. food vendors › Increase people's interaction will result to other social ills such as spread of diseases, unwanted pregnancies, communicable diseases › There should be proper level crossings for people, motorcycles and vehicles. People should be educated on their importance and respect them › There should be awareness and educational messages on health and safety › Budgetary constraints is a major implementation constraint › Railway improvement will ease congestion thus increase productivity. In turn people will spend more time with their families and raise their children well
20.12.2017 Ernest Mgolofu, Ag.Municipal Engineer – Ubungo Municipality	› They are optimistic about the project since it will reduce congestion in the city › The route, which has more demand in terms of passengers, is Morogoro road, if possible a commuter train be stablished in this route. The road authority had already demolished properties, which are in the ROW of way therefore, it will be ideal for RAHCO to use the same way of leave in the future for the railway infrastructure. › Ubungo-Mwenge section (along Sam Nujoma) road is well built up area ,therefore, whatever plans to develop a railway corridor need to integrate with other existing developments which are under way such as construction of Ubungo Flyover etc. › In order to avoid demolition and cost for the compensation the railway to be constructed need to be elevated all the way from Ubungo to Mwenge › Use the existing road corridor from Ubungo to Mwenge for railway infrastructure. › There should be considerations for the level crossing alignment. › Upgrading of the CBD –Ubungo from Meter Gauge to Standard Gauge has to keep the existing truck operational (CBD- Ubungo) and construct a new railway parallel to the existing.

10.01.2017 Mr Churchil Mujuni, Forest Officer – Dar es Salaam RAS office	› Railway project will increase competition with other transport operators such as BRT. This will improve efficiency in the transport sector. Currently BRT system is overwhelmed with passengers, thus introduction of the railway transport is an optimal solution for transport woe in the city › Improved railway system will reduce travel time to passengers › Mangroves at the Salender Bridge need to be conserved and not destroyed
10.01.2017 Mr Awadh Chambo, Environmental Officer – Kinondoni Municipality	› Utilize the existing structures such as Ubungo interchange and BRT system when connecting the loop from Ubungo to Mwenge. Possible the railway structures › should be elevated. › For section (Mwenge-Tegeta) Lugalo barack is the restricted area, therefore for the future studies, a Ministry of defense need to be made aware. › There are several rivers crossings namely river Msimbazi, Sinza, Mbezi and Mlalakuwa which need to be considered during construction and avoid pollution. › Railway project will develop suburb areas such as Bunju and Bagamoyo › Minimize pollution such as dust and noise during construction. › The location of the proposed developments will most likely require relocation of the population, or at least part of the population involving physical displacement (loss of housing and associated assets), and/or land acquisition with resulting economical displacement (loss of/or access to income sources or means of livelihood). › Because of the potential economic displacement, compensation to affected persons will be required to mitigate social impacts.
04.01.2018 Eng Simon Augustine, Project Delivery Manager, DAWASA	› DAWASA operates a transmission mains running parallel to Bagamoyo Road, which branch off into distribution pipelines at different point. NOTE: The asset manager shared with the Consultant drawings of the existing transmission and distribution networks schemes for Dar es Salaam City.
0.5.01.2018 Mr Edwin Hema, Town Planner, DART	› Planning for the railway developments should be integrated with that for BRT Phase 4; institutional coordination is key in achieving this. › To maximize the added value of the proposed railway(s) linking Tegeta and the CBD (in relation to road infrastructure), additional railway stations should be taken into consideration.

Appendix C Land Take and Property Count

Estimation Report: Land-Take and Property Count for Proposed Medium-Term Railway Developments under the Revised Dar es Salaam Urban Transport Master Plan

This report presents the results of the GIS analysis for footprint estimations and affected properties count for Rights of Way (RoWs) for a total of six railway sections and Case 3b as a whole, all of which are proposed in the Updated Pre-Feasibility Study Report for the Dar es Salaam Urban Transport Master Plan.

In consideration of the possibility of section recombinations and additional railway cases, the Consultant has carried out an estimation of **property count**, **area of occupied land** and **total RoW area**[1] on a section-by-section basis for six different sections and for Case 3b as a whole listed below:

- Elevated Section Tegeta-Mwenge;
- Elevated Section Mwenge-Aga Khan;
- Elevated Section Mwenge-Ubungo;
- At-Grade Section Ubungo-CBD;
- Transition Section;
- Underground Section; and
- Case 3b (Elevated Tegeta-Aga Khan Line)

The estimations were also made for the depot site (located in Makongo) and its railway branch.

The results of the analysis are detailed in the table below (overleaf).

[1] Inclusive of train station area (200 metres (L) × 25 metres (W)) covered by the 15m RoW

Table 0-1 Estimates of property count, total property area and RoW area for the six proposed railway sections, Case 3b and the depot sites.

Railway Section	Property Count	Occupied Area[2] (m²)	Total Footprint Area (m²)
Elevated Tegeta-Mwenge	35	3,011.4	399,944.0
Elevated Mwenge-Aga Khan	78	5,639.5	273,711.0
Elevated Mwenge-Ubungo	79	5,254.8	144,805.0
At-Grade Section (Ubungo-CBD)	0	0.0	0.0
Transition Section	1	0.0	15,988.0
Underground Section	25	2,609.5	7,428.0
Case 3b (Elevated Tegeta-Aga Khan Line)	72	5,419.2	667,679.0
Depot Site	423	51,539.2	89,676.0
Depot Line	32	2,353.0	74,038.0

The estimates in Table 0-1 have been computed under the assumption that the RoWs for all five sections require a railway strip width (from each side of the centreline) of 15m, as mandated by the Railway Act (2002). The RoW for each section is therefore held to measure a total width of 30 metres, irrespective of the above-ground elevation modalities.

[2] Occupied area refers to the total land area within the RoW occupied by constructed land-uses (i.e. residential, commercial and industrial buildings).

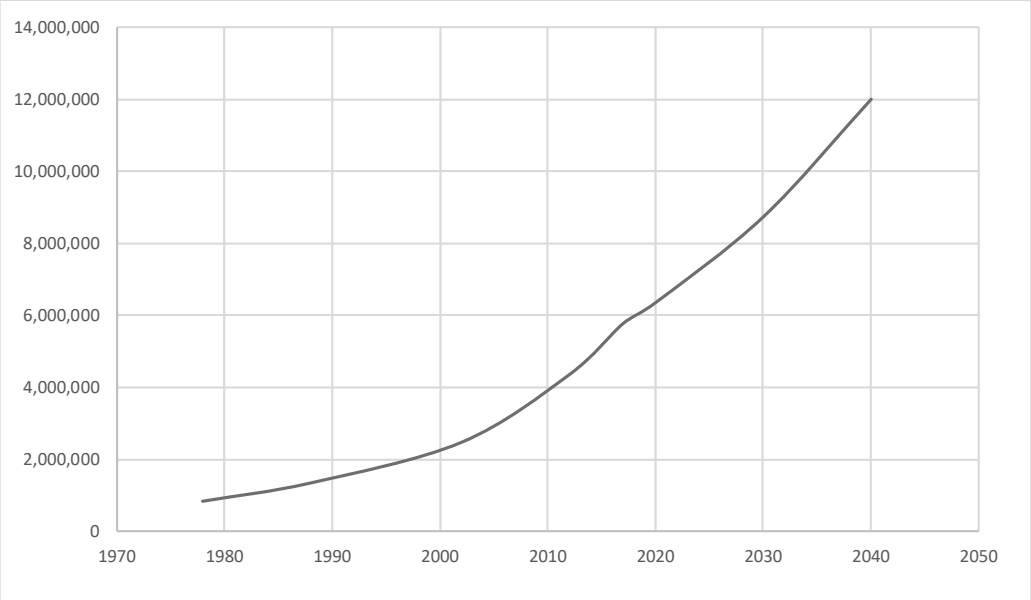
Annex-7: Population Framework (For Chapter-12)

- Annex 7-1: Change of DSM and Greater DSM Population (1978 - 2040)
- Annex 7-2: Population and Population Density Distribution of Greater DSM
- Annex 7-3: Average Annual Change in Population in Greater DSM
- Annex 7-4. Trend of Working Population
- Annex 7-5. Ratio of Day Time and Night Time Population (D/N ratio)
- Annex 7-6. Working Population and Density of DSM by Distance

Annex 7-1. Change of DSM and Greater DSM Population (1978 - 2040)

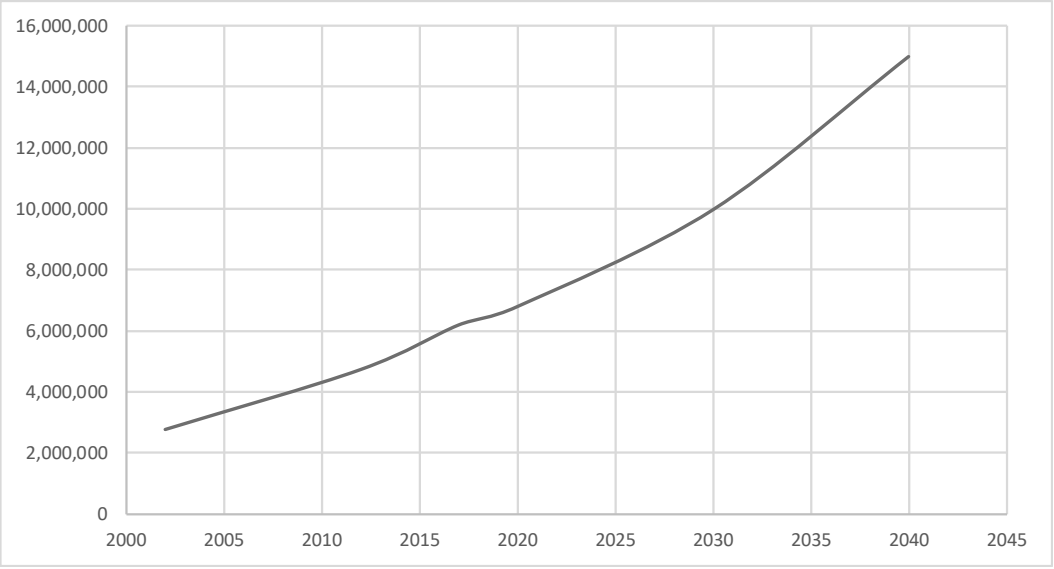
The following figures show the change of DSM and Greater DSM population. DSM population includes past population growth since 1978 and projected future population after 2018 up to 2040. DSM population was about 850,000 in 1978. As of 2017, the estimated population is about 5,781,000. JST projected that population would grow to about 8,735,000 in 2030 and 12,000,000 in 2040.

On the other hand, Greater DSM population including past population growth since 2002 and projected future population after 2018 up to 2040. The population was about 2,757,000 in 2002. The estimated population in 2017 was about 6,188,000. JST projected that population would grow to 9,975,000 in 2030 and 15,000,000 in 2040.



Source: JST

Change of DSM Population (1978-2040)



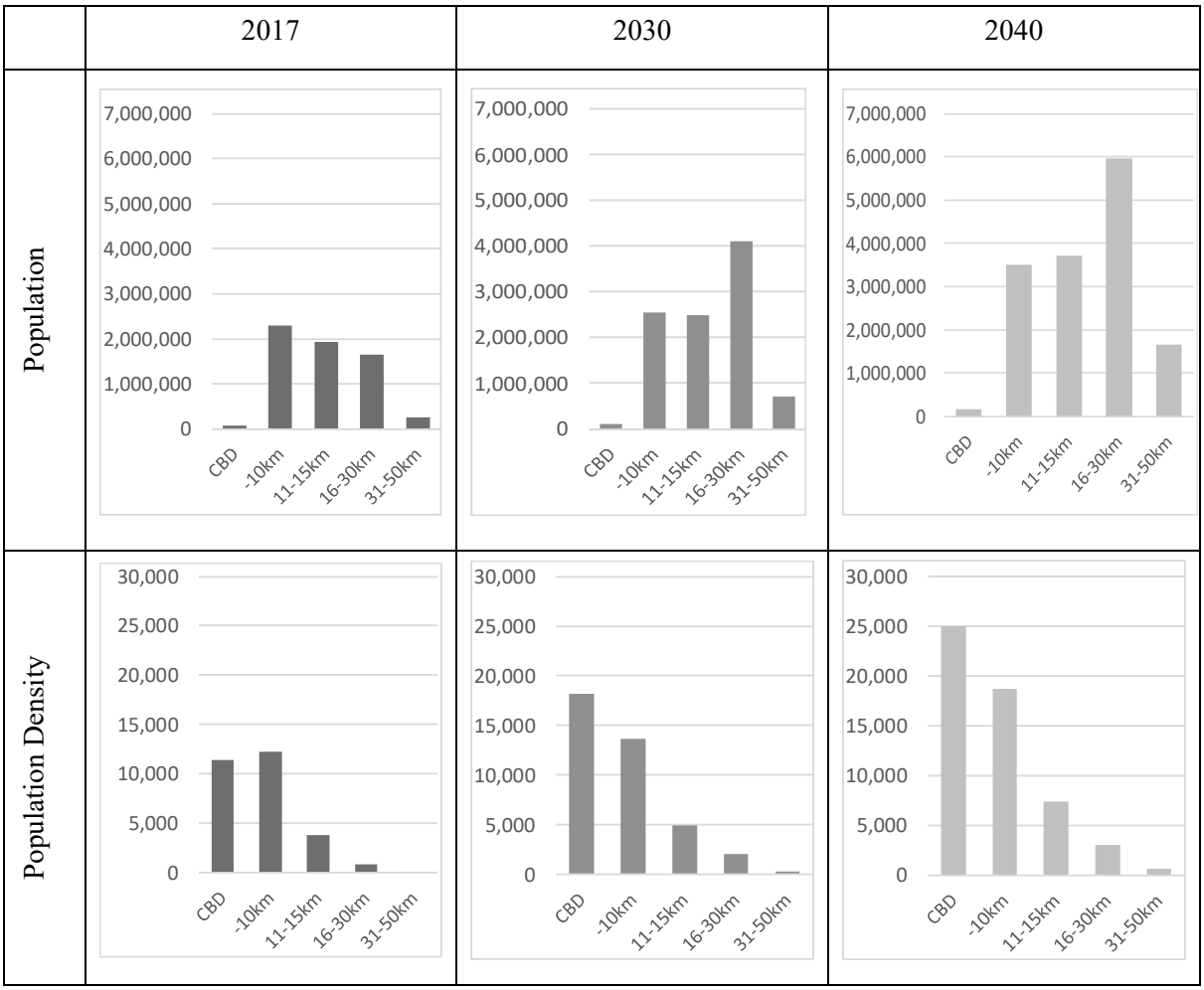
Source: JST

Change of Greater DSM Population (1978-2040)

● Annex 7-2. Population and Population Density Distribution of Greater DSM

The figure shows the distribution of population and population density for Greater DSM. For population, as of 2017, the population within 10km from CBD is highest. In 2030 and 2040, the population of 16km - 30km from CBD is the highest.

For population density, the population density within 10km from CBD is highest, followed by CBD. In 2030 and 2040, the population density in CBD and within 10km is fairly high. Although population of 16km - 30km from CBD is the highest in 2030 and 2040, but population density in 2030 and 2040 is not high.



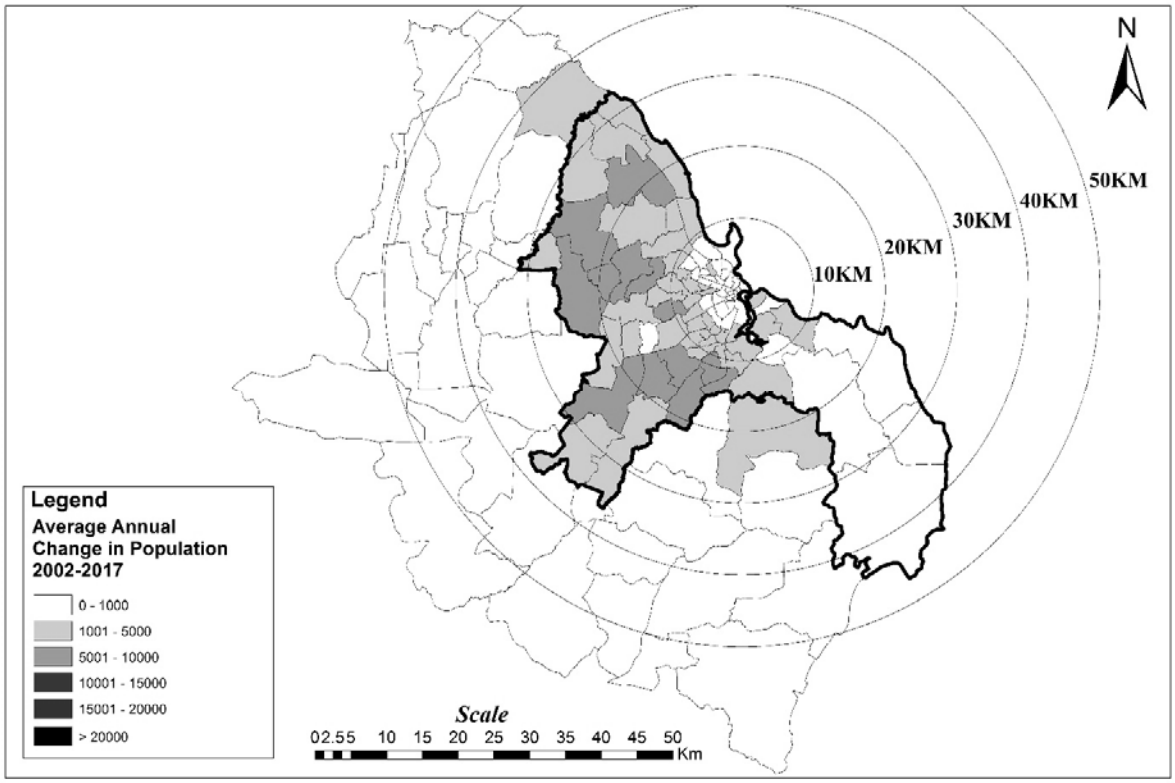
Source: JST

Population and Population Density of Greater DSM by Distance (2017, 2030, 2040)

● Annex 7-3. Average Annual Change in Population in Greater DSM

(1) 2002-2017

Average annual change in population between 2002 and 2017, population tends to grow at the areas 10km to 30km from CBD. The population growth is small within 10km from CBD. The population beyond 30km from CBD is also small.

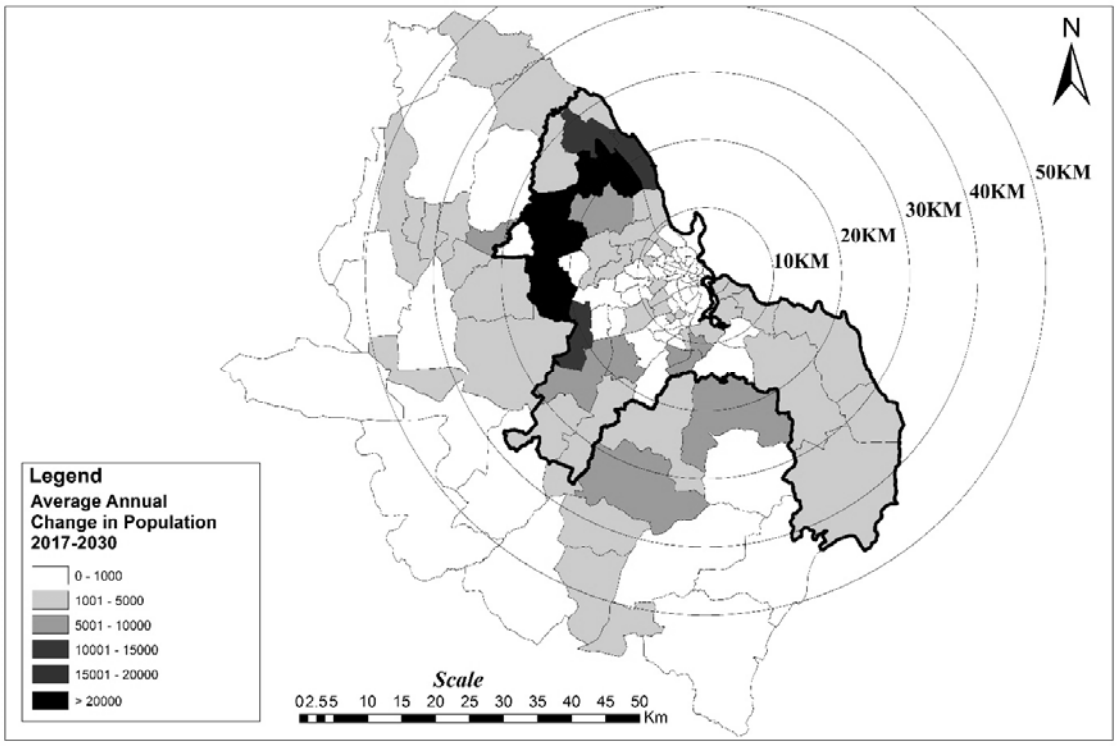


Source: JST

Average Annual Change in Population (2012-2017)

(2) 2017-2030

Average annual change in population between 2017 and 2030, population tends to grow at the areas of 20km to 30km from CBD, especially at western and north western part of DSM. The population at the areas beyond 30km also grow especially outside of DSM along major roads such as Bagamoyo Rd., Morogoro Rd., and Kilwa Rd.

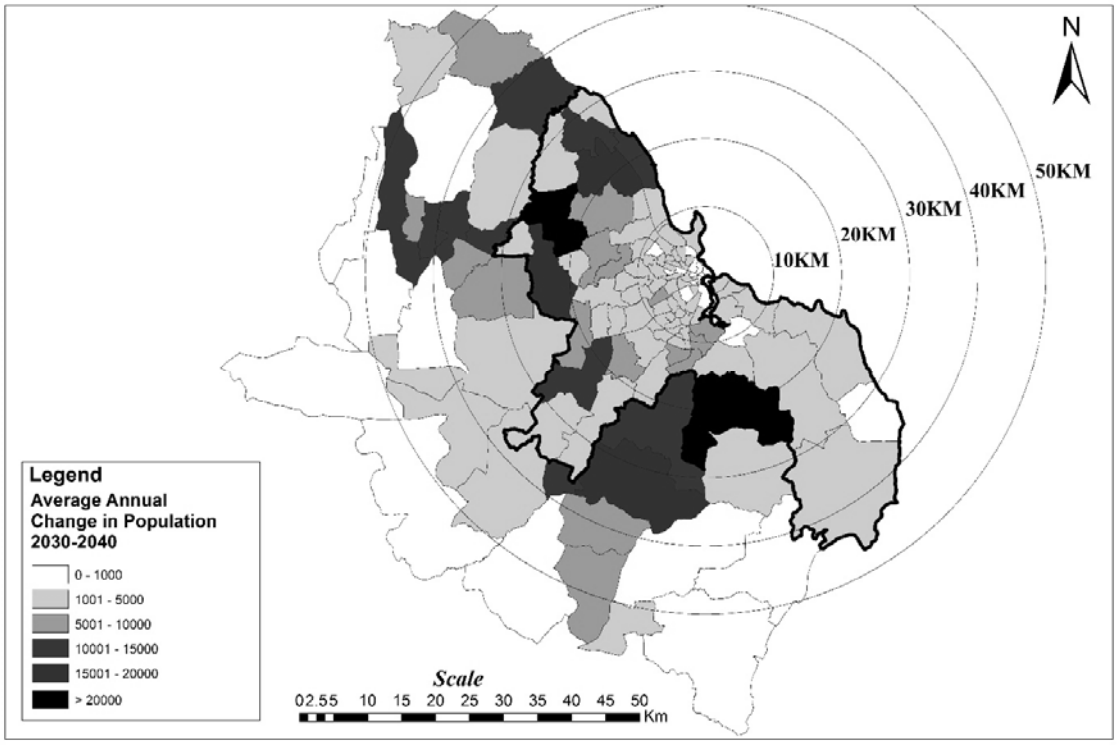


Source: JST

Average Annual Change in Population (2017-2030)

(3) 2030-2040

Average annual change in population between 2030 and 2040, the tendency as seen between 2017 and 2030 continues between 2030 and 2040. In addition, population of areas within 20km from CBD also grow in this period.

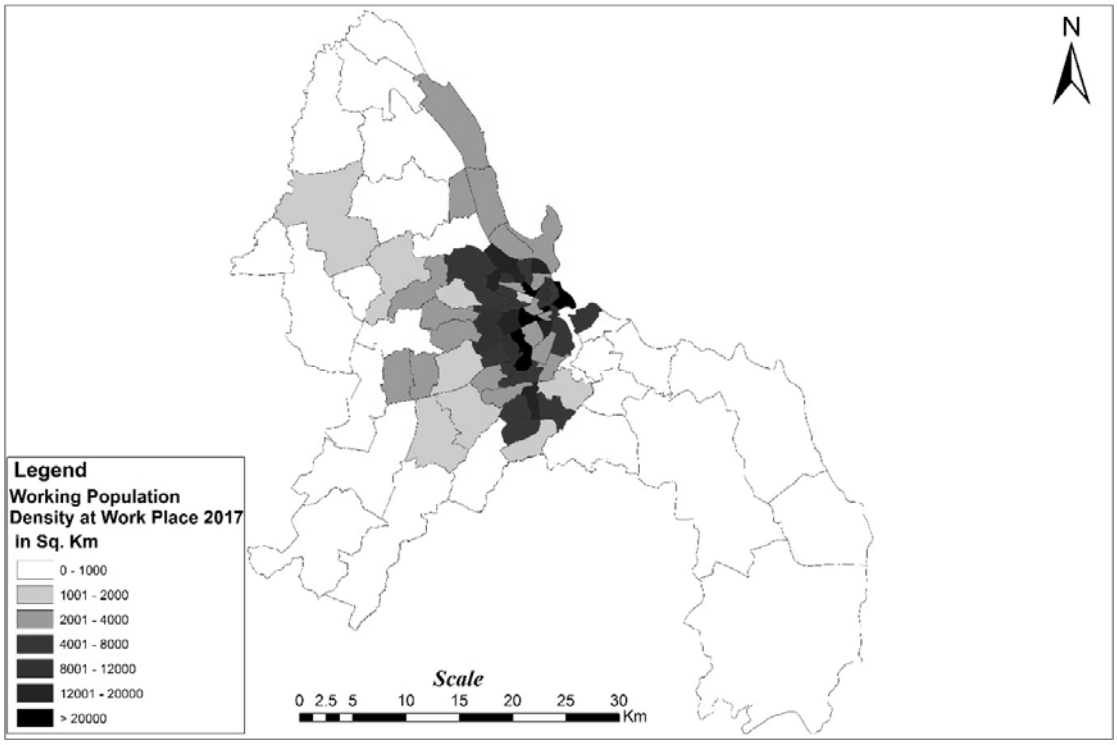


Source: JST

Average Annual Change in Population (2030-2040)

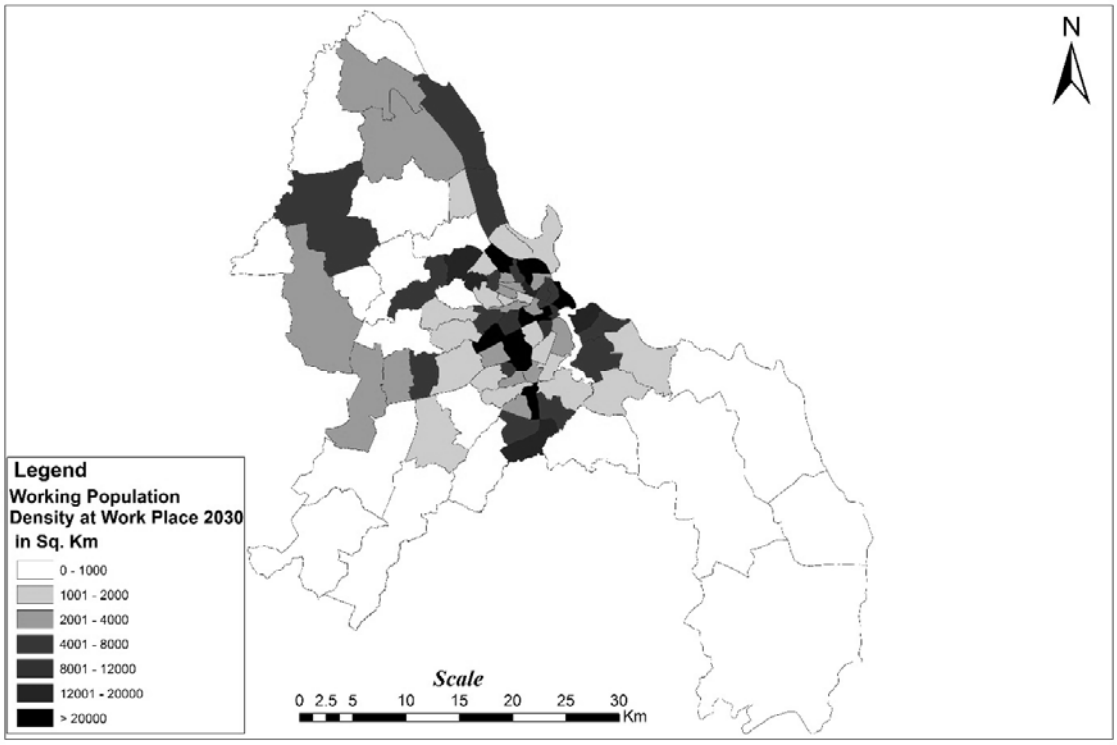
Annex 7-4. Trend of Working Population

Comparing the distribution of working population density of DSM in 2017, 2030, and 2040, working population density tends to grow along the main roads such as Bagamoyo Rd., Morogoro Rd., and Nyere Rd. The trend between 2017 and 2040 also shows the population density will be high at the wards where satellite cities and sub-centers are planned.



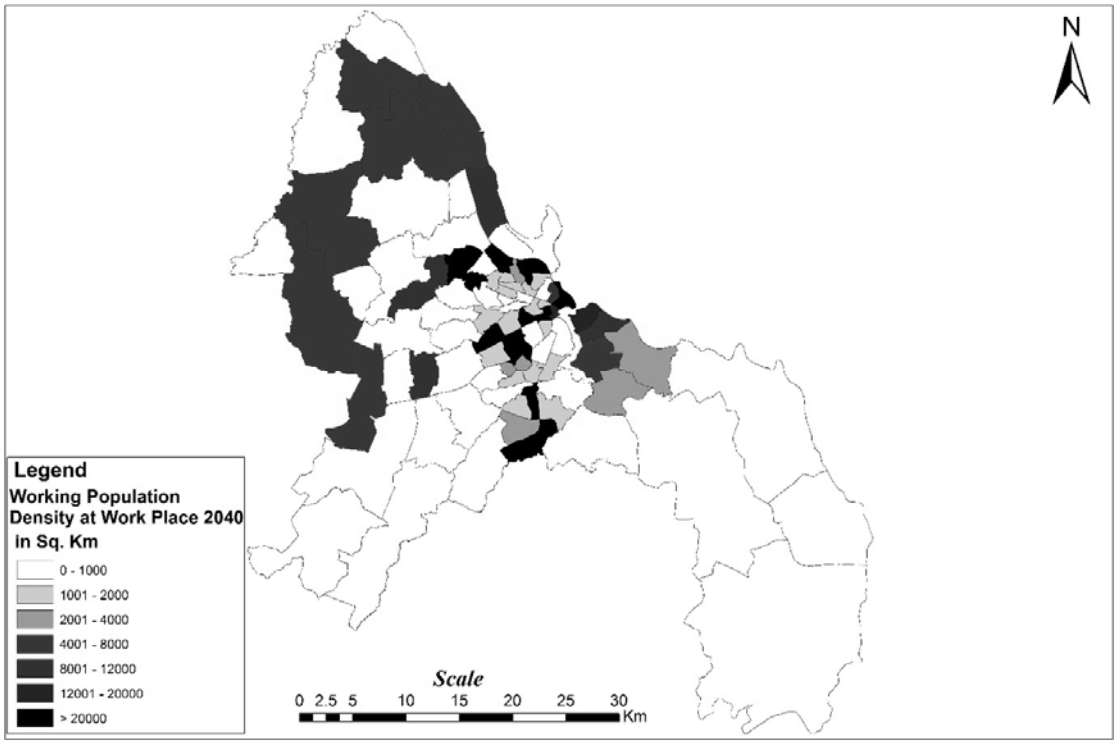
Source: JST

Distribution of Working Population Density at Working Place in 2017



Source: JST

Distribution of Working Population Density at Working Place in 2030

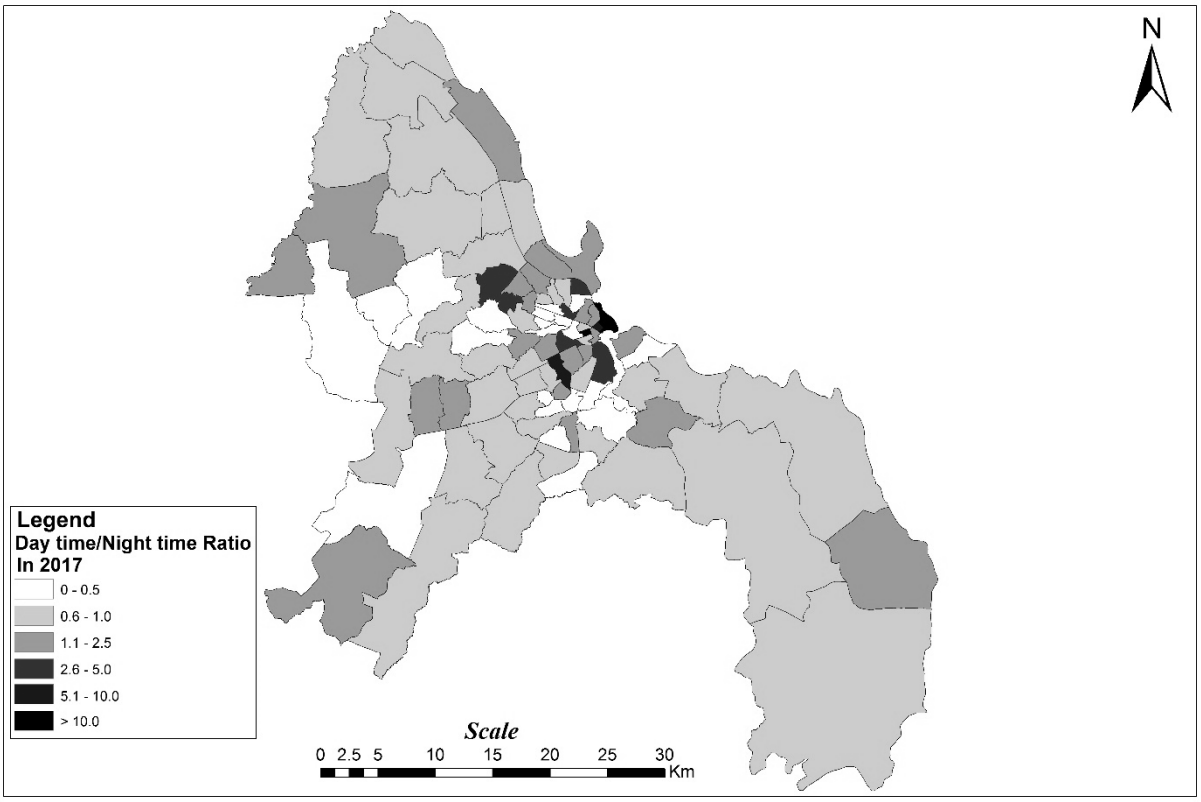


Source: JST

Distribution of Working Population Density at Working Place in 2040

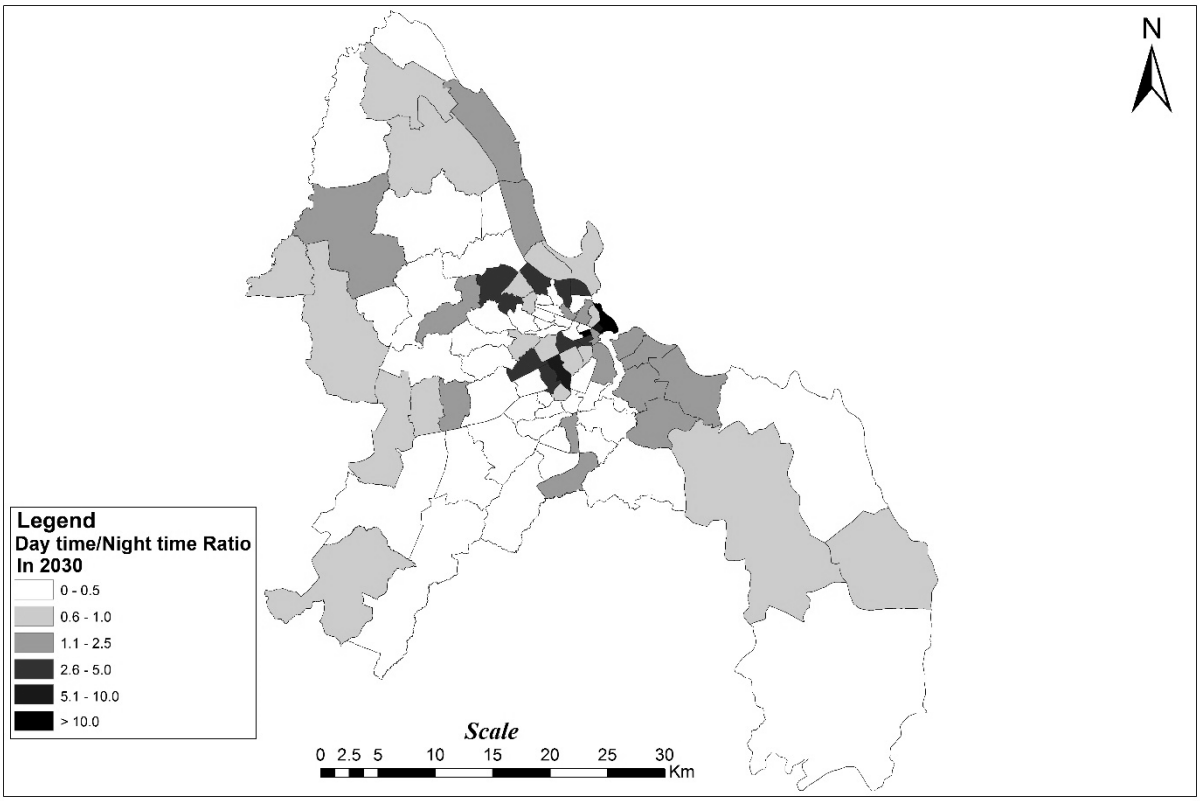
● Annex 7-5. Ratio of Day Time and Night Time Population (D/N ratio)

Figures show the distribution of D/N ratio. As of 2017, the ratio of 0.6 to 1.0 is dominant in DSM. The ratio will be less than 0.5 at many wards of DSM in 2030 and 2040. On the other hand, the wards where sub-centres are to be located and CBD is located have high ratio in 2030 and 2040.



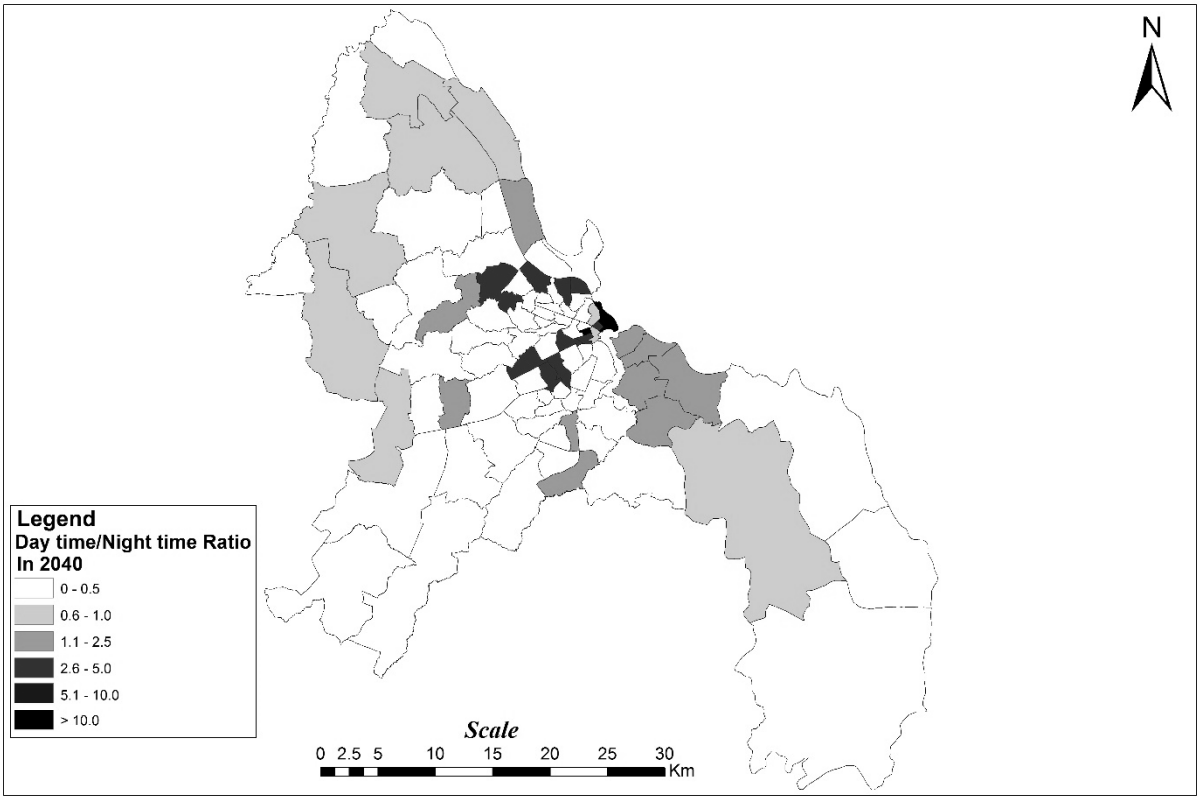
Source: JST

Distribution of D/N ratio in DSM (2017)



Source: JST

Distribution of D/N ratio in DSM (2030)



Source: JST

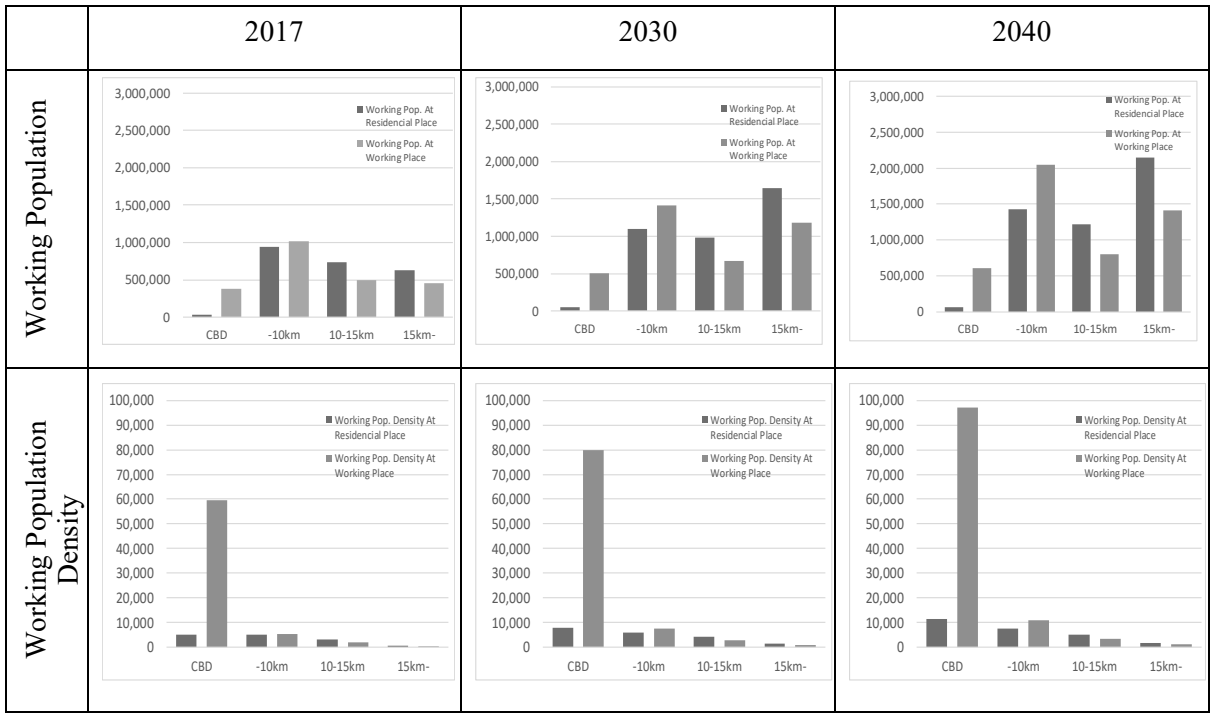
Distribution of D/N ratio in DSM (2040)

Annex 7-6. Working Population and Density of DSM by Distance

The following figure shows the working population and working population density of DSM by distance.

The blue bars show the working population or working population density at residential place, and the orange bars show the working population or working population density at working place. The working population within 10km from CBD is the highest in 2030 and 2040.

The working population density at working place at CBD is the highest in 2017, 2030, and 2040. It is because the land area of CBD is only 3.5km^2.



Source: JST

Working Population and Working Population Density of DSM by Distance (2017, 2030, 2040)

Annex-8: Seminar and Study Tour

- Annex 8-1: Seminar in DSM
- Annex 8-2: Seminar in Japan
- Annex 8-3: Study Tour in Japan

Annex 8-1. Seminar in DSM

Seminar in DSM was conducted in order to share the contents, and to promote the private investment to the proposed projects of the M/P. Since the M/P was at the stage of the Draft Final Report at the time of Seminar, it was requested to convene the official ceremony after the Final Report submission, planned in July 2018. The outline of the Seminar in DSM is as follows.

- Date: 6th April, 2018
- Venue: Julius Nyerere International Convention Centre, Dar es Salaam
- Participants: 133, including Governmental Officials, private companies, and Development Partners
- Agenda:

Time	Agenda	Responsible /Presentation
10:00	- Welcome Speech	PO-RALG
10:10	- Opening Speech	PO-RALG
10:20	- Opening Remarks	Ambassador, Embassy of Japan in TZ Chief Representative, JICA TZ
10:30	- DSM Urban Transport Master Plan - DSM Urban Transport Master Plan - Proposed Projects	JICA Study Team
11:30	- The Way forward	DCC
11:40	- Closing Remarks	Chief Representative, JICA TZ
11:50	- Closing	All

Photos Seminar in DSM

Dar es Salaam for Future

◆ **Population in DSM**

2002 2,487,288 | 2012 4,364,541 | 2040 (JST estimation) 12,000,000

◆ **GDP per Capita in DSM**

2017 3.4 million TZS | 2040 (JST estimation) 6.3 million TZS

◆ **Car Ownership per 1,000 persons in DSM**

2017 33 vehicles per 1,000 | 2040 (JST estimation) 75 vehicles per 1,000

◆ **Person Trips in DSM**

2017 8.8 million person trip/day | 2040 (JST estimation) 19.2 million person trip/

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This Master Plan has been supported by Japan International Cooperation Agency.

Dar es Salaam
Urban Transport Master Plan
2018—2040

Brief Outlines

for the Strategy of "Transit Oriented Mega City"

April, 2018

For Dar es Salaam City

JICA Study Team for the Project for

The Revision of Dar es Salaam Urban Transport Master Plan

May 23, 2018

Create "Transit Oriented Mega City" for the Future of Dar es Salaam

Dar es Salaam is the economic and social centre of Tanzania with a population of 5.8 million in 2017. Recently, rapid increase of population and vehicles has caused severe traffic jam in peak hours. In 2040, the population of Dar es Salaam is predicted to exceed more than 12 million and, as a result, traffic demand would be more than double from 2017.

This is the time to shift for "Transit Oriented Mega City" supported by Mass Rapid Transit (MRT) System including Railway and Bus Rapid Transit (BRT) alongside the transport corridors. This Master Plan proposed the necessary strategies and plans relating to Urban Structure, Road, Public Transport and Traffic Management, in addition to institutional arrangement required for its sustainable management and implementation.

Public Transport

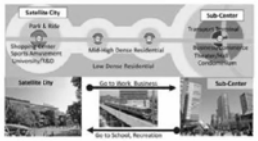
- **Collaboration and Integration of BRT and Railway**

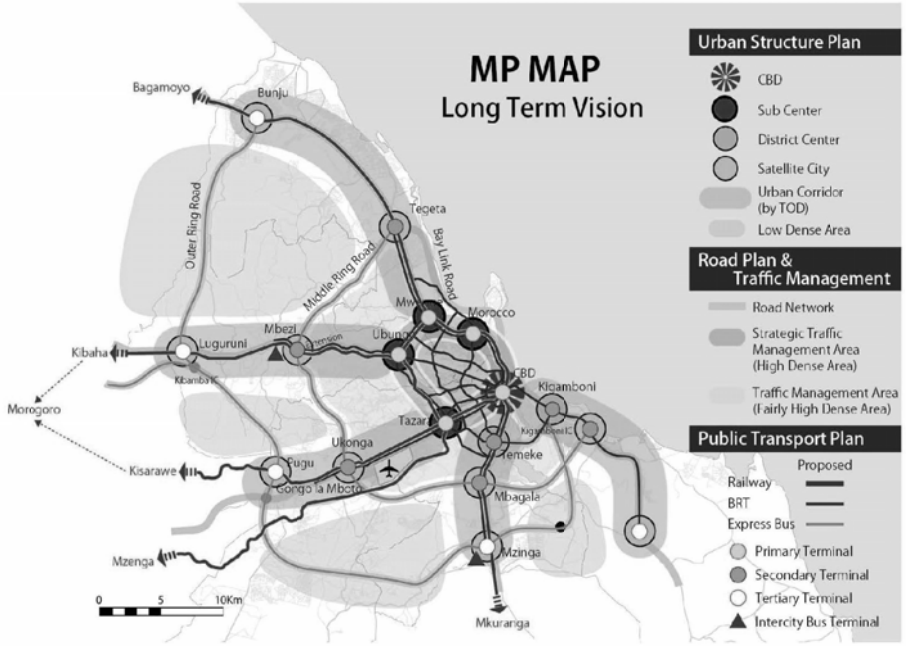
Enhancement of public transport system is crucial for the future of Dar es Salaam. **Collaboration and integration of BRT and Railway** is proposed to deal with the future huge traffic demand and provide better services for public transport users. BRT covers mainly for short-medium distance trip up to 20km, while railway covers for longer trips. Future railway network is proposed to add new lines; **Bagamoyo line, Morogoro line, Loop line and Kilwa line**. This future public transport network will enable citizens to commute from anywhere to the CBD in Dar es Salaam within one hour.

Urban Structure

- **Palm and Fingers with Sub-Centres and Satellite Cities**

Future Urban Structure is proposed to be called "Palm and Fingers structure". The palm consists of the CBD (Central Business District) and **four Sub-centers (Morocco, Mwenge, Ubungo, Tazara)** located along the Loop corridor with a radius of approximately 5km. The five fingers are Bagamoyo, Morogoro, Nyerere, Kilwa and Kigamboni corridors which connect between CBD or Sub-centers and **Satellite Cities** in suburb within 30km from the CBD.





- **Feeder Bus and Express Bus Service**

Feeder bus services connecting to BRT, railway and public transport terminals are proposed in suburb. In addition, **Express-Bus services** for longer bus trips are proposed to be provided by utilization of the Middle Ring and Outer Ring roads. roads.

- **Terminal establishment for the connectivity**

Primary, Secondary, and Tertiary Transport Terminals are proposed to ensure smooth transit among different types of transport mode. **Seventeen terminals** at CBD, Sub-Centres, and Satellite Cities are proposed to enhance connectivity between Railway lines, Railway and BRT, BRT and feeder buses and so on.

Road Network

- **Radial and Ring Road Network with Advanced Technology**

Roads are the most fundamental infrastructure in cities which have a close relationship with urban structure, public transport, traffic management and other lifelines. Future Road Network will be structured by **Middle Ring Road, Outer Ring Road** and **Bay Link Road** adding to the existing radial arterial roads to utilize transport infrastructure more efficiently. Middle Ring Road is proposed as a **smart way with advanced technology** such as **Dynamic-Lane-Management** and **Automated Driving Lanes**. It will also enable smooth access to the International Airport connecting to urban corridors. In addition, **11 Flyover projects** are proposed at the major intersections which suffer from traffic congestion, traffic accident and flood.

- **Improvement of Regional/Collector/Feeder Road Network Density**

Three kinds of areas divided by Nelson Mandela and Middle Ring Road are set up to improve road density with respect to the target density. Especially in current suburbs outside the Nelson Mandela Road, a proposal to **increase the density to 2.0km/km2 with two-lane, paved carriageway and maximum grade of less than 10%** will contribute to improve accessibility to feeder bus services in the suburbs.

Traffic Management

- **Dynamic Signal Optimization System and Travel Information System**

"Smart and Safe Mobility" is the key term for the traffic management in the future. **Dynamic Signal Optimization System, Real-Time Traffic Information System** and **Public Transport Priority System** are proposed to manage traffic movement and provide information; travel time to destination, arrival time of public transport, congested route, traffic accident, flooded places. The installation of the new systems will be implemented together with the establishment of **Traffic Control/Emergency Centre** and the designation of Strategic Traffic Management Area.

- **Parking Management and Non-Motorized Transport (NMT)**

The Transport network of BRT and Railway is expected to promote the modal shift from private vehicle to public transport. The Master Plan proposes encouragement of **Park & Ride (P&R) system** to ensure parking spaces for P&R users near transport terminals. The parking inside CBD will be controlled by parking fee or regulation on roadside parking. For the NMT, ensuring space or network around transport terminals is proposed for **pedestrians and bicycles**, in particular.

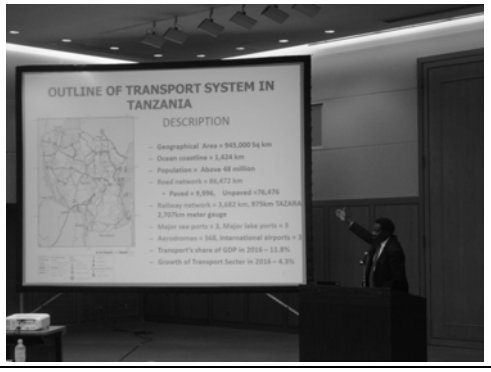
● Annex 8-2. Seminar in Japan

Seminar in Japan was convened aiming for sharing the contents of proposed projects of the M/P to the Japanese enterprises and companies. The Seminar welcomed Tanzania Delegation, which consisted of 13 members of M/P stakeholders; from PO-RALG, MOWTC-Works, MOWTC-Transport, DSM-RAS, DCC, Municipal Councils of Ilala, Kinondoni, Ubungo, Kigamboni, and NIT. On behalf of GOT, Ambassador of Embassy of Tanzania in Japan also represented. From the Japanese side, about 90 people attended the Seminar, including from JICA Headquarters, Ministry of Land, Infrastructure and Transport (MLIT), City of YOKOHAMA, enterprises of international trading, construction, traffic system, equipment, GIS & Mapping systems, etc.

Prof. Zacharia Nganliwa, principal of NIT, delivered the presentation of "Investment Opportunity in DSM Urban Transport" on behalf of Tanzanian Delegation. Variety of materials to promote investment, such as Investment Guide, PPP Act, were displayed at the Conference Hall and shared to the participants by soft copy. After the Seminar, the business matching and interaction opportunity had been arranged between Japanese participants and Tanzanian delegation. Outline of the Seminar in Japan is summarized as follows.

- Date: 7th June, 2018
- Venue: JICA Ichigaya International Conference hall, Tokyo, Japan
- Participants: 107, including JICA HQ Officials, Governmental Officials, private companies, and Tanzania Delegation
- Agenda:

Time	Agenda	Responsible /Presentation
9:00 - 9:30	Registration	JICA / JICA Study Team
9:30	Opening Remarks	Mr. KATO, JICA Vice President
9:35 - 9:40	Opening Speech from the Honorable Guests	Ambassador, Embassy of Tanzania in Japan
9:40 - 10:15	Presentation : Investment Opportunity in DSM Urban Transport	Government of Tanzania Delegation, Prof. Zacharia Nganliwa
10:15 - 10:30	Attractiveness of Tanzania Investment	Dr. Tokunaga, Professor of University of Takushoku
10:30 - 11:30	Presentation : DSM Urban Transport Master Plan - Contents of M/P - Good Practice: Urban Transport Technology and Approach in Japan (A) TOD in Japan (B) Advanced Technology for the Traffic Management-How to apply to DSM MP	JICA Study Team (EJEC/NK/CTII/MEX)
11:30 - 11:50	Discussion	All
11:50 - 12:00	Closing Remarks	Mr. KATO, Director of Africa Section, JICA
12:00 -13:00	Exchange of Opinions & information	




Photos Seminar in Japan

During the discussion, there were several comments and questions raised from Japanese participants, and Tanzania delegation answered.

- **Land Use Assurance and GOT Support**

For the foreign investors who intend to participate the M/P proposed projects, it would be supportive if there is simple and easily understandable system of land use permission.

- **Procurement Procedure in Tanzania**

It will be helpful for Japanese companies to get more detailed information for the procurement procedure and specification. It is requested to share the schedule of planned BRT phases, and schedule for bidding.

- **Members of Tanzania Delegation**

S/N	Organization	Participants	Position
1	PORALG	Davis B. Shemangale	Assist. Director Urban Roads
2	PORALG	Gilbert Mwoga	Assist. Director Roads
3	PORALG	Emmanuel K. Ndyamukama	Senior Engineer
4	PORALG	Jovin B. Bujulu	Procurement Specialist
5	DCC	Sipora J. Liana	Director DSM City Council
6	Dar Municipal	Msongeka Palela	Director Ilala Municipal Council
7	Dar Municipal	Aron T. Kagurumjuli	Director Kinondomi Municipal Council
8	Dar Municipal	John L. Kayombo	Director Ubungo Municipal Council
9	Dar Municipal	Stephen Katemba	Director Kigamboni Municipal Council
10	DSM-RAS	Gilberth Bakula	Quantity Surveyor
11	MOWTC-T	Aunyisa B. Meena	Assist. Director of Planning
12	MOWTC-W	Antony S. Masha	Assist. Director of Roads
13	NIT	Prof. Zacharia M.D. Nganilwa	Principal

ダルエスサラーム
都市交通マスタープラン
2018—2040

「公共交通指向型メガシティ」の戦略に関する概要

2018年6月

JICA調査団

(株)エイト日本技術開発、日本工営株式会社、(株)建設技研インターナショナル、首都高速道路株式会社)

ダルエスサラーム都市交通マスタープラン改訂プロジェクト

2018.05.23

将来のダルエスサラーム

◆ ダルエスサラーム市の人口

◆ ダルエスサラーム市の一人あたりGDP

◆ ダルエスサラーム市の1,000人あたりの自動車保有台数

◆ ダルエスサラーム市のパーソントリップ

本マスタープランに係る担当機関の連絡先

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TEL: + 255 (26) 2322848,
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WEB Site: http://www.tamisemi.go.tz/

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Dar es Salaam City Council

Department of Urban Planning, Environment and Transportation
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本マスタープランは国際協力機構の支援により作成されました。

将来のダルエスサラーム「公共交通指向型メガシティ」の形成

ダルエスサラームはタンザニアの経済および社会の中心であり、2017年時点で580万人の人口を擁する。近年の急速な人口と車の増加はピーク時の交通渋滞の原因となっている。2040年にダルエスサラームの人口は1,200万人を超え、その結果、交通需要も2017年の2倍以上に増大すると予測される。

今、鉄道などの大量高速輸送システム（MRT）やバス高速輸送システム（BRT）に支えられた「公共交通指向型のメガシティ」を目指すべきである。本マスタープランでは、都市構造、道路、公共交通、交通管理に係る提案を行うと共に、その持続可能な管理と実施に必要な組織や制度の提案を行っている。

公共交通

● **BRTと鉄道の連携および統合**

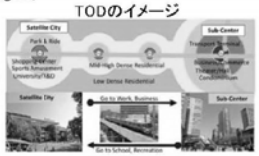
公共交通の整備は将来のダルエスサラームにとって極めて重要である。将来の膨大な交通需要への対応と、より良いサービスを公共交通のユーザーに提供するため、**BRTと鉄道の連携および統合**を提案している。BRTは主に20km以下の短中距離のトリップをカバーし、それ以上の距離については鉄道がカバーする。将来の鉄道ネットワークについては既存線に加え**Bagamoyo線、Morogoro線、Loop線、およびKilwa線**の新線整備を提案している。この将来交通ネットワークの整備により、ダルエスサラーム市内のどこからでも1時間以内でCBDに通勤できるようになる。

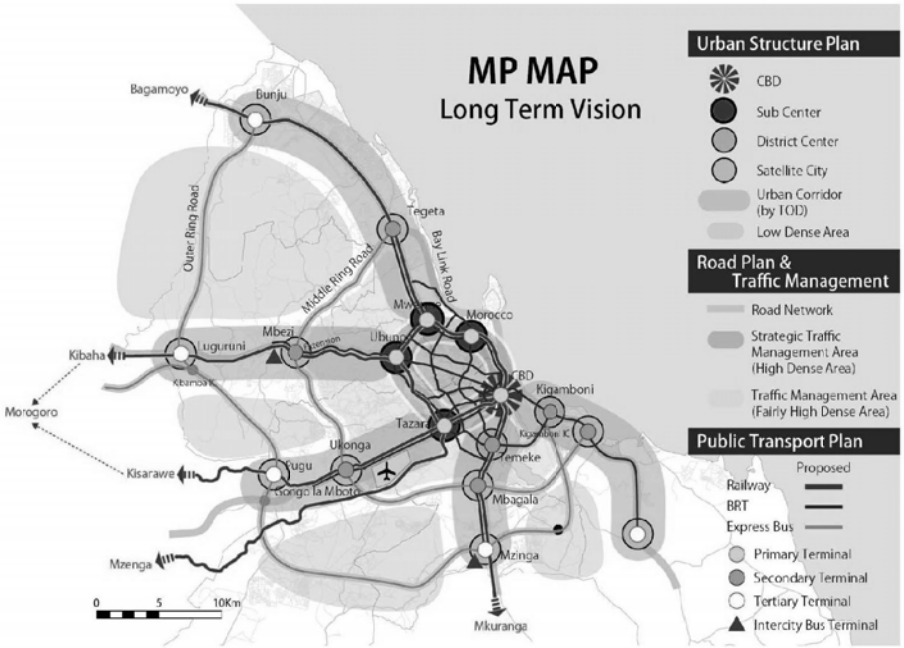
都市構造

● **副都心と衛星都市の形成によるパーム＆フィンガー型都市構造**

「パーム＆フィンガー型構造」と呼ばれる将来都市構造を提案する。パームはループ線沿いの中心業務地区（CBD）と4つの**副都心（Morocco, Mwenge, Ubungo, Tazara）**から構成される。これらは、CBDから約10km圏内に位置する。5本のフィンガー（指）は Bagamoyo, Morogoro, Nyerere, KilwaとKigamboniの都市回廊であり、これらの5本の指はCBDと約30km圏に位置する**衛星都市**を結んでいる。

TODのイメージ





● **フィーダーバスおよび急行バスサービス**

郊外部においてBRT、鉄道、その他の公共交通に接続する**フィーダーバスサービス**を提案している。さらに、長いバストリップについては中環状道路や外環状道路を活用した**急行バスサービス**を提案している。

● **連結性強化のためのターミナル整備**

異なる種類の交通モード間の円滑な乗り換えを実現すべく、**交通ターミナル**の整備を提案している。CBD、副都心、衛星都市において**17箇所の交通ターミナル**を提案し、鉄道路線間、鉄道とBRT間、BRTとフィーダーバス間などの連結性強化を目指す。

交通管理

● **信号制御システム・交通情報提供システム**

“スマートで安全なモビリティ”の実現は将来の交通管理のキーワードとなる。本マスタープランでは、**信号制御システム、リアルタイム交通情報システム、および公共交通優先システム**により、市内の交通の動きをコントロールするとともに、目的地までの旅行時間や公共交通の発着時間、渋滞路線、交通事故や洪水の発生箇所などに関する情報提供をリアルタイムに行うことを提案している。これら新しいシステムの導入は**交通管制センターおよび緊急コールセンター**の整備と合わせて実施する。

道路ネットワーク

● **先端技術を駆使する放射・環状道路ネットワーク**

道路は都市における最も基礎的な社会基盤であり、都市構造、公共交通、交通管理、その他のライフラインと密接な関係を持つ。ダルエスサラームの将来の道路ネットワークは、交通インフラをより効率的に活用できるよう、既存の放射道路に加え、**中環状道路、外環状道路、湾口部接続道路**から構成される。中環状道路は、**ダイナミックな車線運用や自動運転専用レーン**など**先端技術を導入したスマート道路**として提案する。これにより、都市回廊に接続した国際空港への円滑なアクセスが可能となる。さらに、交通渋滞、交通事故、洪水が発生する主要な交差点において**11のフライオーバー整備事業**を行うことを提案している。

● **フィーダー道路のネットワーク密度の向上**

道路密度の向上のため、Nelson Mandela道路および中環状道路で分割される3種類の地域を設定した。特に、Nelson Mandela道路の外側の郊外部では、**最大傾斜10度以下の2車線舗装道路により道路密度を2.0km/km²（1kmメッシュ）以上に高める**提案を行っている。これにより、郊外部のフィーダーバスサービスのアクセシビリティ改善に寄与する。

雨期の道路冠水状況

交通管制センターのイメージ

● **駐車場管理および非動力交通（NMT）**

BRTや鉄道の交通ネットワークの整備を進め将来にわたり、乗用車から公共交通へのモーダルシフトを促す。本マスタープランでは、**パーク＆ライド**を促進すべく、交通ターミナル付近でパーク＆ライドシステムユーザーのための駐車スペースの確保を提案している。CBD内の駐車場については駐車料金の設定や路上駐車規制により制御を行う。非動力交通については、交通ターミナル周辺で**歩行者や自転車利用者**のためのスペースやネットワークの確保を提案している。

Annex 8-3.Study Tour in Japan

Study Tour in Japan was conducted as the one of the Project activities from 17th August 2017 for 2 weeks. The Objectives and outline of the Study Tour is as follows.

- Name of the Course: Urban Transport Master Plan Management Course
- Duration：19th August (depart from DSM) to 1st September (Arrive at DSM), 2017
- Number of participants: 10
- Purpose of the Training:
  - To understand the effective management system of urban transport
  - To learn the latest technology contributes to decrease the congestion of urban transport.
- Schedule：

Date		Schedule		Lecture/Site Visit	Stay
19-Aug-17	Sat	Flight from TZ to Dobai/Doha	Move		
20-Aug-17	Sun	Flight from Dobai/Doha to Japan (Narita Airport)	Move	Move from Narita Airport to JICA Tokyo	JICA Tokyo
21-Aug-17	Mon	AM：Programme Orientation	Briefing	JICA-DARTMP Team	JICA Tokyo
22-Aug-17	Tue	AM：Monistry of Land, Infrastructure and Transport (MLIT) PM：Site Visit -Integrated Tokyo Transport System	Lecture Site Visit	MLIT: Transport System and Administration of Maga cities in Japan Site Visit: Japan Rail Yamanote Circle Line, Shonan-Shinjyuku Line, Development of Shinagawa Station	JICA Tokyo
23-Aug-17	Wed	AM：Yokohama City PM：Site Visit - Transport Plan and Management at City Level, Integration of variety of Transport	Lecture Site Visit	Yokohama City: Transport Plan and Management in Yokohama Site Visit: Yokohama Underground, City Bus	JICA Tokyo
24-Aug-17	Thu	AM：TOD Examples - Experience of Japan PM：Site Visit - TOD sample Tokyu Railway Line	Lecture Site Visit	Prof. Hyodo/Dr. Tokunaga: TOD Examples and experience in Japan Site Visit: Tokyu Railways TOYOKO Line, Minato Mirai 21	JICA Tokyo
25-Aug-17	Fri	AM: Metropolitan Express Way Co. Ltd. (SHUTOKO) PM: Site Visit - Expressway Network, Traffic Control	Lecture Site Visit	SHUTOKO: Highway Netowk in Tokyo, Traffic Information and Control Centre Site Visit - Metropolitan Express Way network, Traffic Control Centre, Rainbow Bridge	JICA Tokyo
26-Aug-17	Sat				JICA Tokyo
27-Aug-17	Sun	Tokyo City Tour	Site Visit		JICA Tokyo
28-Aug-17	Mon	AM: Site Visit PM: Nippon Signal Co. Ltd,.	Move Lecture Site Visit Discussion	Site Visit - Shinjyuku BUSTA Nippon Signal: Traffic Control System Site Visit - Factory Tour, Nippon Signal, Discussion	JICA Tokyo
29-Aug-17	Tue	Site Visit - Advanced Technology of Cross-Habour Tunnel Summarization Workshop	Workshop	Tokyo Wan Aqua Line, Tokyo City Tour Findings from Study Tour, Application for the DSM Urban Transport System	JICA Tokyo
30-Aug-17	Wed	AM：Discussion PM: Presentation of Findings	Discussion Presentation	Findings of Study Tour, Implecations for DARTMP Presentation	JICA Tokyo
31-Aug-17	Thu	Move from JICA Tokyo to Narita Airport Move from Narita/Japan to Dubai/Doha	Move		
1-Sep-17	Fri	Movefrom Dubai/Doha to Dar Tanzania	Move		

The participants attended the series of lectures during the Study Tour, which were provided by the lecturers from Ministry of Land, Infrastructure and Transport (MLIT), City of YOKOHAMA, Seaside Line Company, and Nippon Signal Company. Site visit were also arranged to get the practical lessons learned from the Japanese experience of TOD and advanced technology utilization for urban traffic management. Findings and Proposals are summarized as lessons learned from Study Tour.

(i) Findings from the Study Tour in Japan

Land Use

- In Japan, Land use is based on the development of satellite cities. Investment on transportation system runs parallel with housing estates investments. Different modes of transportation systems are invested, integrated and harmonized (synchronized) on the same corridor in order to provide services to people.
- There is efficient policy on land use that provides proper utilization of the available land. Government facilitates the developments or improvements of urban transport as well as integrated urban development projects

Road Network

- The Road network in Japan is paved and provides smooth flow traffic. Traffic friction at the junctions has been eliminated through Grade separation, fencing and tunneling. Noise pollution has been reduced through provision of noise barrier at the residence.
- The road density is high with good condition. With high road density and road condition, accidents have been reduced.
- There is no use of road humps or rumble strips for the case of speed reduction. A quite number of express ways have been provided to easy traffic movement.
- There is real time information display along the road network.
- Road network for smooth flow of traffic within the city of Dar es Salaam can be constructed in order to have connectivity among other roads (radial and ring)

Public Transport

- In Japan various modes are used to provide efficient public transportation. All modes of transport are integrated at station or hubs. In metropolitan long distance travel, Mass Rapid Transit used for commuting.
- A single Smart Card is integrated with other uses and public transportation network which creates a smooth environment for both users and transportation system. Payment of fare is based at distance travelled from origin to destination.
- Public transport system is operated by private companies. The public transport system is governed and monitored through ITS.
- In General the public transportation system in Japan is reliable, safe and comfort compared to Tanzania. Different researches for different system for monitoring public transport are conducted in order to ensure safety of the users.

- A circular loop commuter railway line (MRT) can be introduced within the city of Dar es Salaam in order to transport from different places to and away from other places.

Traffic Management

- In Japan, Intelligent Traffic Management System has been adopted all over the country in which vehicles are detected, analyzed, monitored and evaluated from all road network through a single control centre located at different places such as for Shutoko Group in East Tokyo Bureau, West Tokyo Bureau and Kanagawa Operation Bureau for Tokyo Metropolitan Expressway.

(ii) Applicable Solution and Proposal

Land Use

- Completion of on-going Land Use Master Plan (physical) is essential.
- Enforcements of laws that will govern construction of buildings in unplanned areas to halt unplanned settlements.
- Establishment of sub-centres along major transportation corridors to improve ridership on existing routes that provides public transport. Upgrading of unplanned existing settlements by land re-adjustment or developments. Establishment of revolving fund that will expedite survey of land and issuing tittles to people

Road Networks

- Harmonization of on-going Land Use and Transport Master Plan is required.
- Opening new corridors that will improve linkages and connectivity.
- Opening new ring roads, Upgrading of earth/gravel roads to paved standard, Separation of different modes transport e.g. roads and railways when meet each other will practical and effective.
- Carry out public awareness campaigns to rise awareness on proper and safe use of roads.
- Establishment of road asset management system to enhance management and maintenance of roads

Public Transport

- Introduction of development areas/sites by the Government of private sector that will attract people in order to increase ridership.
- Improvements/Upgrading of the existing commuter railway services to modern service as a short term and establishing of new routes for long term mass transit. For long term railway investment, railway should be implemented as a mass rapid transit for long distance commuting. To use railway network as the backbone for Transit Oriented Development (TODs)
- Acquiring of enough land that will be developed into hubs for different modes of transport. Establishment of coordination mechanism that will enhance realization of the project for TOD whether in Public Private Partnership (PPP) or Private Investments.
- Establishment of Park and Ride (P&R) facilities along public transport corridors.
- Improvement on scheduling and information dissemination for public transport system.

- Suppress demand for use of private vehicle use by establishing fringe parking and introduction of shuttle services routes.
- Policy for provision of public transport should be done through companies instead of individual.
- Introduction of integrated smart cards for public transport use and other commercial services/use.

Traffic Management

- Synchronization of signals to enhance smooth flow of traffic. Installation of ITS, CCTV cameras and other components for traffic control and management. Acquiring software that will run traffic management issues
- Establishment of state of the act control centre for traffic management.

Implementation and Harmonization

- Dar es Salaam City Council should be a champion of the Transport Masterplan and guide its implementation with other institution.
- There should be a single Data centre for Urban Transport and land use developments at Dar es Salaam City Council.
- Dar es Salaam City Council should be capacitated to take over its responsibility on the masterplan.
- Other infrastructure developments should be guided by the Transport master plan.

Participants :

S/N	Organization	Participants	Position
1	PO-RALG	Charles A. Mariki	Town Planner
2	MOWTC-T	Paulo Laizer	Senior Statistian
3	MOLHHSD	Nzori Kinero	Principal Town Planner
4	DSM-RAS	Eng. Josephat Shehemba	Regional Secretariat Engineer
5	DCC	Eng. Swalehe Nyenye	Road Engineer
6	DART	Eng. Ahmed Wamala	Engineer
7	SUMATRA	Aisha Kuwa	Road Licensing and Monitoring Officer
8	TANROADS	Eng. Ephata Mlavi	Senior Engineer
9	TRC-RAHCO	Eng. Machibya Masanja	Engineer
10	Ilala MC	Eng Allan Shula	Civil Engineer








Photos Training in Japan

Annex-9: GIS Data and Mapping

- Annex 9-1: GIS Data
- Annex 9-2: Mapping

Annex 9-1. GIS Data

The following GIS files were collected from the related organization for analysis.

List of GIS data collected

Organization	Contents of GIS File	File Name
Tanroads	Roads Data for Dar es Salaam	Main Road Network, Minor roads
DCC (Under MOLHHSD)	Dar es Salaam Image	DSM Image arc 1960
DCC (Under MOLHHSD)	Masterplan data for the Existing Land Use	Masterplan
CUPID	Boundary, Natural Condition, Landuse,Utility,River,Transport,Place Names,Raster, Others, Collected Data)	00_DSM_GIS
DMDP	BRT Phases, collection points, Roads, Drainage, footpaths	DMDP Shapefiles
JST	Staging plans for 2017, 2020-2025, 2025-2030, 2030-2040	Staging Plan

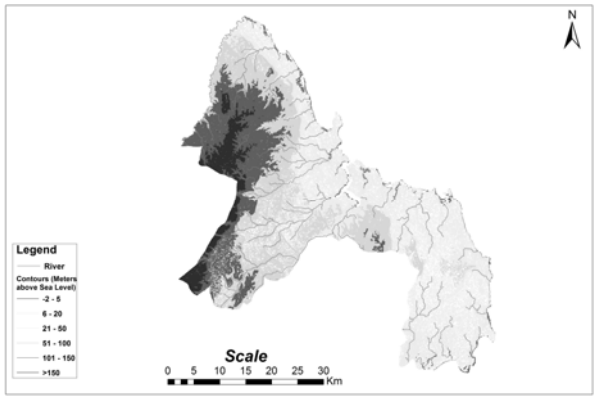
● Annex 9-2. Mapping

The following type of maps were created for the master plan study.

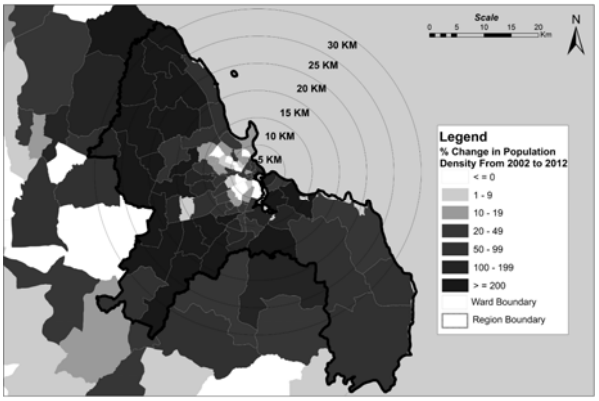
Prepared Maps
1. Population Maps for 2002,2012,2040
2. Population Density Maps 2002,2012,2017,2040
3. Population Growth Rate 2002-2012,2002-2017, 2017-2040
4. Planned Junction, Intersection Improvement
5. DMDP Map
6. Existing Land use Map
7. 1978 DSM Masterplan
8. Trunk Road for Greater DSM Region
9. Trunk Road for Tanzania
10. 2008 Transport Masterplan Map
11. Bus Terminals
12. Flood Points
13. Parking spaces within DSM
14. Municipality Map
15. Incidence Map
16. Planned Road Projects
17. Protected areas
18. Rock Structure in DSM
19. Topology of DSM

Administrative Boundaries

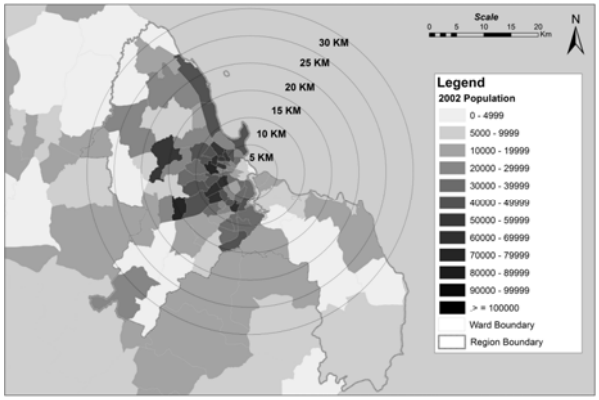
Municipality Map



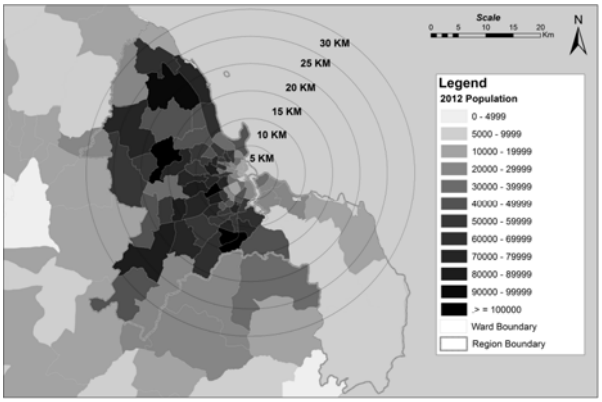
Topology of Dar es Salaam



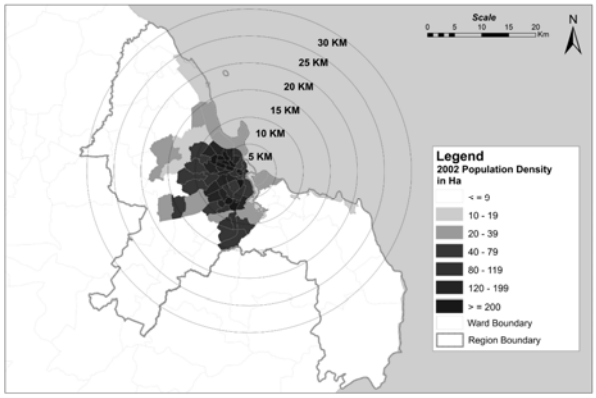
Population Change



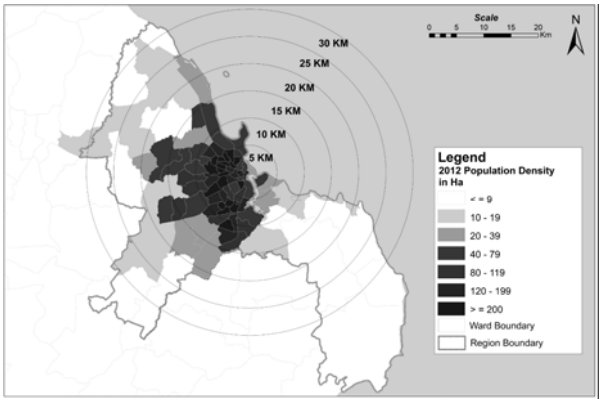
2002 population



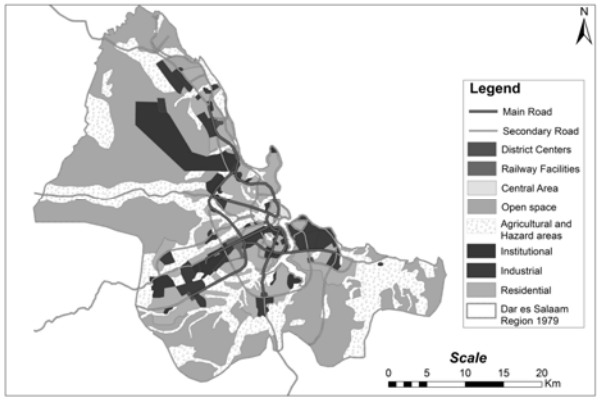
2012 population



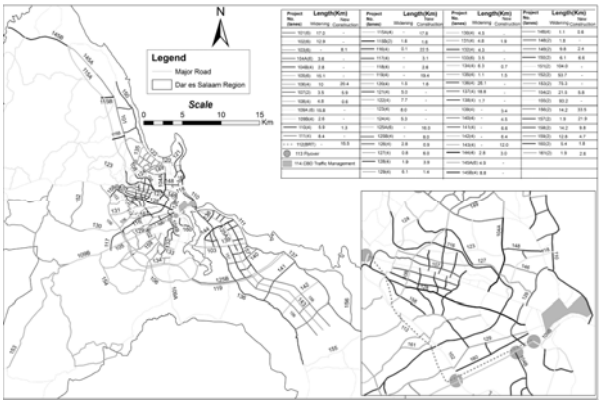
Population Density 2002



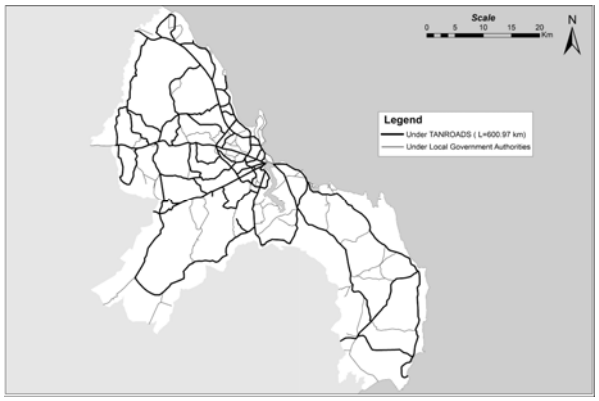
Population Density 2012



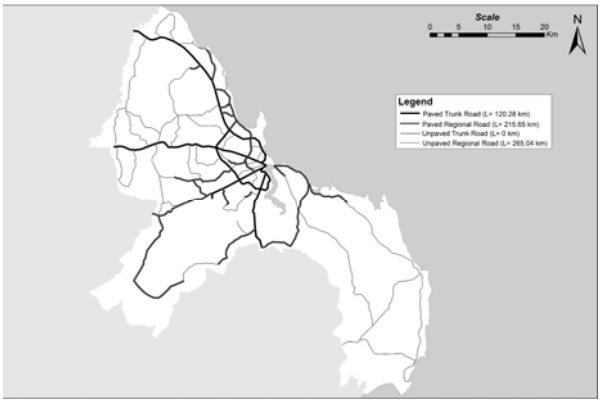
1978 Master Plan



2008 Master Plan



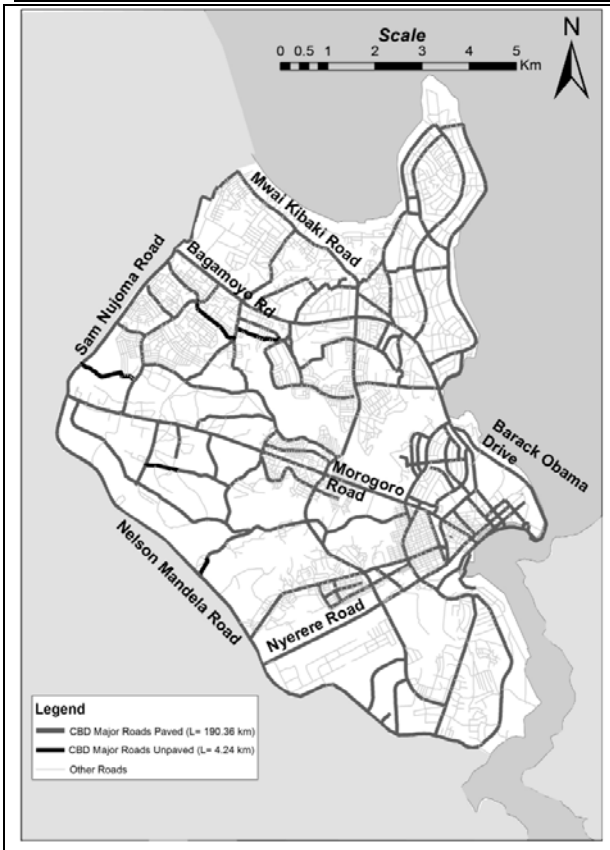
Dar es Salaam Road Network Map



Road Network by Pavement Type

Current Road Network by lane

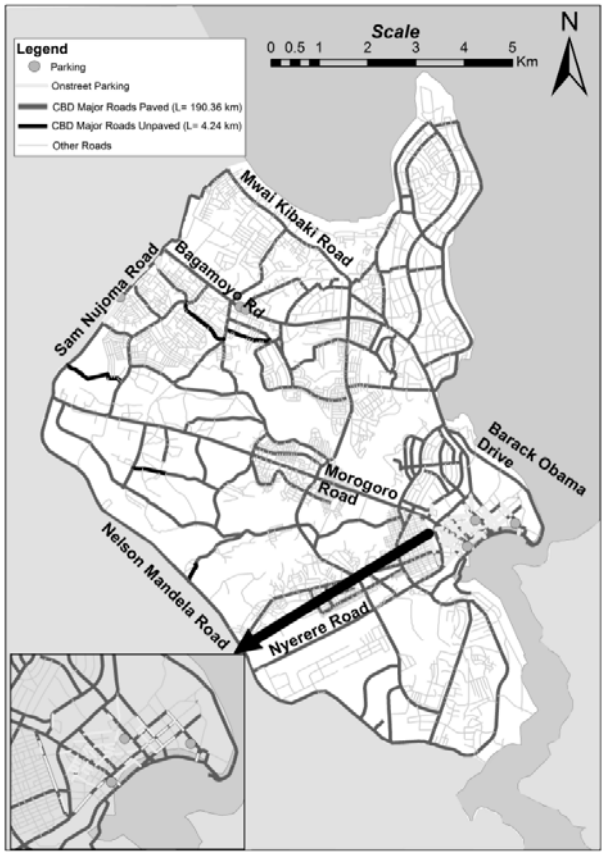
Road Project Status Map



Road Network Map within Nelson Mandela Road

Bus Terminal Location Map

Flood Area Map



Parking Location Map