United Republic of Tanzania
President's Office, Regional Administration and Local Government (PO-RALG)
Dar es Salaam City Council (DCC)

THE PROJECT FOR REVISION OF DAR ES SALAAM URBAN TRANSPORT MASTER PLAN IN UNITED REPUBLIC OF TANZANIA

FINAL REPORT

SUMMARY

JULY 2018

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

EIGHT-JAPAN ENGINEERING CONSULTANTS INC.
NIPPON KOEI CO., LTD.
CTI ENGINEERING INTERNATIONAL CO., LTD.
METROPOLITAN EXPRESSWAY COMPANY LTD.

CURRENCY EXCHANGE RATE

(1) Tanzania Shillings (TZS) to Japanese Yen (JPY)
1TZS = 0.05 JPY (JICA Monthly Exchange Rate, December 2017)

(2) US Dollar (USD) to Japanese Yen (JPY)
1 USD =111.291 JPY (JICA Monthly Exchange Rate, December 2017)

(3) US Dollar (USD) to Tanzania Shillings (TZS)
1 USD =2,226 TZS (JICA Monthly Exchange Rate, December 2017)

FOREWORD

It is an exciting times in Dar es Salaam. Planning for a series of major infrastructure projects are now at an advanced stage. This Transport Master Plan provides a totally new way of viewing our city. It is estimated that by 2040 Dar es Salaam will have a population of 12million inhabitants. This will produce numerous challenges but at the same time an invaluable opportunity to create a cohesive city that lives up to ambitious environmental objectives – an opportunity not available to every city.

The goals and direction outlined in the Dar es Salaam Transport Master Plan are aimed at making everyday life simpler in a large, competitive, close-knit city. The Transport Master Plan will be implemented in action and investment plans, and will be the starting point for present and future plans and programmes for different modes of transport in Dar es Salaam City. Work on the Dar es Salaam Transport Master Plan has been in progress since it was first commissioned by the City to JICA in 2008. Due to some shortfalls it was not well completed and there it was re-done since November 2016 and now it's come to a cheerful completion in July 2018.

It comprises number of sub-projects, resulting in reports that subsequently formed the basis of the provisional draft that was circulated for comments to various stakeholders. The Transport Master Plan was well received, and the comments that were presented helped make the final version of the Transport Master Plan even clearer. Support from the Ministries, Government Agencies, Academic Institutions, Private sector, politicians and other parties was secured gradually as the work progressed. This was achieved through dialogue, workshops and presentations. Political support for the Transport Master Plan has been built up incrementally.

The Transport Master Plan has been developed in parallel with the Corridor Development Strategy (CDS) under BRT phase 1 as they are all aiming at introducing Transit Oriented Development (TOD) to the city of Dar es Salaam. Close collaboration between the EJEC team of specialists, Five Dar es Salaam Municipalities the City Urban Planning Office led to highly favourable conditions for the successful preparation of the Dar es Salaam Transport Master Plan. The Master Plan point out a clear direction for transport plan until year 2040. This Transport Master Plan will provide Dar es Salaam inhabitants, businesses and other stakeholders with the opportunity to make their own long-term decisions, on where to live and invest. The result will be a large, close-knit city with successful businesses, environmental qualities, a vibrant urban landscape and a simpler everyday life.

On behalf of all citizens of Dar es Salaam, Dar City Council extends its deepest gratitude to the JICA for unmeasurable support to make this Transport Master Plan completed.

Sipora J. Liana

Director,
Dar es Salaam City Council
Dar es Salaam, July10, 2018

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ABBREVIATIONS

AfDB	Africa Development Bank
AFC	Automatic Fare Collection
AOMCBP	Air Quality Monitoring Capacity Building Project
ARU	Ardhi University
ATC	Automatic Train Control
ATO	Automatic Train Operation
ATP	Auto Transformer Post
ATS	Automatic Train Stop
B/C	Cost Benefit Ratio
BOT	Build-Operate-Transfer
BRT	Bus Rapid Transit
C/P	Counterpart
CA	Contracting Authority
CAPEX	Capital Expenditure
CBD	Central Business District
CBTC	Communication-Based Train Control
CBTST	Capacity Building of Transport Sector in Tanzania
CCTV	Closed-circuit Television
CSG	Client Stakeholders Group
CMHI	China Merchants Holdings International
CPI	Consumer Price Index
CRIP	Country Risk Insurance Premium
CTC	Centralized Traffic Control
CUPID	Capacity Building Project for the Improvement of Dar es Salaam Transport
DART	Dar es Salaam Rapid Transit
DAWASA	Dar es Salaam Water and Sewerage Authority
DCC	Dar es Salaam City Council
DDM	Dodoma
DMDP	DSM Metropolitan Development Project
DMU	Diesel Multiple Units
DRC	Democratic Republic of the Congo
DSM	Dar es Salaam
DSMGP	DSM Marine Gateway Project
DSM-RAS	Dar es Salaam Regional Administrative Secretary
DUMP	Dar es Salaam Urban Master Plan
DUTA	Dar es Salaam Urban Transport Authority
EAC	East African Community
EBF	Equity Bank Finance
EHU	Equipment Hire Units
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EIS	Environmental Impact Statement
EMU	Electric Multiple Unit
EPZA	Export Processing Zone Authority
EU	European Union
FIRR	Financial Internal Rate of Return
FYDP I	First Five Year Development Plan
FYDP II	Second Five Year Development Plan
GDI	Gender Development Index
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information System

GoJ	Government of Japan
GoK	Government of Korea
GoT	Government of Tanzania
GVM	Gross Vehicle Mass
HCM	Highway Capacity Manual
HIS	Household Interview Survey
HSSE	Health, Safety, Security and Environment
ICD	Inland Container Depot
IEE	Initial Environmental Examination
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
ISP	Interim Service Provider
ITS	Intelligent Transport System
JCC	Joint Coordination Committee
JICA	Japan International Cooperation Agency
JNIA	Julius Nyerere International Airport
JPY	Japanese Yen
JST	JICA Study Team
KDA	Kigamboni Development Authority
KSG	Key Stakeholders Group
LAPF	Local Government Authority Pension Fund
LDC	Least Developed Country
LGA	Local Government Authority
LRT	Light Rail Transit
LTPP	Long-Term Perspective Plan
M/M	Minutes of Meeting
M/P	Master Plan
MC	Municipal Council
MC	Motor Cycle
MDGs	Millennium Development Goals
MOFP	Ministry of Finance and Planning
MOHA	Ministry of Home Affairs
MOLHHSD	Ministry of Land, Housing and Human Settlements Development
MOWTC	Ministry of Works, Transport and Communication
MPI	Multidimensional Poverty Index
MRR	Middle Ring Road
MRT	Mass Rapid Transit
NBS	National Bureau of Statistics
NEAP	National Environmental Action Plan
NEMC	National Environment Management Council
NHC	National Housing Corporation
NIT	National Institute of Transport
NM	Nelson Mandela Road
NMT	Non-Motorized Transport
NSGRP	National Strategy for Growth and Reduction of Poverty
NSSF	National Social Security Fund
NPV	Net Present Value
O & M	Operation and Maintenance
OCC	Operation Control Centre
OCS	Overhead Contact System
OD	Origin - Destination
ODA	Official Development Assistance
OPEX	Operating Expense
PCU	Passenger Car Unit
PDCA	Plan-Do-Check-Act

PHPDT	Peak Hour Peak Direction Traffic
PIM	Public Investment Management
PIRR	Project Internal Rate of Return
PO-RALG	President Office, Regional Administration and Local Government
PP	Public Procurement
PPE	Personal Protective Equipment
PPP	Public-Private Partnership
PS	Permanent Secretary
PT	Person Trip
R/D	Record of Discussions
RAHCO	Reli Assets Holding Company
RAIS	Road Accident Information System
RFB	Road Fund Board
RFP	Request for Proposal
RoRo	Roll-on/Roll-off
ROW	Right of Way
RP/SP	Revealed Preference/Stated Preference
RRB	Regional Road Board
RSS	Receiving Substation
SADC	Southern African Development Community
SADCC	Southern African Development Coordination Conference
SATTF	Southern Africa Trade and Transport Facilitation Project
SEA	Strategic Environmental Assessment
SEZ	Special Economic Zone
SGR	Standard Gauge Railway
SP	Service Provider
SPC	Special Purpose Company
SPV	Special Purpose Vehicle
SUMATRA	Surface and Marine Transport Regulatory Authority
SUTP	Strategic Transport
TAA	Tanzania Airport Authority
TAC	Technical Advisory Committee
TANESCO	Tanzania Electric Supply Company Limited
TANLAB	Tanzania Roads Agency Laboratory
TANROADS	Tanzania National Roads Agency
TARURA	Tanzania Rural and Urban Road Authority
TAT	Transporters Association of Tanzania
TATOA	Tanzania Truck Owners Association
TAZARA	Tanzania-Zambia Railway
TDV	Tanzania Development Vision
TEMESA	Tanzania Electrical, Mechanical and Electronics Service Agency
TEU	Twenty-foot Equivalent Unit
TIB	Tanzania Investment Bank
TICTS	Tanzania Internal Container Terminal Services Limited
TIF	Tax Increment Financing
TOD	Transit Oriented Development
TPA	Tanzania Port Authority
TPF	Tanzania Police Force
TPDC	Tanzania Petroleum Development Corporation
TRA	Tanzania Revenue Authority
TRC	Tanzania Railways Corporation
TRL	Tanzania Rail Limited
TSIP	Transport Sector Investment Programme
TTC	Travel Time Cost
TZS	Tanzanian Shilling

TSS	Traction Substation
TWG	Technical Working Group
UDA	Usafiri Dar es Salaam
UDA-RT	Usafiri salama Dar es Salaam Rapid Transit
UDSM	University of Dar es Salaam
UGB	Urban Growth Boundary
UNRA	Uganda National Road Authority
UTMP	(Dar es Salaam) Urban Transport Master Plan
VAT	Value Added Tax
VFM	Value for Money
VGF	Viability Gap Funding
VMS	Variable Message Sign
VOC	Vehicle Operation Cost
VPO	Vice President's Office
WB	World Bank

Executive Summary

Background and Objective

The revision of Dar es Salaam Urban Transport Master Plan, upon request from Government of Tanzania, started the Project in November 2016 and was completed in July 2018. It aimed to revise and update Dar es Salaam Urban Transport Master Plan, which was formulated in 2008 with the target year of 2030, under support from JICA (hereafter "previous M/P").

A decade after the previous M/P was developed, the population and traffic demand of Dar es Salaam City drastically increased, far exceeding the estimation of the previous M/P. Several projects proposed in the previous M/P, such as Tazara Junction Fly-over Project and New Bagamoyo Road Widening Project have been started by the Japan's Grant Aid. To meet the boosting demand of the transport, development and introduction of the new transport mode, as represented by trials of the urban commuting railway at the morning and evening peak, and BRT operation, have also started under the supervision of MOWTC. A number of the proposed projects by the previous M/P have not sufficiently been implemented yet. Thus, DSM is still struggling for the countermeasures to meet the increasing population and transport demand.

In this background, Project for Revision of DSM Urban Transport M/P was launched to formulate and update based on the current traffic demand and movement. It settled on the target year of 2040, and proposed the contents of projects for Tanzanian stakeholders, represented by PO-RALG and DCC.

Conclusion

1) Future Population and Urban Structure

Current population in Dar es Salaam is 5.8 million in 2017, and is estimated to be 12 million in 2040. Greater Dar es Salaam, which covers approximately 50 km away from CBD, will be formed in 2040, and its population is estimated at 15 million. Master Plan proposed the urban structure as "Palm and Fingers", forming five radial urban corridors and one loop corridor. To formulate that structure, Master Plan proposed the creation of sub-centres and satellite cities, which are connected to CBD.

2) Transit Oriented Mega City

In order to deal with the increasing traffic demand until 2040, cooperation and collaboration of BRT and Railway is proposed to improve travel speed, punctuality and mobility, thus making areas within the city reachable in one hour. BRT delivers transport service for short and medium distance movement, while urban railway covers middle and long distance travel. Transit Oriented Development (TOD) is proposed along railway and BRT corridor. Therefore, the Concept of the M/P is "Transit Oriented Mega City"

3) Improvement of Road Infrastructure to Maximize Investment Effect

Basic policy of Road Plan is to formulate a "Radial and Circular Trunk Road Network", to enhance the function and capacity of transport infrastructure. Three new road developments are proposed: Middle Ring Road at 20 km away from CBD, Outer Ring Road at 30 km away from CBD, and Bay Link Road to Kigamboni on coastline. Tunnel structure is included at the bay mouth of Bay Link Road, where CBD is linked to Kigamboni.

Fly-over projects at the intersection and improvement of Feeder Roads are also proposed. Improvement of bottleneck shall reduce congestion, risk of traffic accident, flood prevention, and improvement of quality of life in DSM.

4) Traffic Management with Advanced Technology

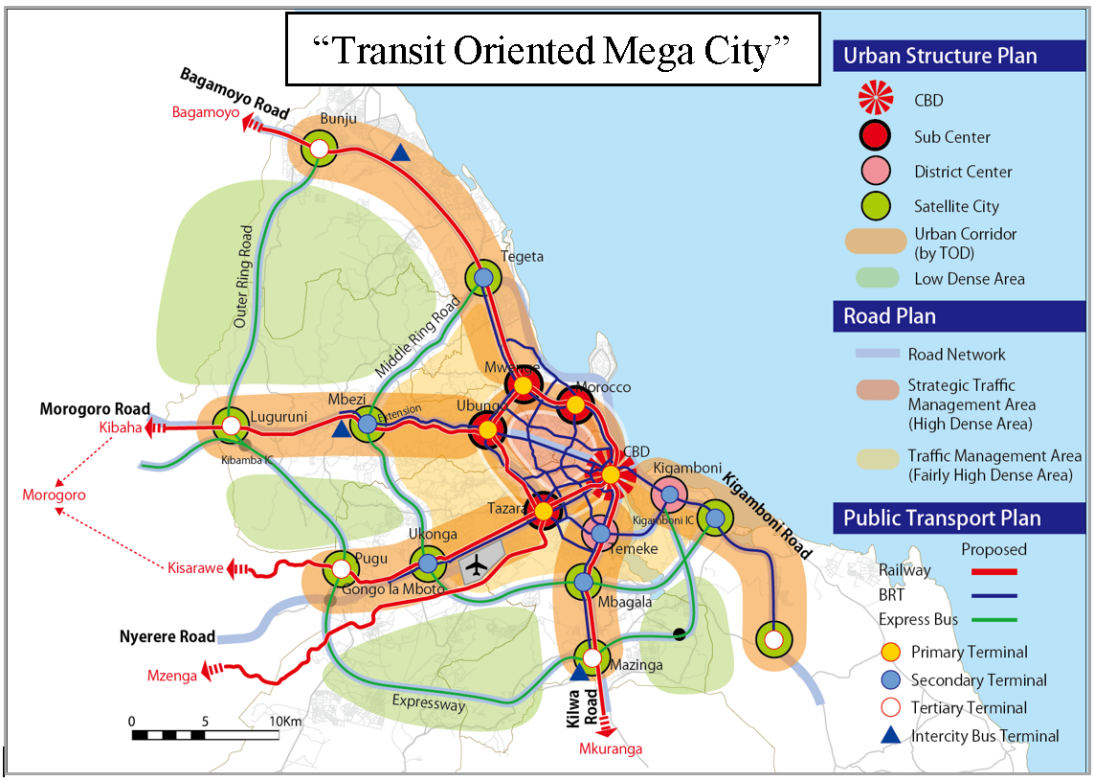
The next 20 years shall be the innovative time for urban transport. Master Plan proposed the introduction of appropriate traffic management system with advanced technology; Dynamic Signal Control Optimization System, Real-Time Traffic Information System, and Public Transport Priority System until 2030. With those advanced traffic management system implementation, Dar es Salaam shall become a leading Mega City in Africa.

5) Capacity Development

To ensure the steady implementation, Master Plan Team clarified its ownership, demarcated the responsibility of stakeholders, proposed the creation of DSM Development Information Centre to share and integrate all the relevant data, and request early-establishment of coordination body. Public-Private partnership is also required to promote TOD. Technical cooperation shall assist capacity development to implement the Master Plan projects.

6) Project Cost and Economic Evaluation

Total project cost is about 10 billion USD as a cost of investing in 22 years from 2018 to 2040. It is equivalent to about 22 trillion Tanzanian Shilling, including construction, rolling stocks, equipment, land acquisition and compensation, design, and overhead cost. Based on the economic evaluation, the economic internal rate of return (EIRR) is 32.3%, which is feasible.



Dar es Salaam Urban Transport Master Plan Vison

Comparison of Transport Infrastructures between Current condition and Future Plan (2017 and 2040)

Item	Current Status 2017	Future Vision 2040	Remarks
Railway Network	TRC(2 lines):31.7km TAZARA:18.0km	TRC(4 lines):101.4km TAZARA:18.0km	Additional 69.7km until 2040 Kilwa line with 15.0km after 2040
BRT Network	Phase 1 ：20.9km	Phase 1 -7：163.1km	Additional 142.2km until 2040
Road Network	Roads with 4-6 lanes:102km Roads with 2 lanes:536km Total length:638km	Roads with 4-6 lanes:372km Roads with 2 lanes:1,195km Total length:1,566km	4-6lanes roads：additional 270km 2 lanes roads：additional 659km Total length：additional 929km

Summary of Proposed Project Cost

Project		Quantities	USD (million)
A. Road Project	01. Middle Ring Road	50.9 km	903
	02. Bay Link Road	46.7 km	707
	03. Outer Ring Road	77.5 km	664
	04. Flyover	11 nos	987
	05. Collector Road	L.S	460
	Total		**3,721**
B. Railway Project *1	01. Upgrade of Ubungo line	11.7 km	207
	02. Track doubling of Pugu line	20.0 km	231
	03. Tegeta Line (Aga Khan-Tegeta)	21.7 km	1,196
	04. Extension line between Mwenge and Ubungo	4.5 km	151
	05. Morogoro line	26.0 km	1,216
	06. Extension line between Aga Khan and Central	4.7 km	999
	07. Extension line between Tegeta and Bunju	13.0 km	517
	Total		**4,517**
C. BRT Project	01. BRT Lane Construction *2	72 km	**249**
D. Terminal	01. Public Transportation Terminal	17 nos	**33**
E. Traffic Management	01. ITS Facilities and Signals *3	1 nos	**78**
F. Waterway	01. Pier Construction	1 nos	10
	02. Boat Purchase	2 nos	13
	Total		**23**
		Total Construction Cost	**8,621**
		Others	**1,724**
		Initial Cost	**10,345**

*1: excluding Kilwa line (construction after 2040)
*2: excluding phase-1 (Extension) - phase 4
*3: including ITS and Signal only, excluding other facilities
Source: JST

Recommendation

1) Reflecting M/P Proposal into the Relative Policy and Plans

The concept of this M/P is "Transit Oriented Mega City". Key strategy is to establish "Palm and Fingers" urban structure by applying TOD development, through improving capacity and service standard of the public transport by networking various transport modes, railway and BRT.

The Concept shall be well known and shared among the stakeholders. In order to promote harmonization of a number of related plans and policies, it is requested for PO-RALG to ensure that M/P contents will reflect onto National, Regional and City plans and policies, specially to Dar es Salaam Master Plan (2012-2032, MOLHHSD), National Transport Policy (Transport-MOWTC), and the upcoming National Five-Year Development Plan (FYDP, MOFP).

2) Promoting Appropriate Land Use by the Regulation

It is surely assumed that the population of Dar es Salaam will continue to increase in the following years. Overcrowding invites various negative impacts and risks, such as traffic congestion, natural disasters, hygiene, security, and natural environment destruction. In order to prevent such a situation, it is necessary to focus on the effective investment for the transport infrastructure to guide appropriate inhabitants to five urban corridors (Bagamoyo, Morogoro, Nyerere, Kilwa, Kigamboni).

Hilly suburbs between the five corridors should be controlled within the zones and development of any large-scale residential or commercial buildings should not be allowed. For that purpose, it is recommended to formulate appropriate land development regulation and standards. On-going DSM Master Plan undertaken by MOLHHSD shall be completed in a short period and is expected to act as the land use regulation for DSM to guide City in the appropriate manner.

Land use regulation shall be produced in consideration of population increase and population density in the future. Population of DSM is estimated at 12 million in 2040, thus, preventing overcrowding, risk of sanitation, disaster, environmental damage shall be important issues. To guide appropriate land use to meet the increasing population in future, population density of the city shall be set as less than 10,000 people / km^2.

3) Promoting TOD through Networking Railway and BRT Collaboration

Along the five urban corridors, it is recommended to invite the private sector for constructive urban development. Promoting modal shift by improving the capacity and service standard of public transportation shall decrease the traffic congestion and reduce the number of cars used. Networking railway and BRT in the future shall become the main transport mode to promote TOD. Applying TOD approach shall improve revenue for the operating agencies by increasing number of users, and drastically reducing loss from road congestion.

Proposed railway project with the elevated structure enables to provide high speed, frequent and mass transit services. It shall dramatically increase the value of land along the railway line. New business model shall be developed through TOD approach by revenue generation with sale of land around the station, development of commercial, business, residential area, etc. In addition to passenger revenue, development projects lead to early recovery of infrastructure investment for the transport operation agencies. This business model is particularly noticeable as the good practice in Japanese railway business.

Virtuous circle towards TOD Mega City shall be created by applying TOD which has wide range of spin-off effects in railway business, to generate revenue from various fields of development. Additional railway infrastructure shall be implemented with this business model and attract increased transportation users.

It is necessary to develop such business management in Tanzania. Establishing a legal framework and systems for TOD, creation of public-private funds is recommended through technical cooperation.

4) Developing Radial-Circular Road Network for Logistics

Middle ring road and the outer ring road shall formulate a new bypass route complementing the traffic volume of Nelson Mandela Road. It shall improve the traffic flow in the suburbs. In the future, three ring roads will connect five radiating trunk roads. Creation of entire road network is crucial to meet the large demand of road traffic, and to ensure safety.

New development of high standard roads in the suburbs is becoming difficult in DSM, since numbers of houses have built up every year. However, in Dar es Salaam where the expansion of urban area is proceeding, the proposed ring roads are indispensable to secure safe, convenient, comfortable circumstances for the quality of life. It is also to prevent situations such as large cargo trucks overflowing on radial arterial roads, traffic congestion and accidents becoming chronic, and cargo vehicles entering quiet environment areas in the suburbs.

Numbers of freight traffic from the industrial areas of DSM Port and the Nyerere Road shall shift to circled-bypassed road network, when proposed M/P project of Nelson Mandela Road (connecting 10 km away from CBD), middle ring road (20 km zone away from CBD) and outer ring road (30 km zone away) are developed. In addition to promote modal shift of long-distance freight to railways from truck, development of road capacity by ring road is crucial for cargo transport in DSM, the largest consuming area in Tanzania. It is also recommended as the priority action to be undertaken in the short term period.

5) Early-Engagement for the Prioritized Project: F/S for Tegeta Railway Line

Tegeta railway line is recommended as one of the prioritized projects based on the Pre-F/S result, due to high traffic demand and effect on reducing congestion. Tegeta line connects Aga Khan in CBD and Tegeta town in suburb. This section consists of a part of the proposed Bagamoyo railway line. Railway Morogoro line, connecting Ubungo and Movezi, is also a highly prioritized project, due to high traffic demand. Linkage of these two railway lines at an early stage shall significantly enhance the capacity of the entire public transportation network and improve the public transport service standard.

Tegeta railway line is appropriate for TOD, because of higher potential for urban development, reasonable land prices, less difficulty for technical railway construction due to topographical conditions, and low population density. For those reasons, it is recommended to engage F/S for Tegeta railway line early. While the case study is being carried out at Tegeta line, technical cooperation is recommended to support capacity development for TOD implementation, institutional arrangement of PPP, and establishment of investment fund.

SUMMARY

1. Introduction

The revision of Dar es Salaam Urban Transport Master Plan, upon request from Government of Tanzania, started in November 2016 and was completed in July. It aimed to revise and update Dar es Salaam Urban Transport Master Plan, which was formulated in 2008 with the target year of 2030, under support from JICA (hereafter "previous M/P").

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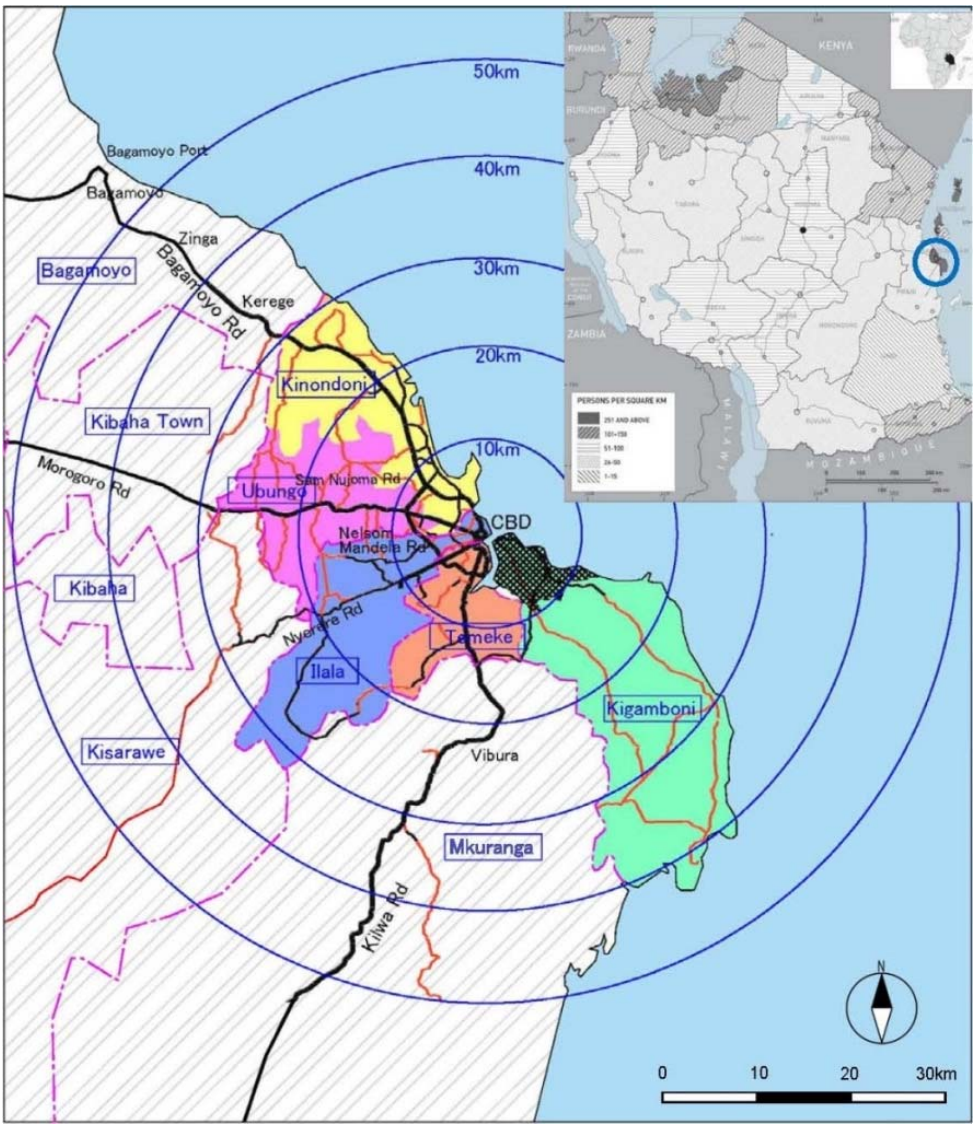


Figure 1-1 Administrative Map of the City of Dar es Salaam

2. Current Status of Dar es Salaam City

2.1 Population

The population of Dar es Salaam City has rapidly increased; the average annual growth rate is around 5% for *the* last 30 years. As of 2017, current population is estimated at 5.8 million, the population increase mainly caused by migration from the rural area. According to the Population Censes in 2012, 45% of the total City population of 4.36 million is assumed by migration.

Many organizations or agencies, along with the previous M/P, estimated a lower future population of DSM back in 2008, so did the previous M/P. In fact, population increased beyond the estimation, because the migration from the rural area exceeded more than the projection.

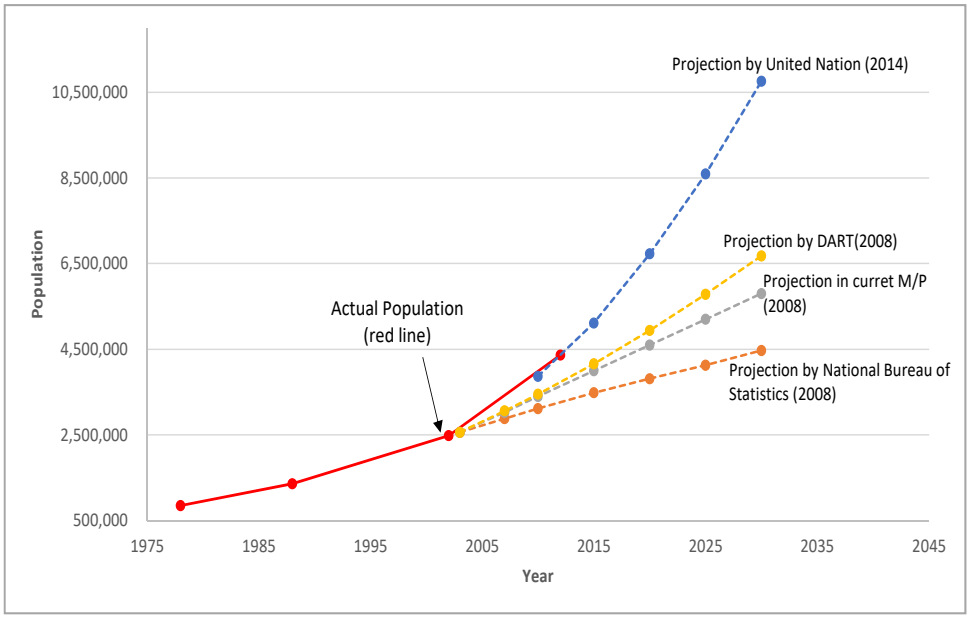


Figure 2-1 Trend and Existing Projection of DSM Population Growth

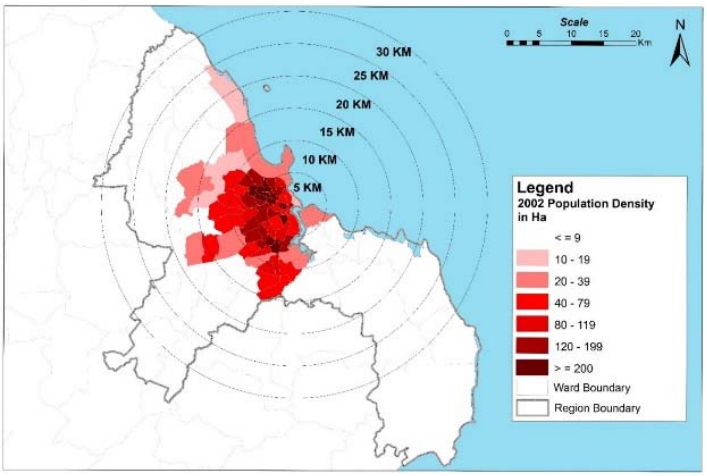
There are five Municipal Councils in DSM. Four Municipal Councils of Kinondoni, Ubungo, Ilala and Temeke are located in the radial direction from the CBD to suburb, along Bagamoyo Road, Morogoro Road, Nyerere Road, and Kilwa Road respectively. Population of these four Municipal Councils vary from 0.85 to 1.2 million, population density from 30 to 83 person/ha. Uurbanization is significantly progressing. Kigamboni Municipal Council has located bay mouth in the southern part of DSM. It has the largest area among the five municipalities, with a population of 0.16 million and population density of 3person/ha. From the point of land availability, Kigamboni has potential for future development.

Table 2-1 Population, Land Area and Population Density by Municipal Councils (2012)

Municipal Council	Population (persons)	Land Area (km^2)	Population Density (persons/km^2)	Population Density (persons/ha)
Kinondoni	929,681	270	3,443	34.43
Ubungo	845,368	261	3,239	32.39
Ilala	1,220,611	210	5,812	58.12
Temeke	1,205,949	145	8,317	83.17
Kigamboni	162,932	507	321	3.21
DSM	4,364,541	1,393	3,087	30.87

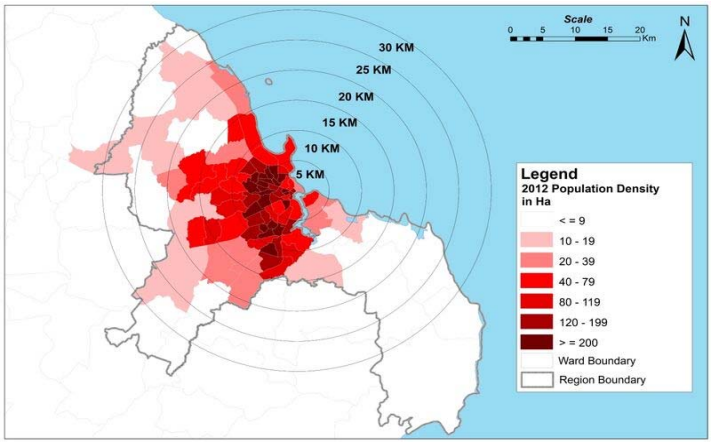
Source: JST based on Population and Housing Census 2012

Population growth also affects the expansion of the urban area. In 2002, urban areas around Nelson Mandela Road have relatively high population density expanded to 20 km away from CBD. In 2012, urban area expanded to 30km away from CBD, and partly beyond the city boundary. Examining the population growth rate by zone between 2002 and 2012, higher-rate zones appear where it away from CBD. The population growth at the areas 15-35 km away from CBD marked 1.5 times and more in these 10 years. It is predicted that the population growth of DSM shall widely expand to the suburbs, reach up to the area of 40 -50 km and more away from CBD in the near future.



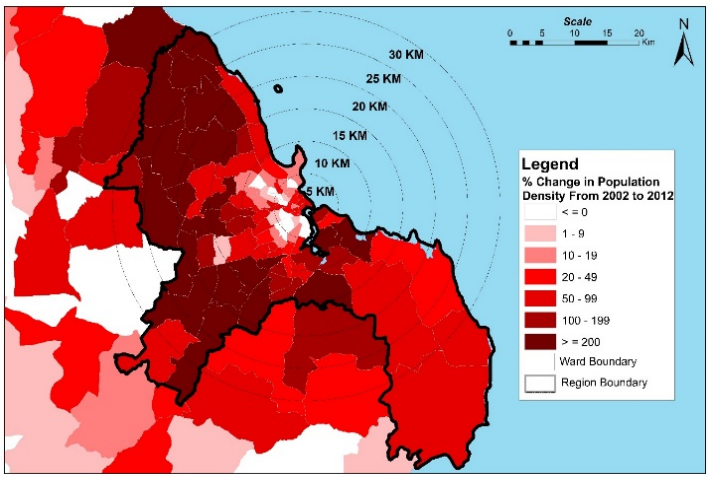
Population Density in 2002

- Population: 2.5 million
- Population Density: 18person/ha



Population Density in 2012

- Population: 4.3 million
- Population Density: 31person/ha



Comparison of Population Density (2012/2002)

- Population Growth Rate: 1.75 times
- Annual Population Growth Rate: 5.6 %

Figure 2-2 Population Density and Growth Rate (2002-2012)

2.2 Topography and Climate

DSM faces the Indian Ocean. Most of the coast line is a sandy beach. Hilly land spreads from north to south in the western part, and a number of rivers flow into the Indian Ocean at the eastern part. Altitude of hilly land is around 100-150m above the sea level, though it is sloping terrain, there is little steep terrain for development. Therefore, people accommodate disorderly at the hilly area near the City boundary.

DSM City is located at the south latitude of 5-6, same as Jakarta in Indonesia. Average temperature is around 30 ℃, rainy season is from March to May and annual rain fall is 1,000 mm in the rainy season. Heavy traffic congestion happens in the rainy season caused by flood. It is because the drainage system of the rivers and roads is in sufficient to meet the volume of rain falls in the season.

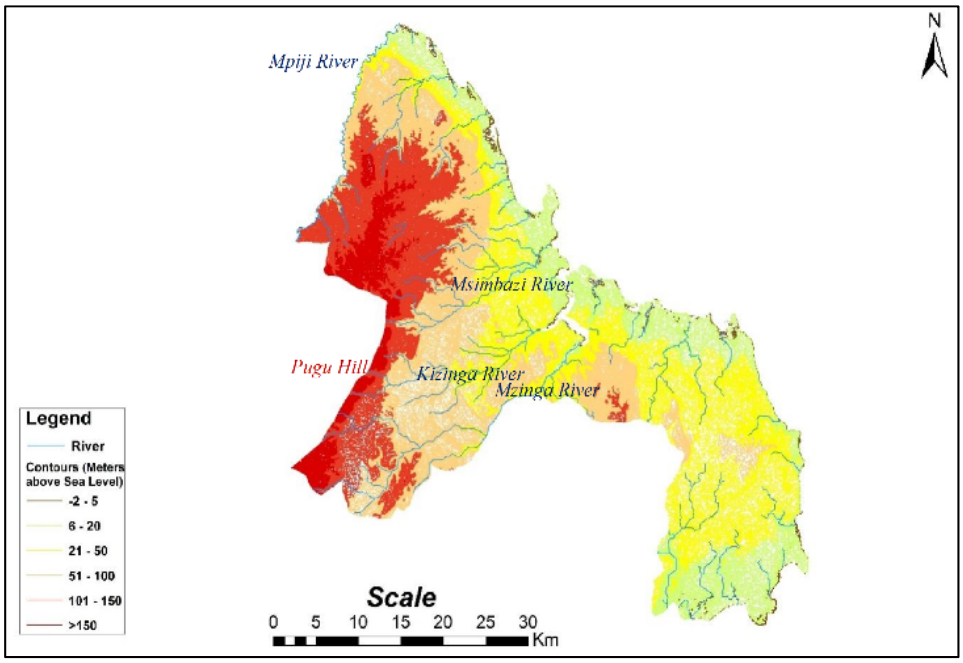


Figure 2-3 Topography of DSM

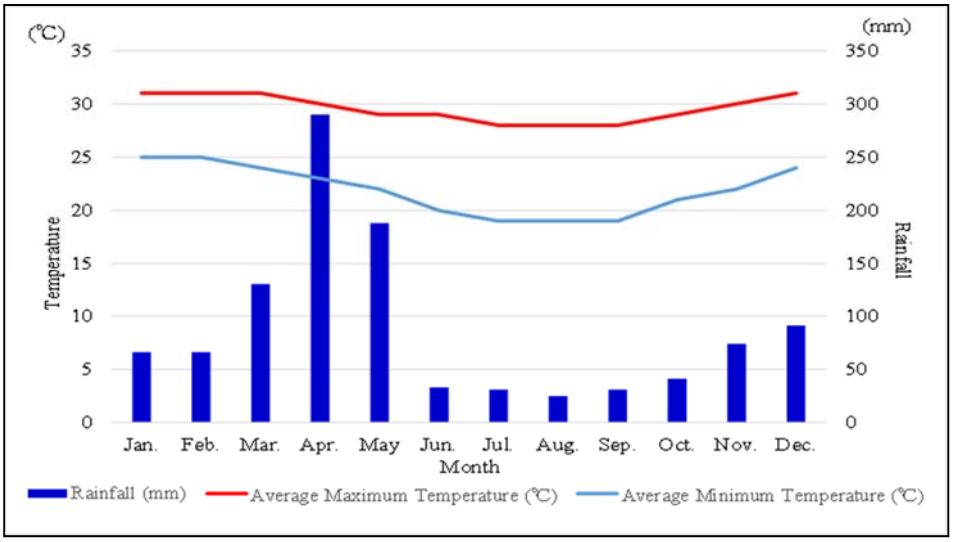
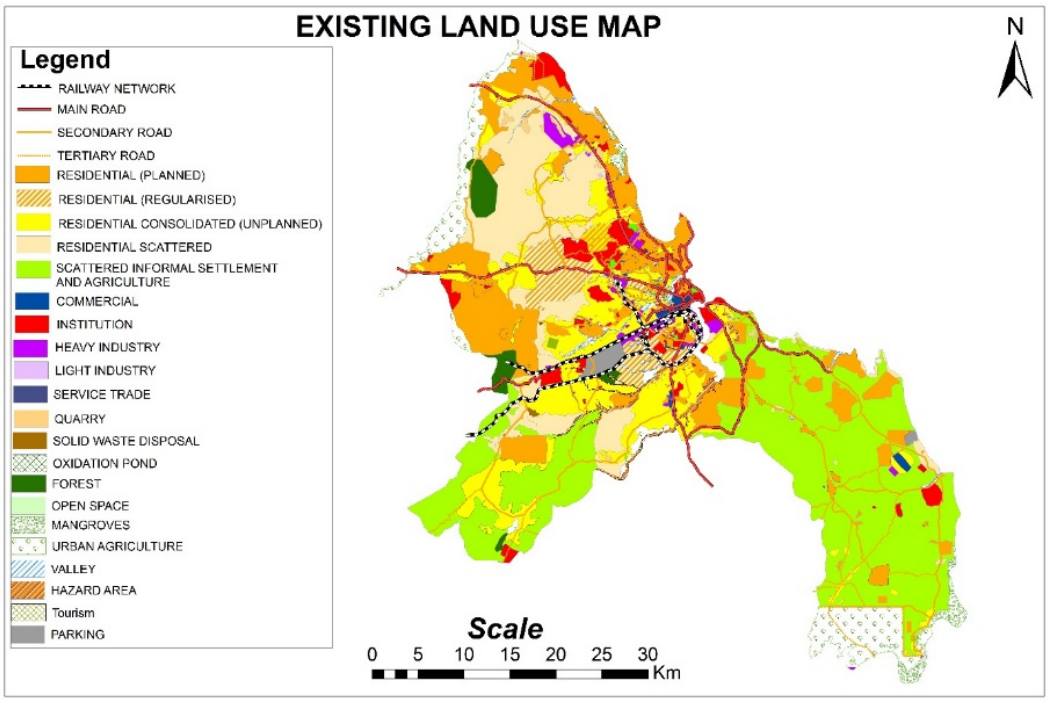


Figure 2-4 Weather of DSM

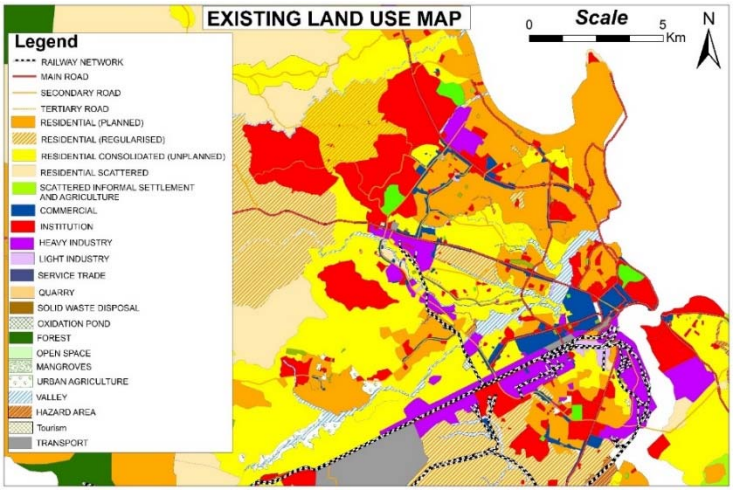
2.3 Land Use

Area nearby DSM Port is the centre of the city from the old times. Currently, the area is still a CBD, where the accumulation of commercial and business activities is accommodats. Nyerere Road connects CBD to the western part of the city and to the International airport. There is industrial accumulation along Nyerere Road, such as business office, industrial plants, and warehouse. Recently, numbers of shopping malls locate alongside Nyerere Road. Tower building or large shopping malls are newly developed along the major roads of Bagamoyo Road, Morogoro Road, and Nelson Mandela Road.

Intervening areas between Bagamoyo Road and Morogoro Road, or between Morogoro Road and Nyrerere Road, are developed for the residential houses. Urbanization is progressing along Kilwa Road. Sprawl phenomenon happens in the suburb, thus, insufficient accessibility and disorderly urban expansion increase.



Whole City Area



Central Area

Source: Ministry of Lands, Housing and Human

Figure 2-5 Land Use in DSM (2016)

2.4 Economy

Economy in Tanzania has been booming in recent years with GDP growth rate of 7 % in the last five years. GDP was 47.3 billion USD in 2016, GDP per Capita was 900 USD (nominal), which is equivalent to 1.4 times of the one in 2007. DSM GRDP exceeds 7 billion USD, and GRDP per capita is estimated 1,200 USD. Annual average growth rate of GRDP in DSM marked 17.4%. DSM is the city which leads the economy of Tanzania.

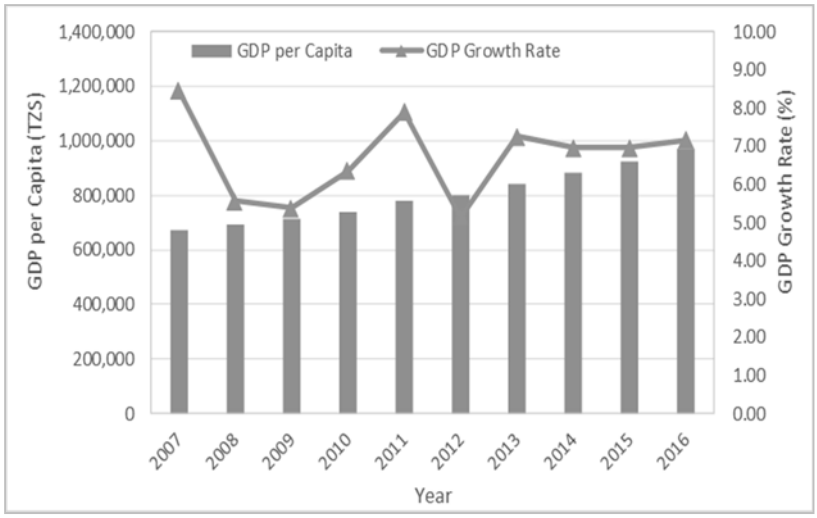


Figure 2-6 Economic Trend of GDP Growth

2.5 Transport

(1) Traffic Demand

According to the transport survey conducted in 2017, total trip generation is 8.7 million per day in DSM. Comparing to the traffic survey conducted in 2007, it is more than tripling increase. While population growth rate increased by 1.9 times in last decade, traffic demand increased more than the speed of population growth rate. Accompanied by the economic growth in DSM, car ownership also increase by 2.4 times compared to the previous survey.

Table 2-2 Comparison of the Growth of Population and Car Ownership (2007-2017)

Item		2017 Survey	2007 Survey	2017/2007
Car Ownership	Population (1,000)	5,782	3,030	1.90
	Number of Car	191,825	78,477	2.44
	Car Ownership ratio (Household)	10.9%	10.0%	1.09
	Number of car (1,000person)	33.2	25.9	1.28
Total Trip (1,000trip/day)		8.674	2.848	3.05

(2) Trip Distribution

Based on the analysis of OD traffic volume from the Household Interview Survey, only 2% of the total trips is to outside DSM. Since commuter area has expanded to 30-50 km away from CBD, long distance trips have also been increasing.

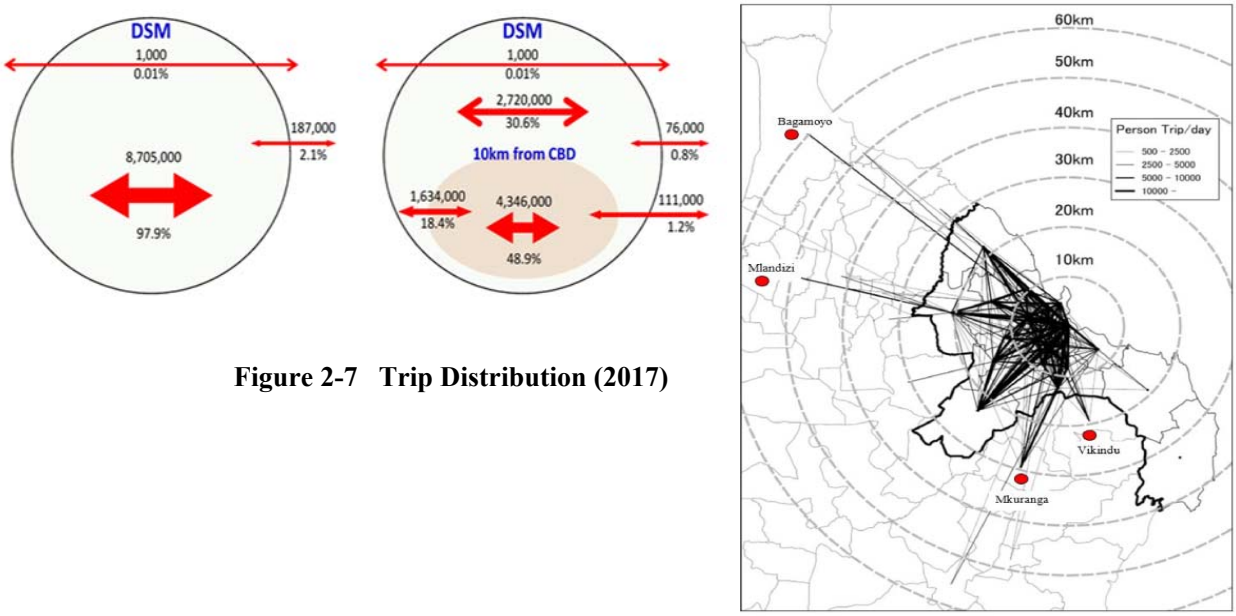
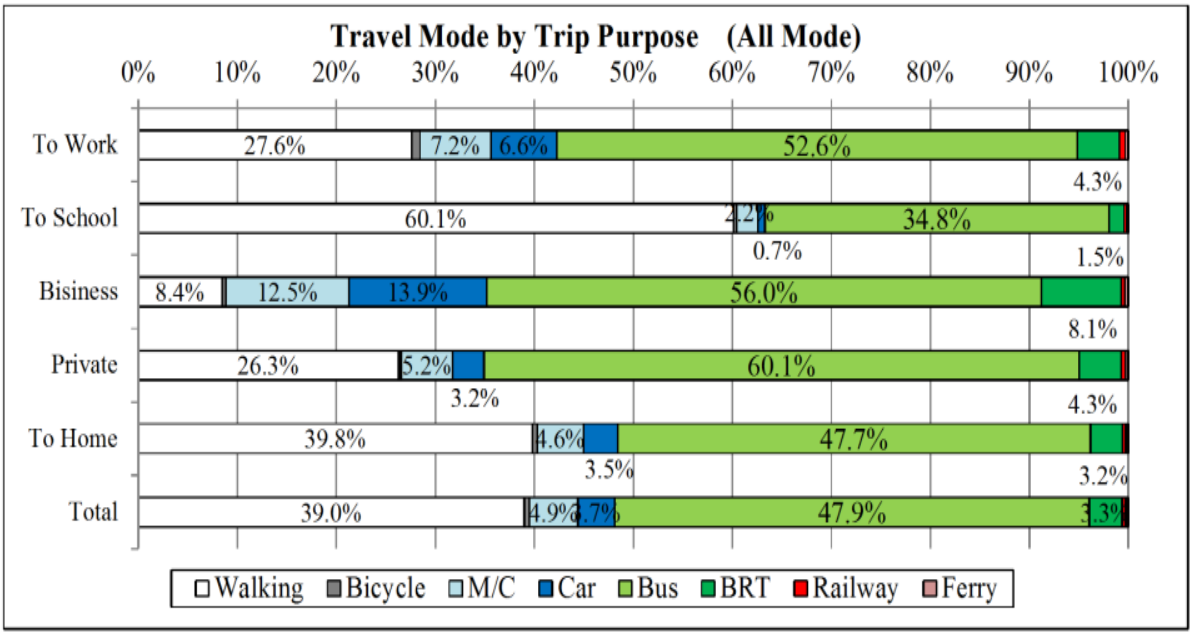


Figure 2-7 Trip Distribution (2017)

(3) Travel Mode

The share of walking and public transport use is 86% among all travel modes in DSM. By trip purpose and by travel mode, use of BRT to work is 4%, or 280,000 trips per day. BRT stared its operation in 2016 and already provides a versatile transport system in DSM.



Note：M/C=Motorcycle

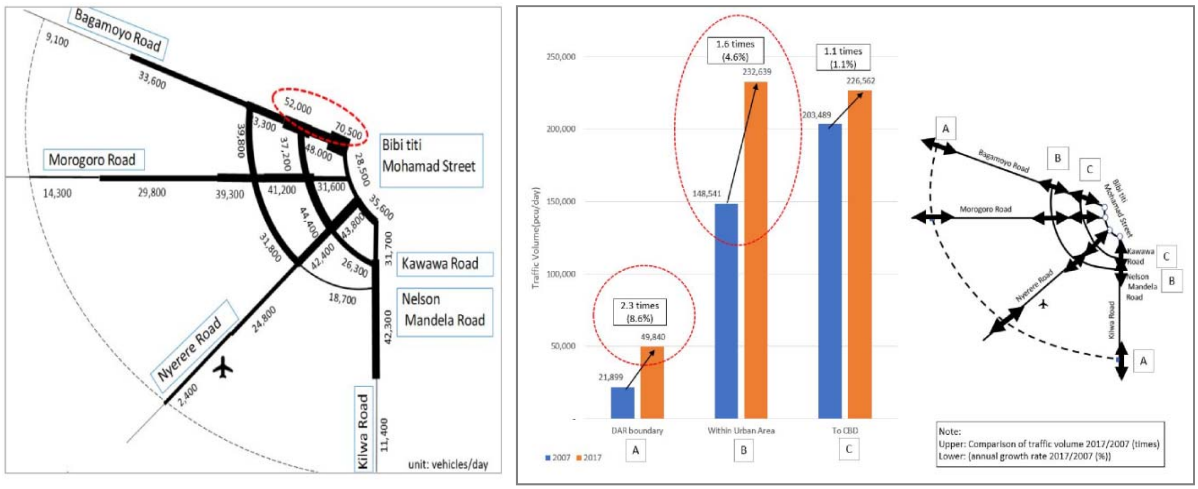
Figure 2-8 Travel Mode by Trip Purpose (2017)

(4) Road Traffic Volume and Congestion

Largest traffic volume is along Bagamoyo Road, between Selander Bridge and Morocco intersection. The traffic volume at the section is more than 70,000 vehicles per day.

Result of the comparison of the traffic volume at the cross-section to the CBD, within Nelson Mandela Road, and at the City boundary shows the largest traffic volume recorded at Nelson Mandela Road. Though the previous traffic survey showed the largest inbound traffic volume to CBD, the current traffic trend has changed. It is reflected that the traffic demand has distributed to wider areas from CBD, caused by the population increase and urban area expansion in the suburbs.

From the results of screen line survey at Nelson Mandela Road, the largest traffic volume was recorded at Bagamoyo Road. The growth rate of the traffic marked 3.8 times in 2017 compared to the previous survey in 2007. Kilwa Road also marked the second largest growth rate.



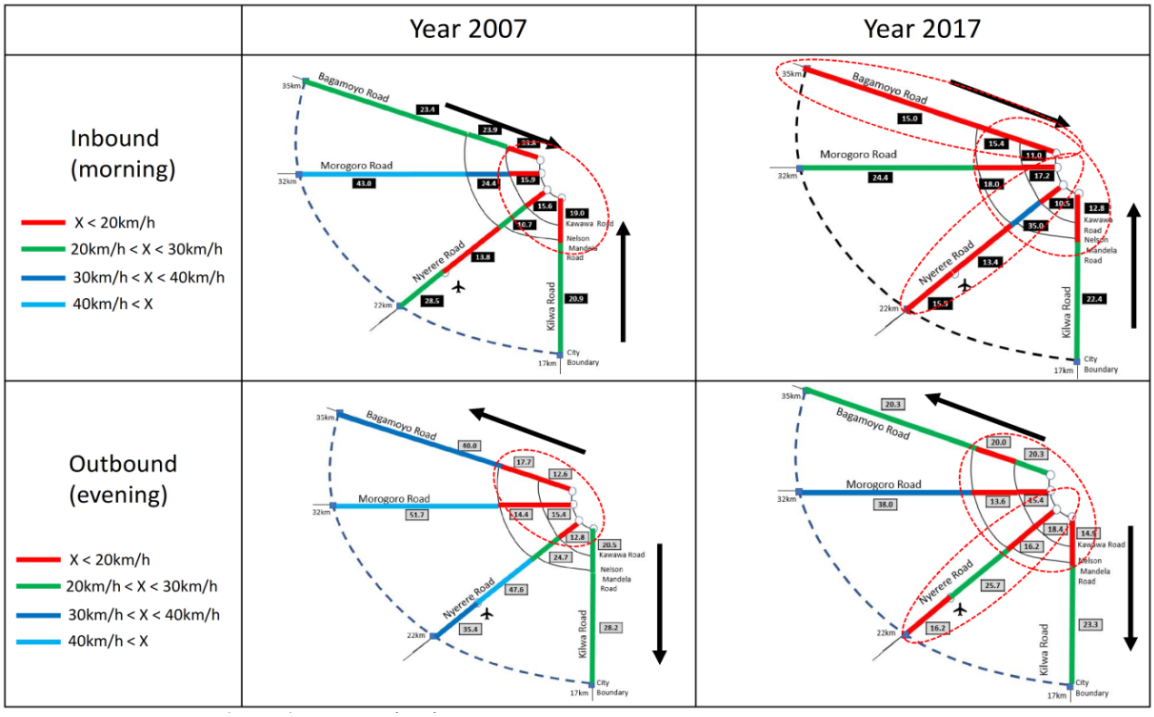
(a) Traffic Volume by Roads and Comparison of Traffic Volume (2007-2017)

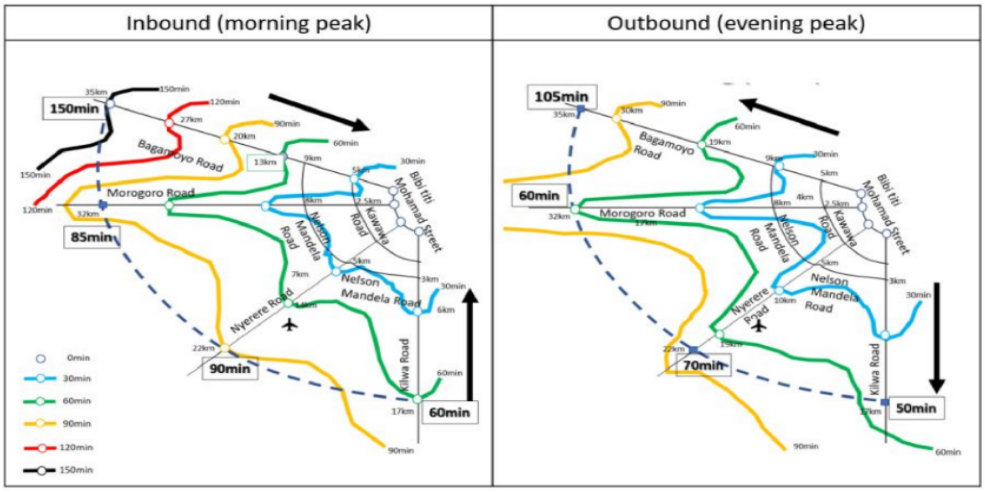
(b) Comparison of Traffic Volume in Trunk Roads (2007-2017)

Figure 2-9 Trend of Traffic Volume on Screen Line (2007-2017)

Results of the traffic survey by travel time and travel speed are summarized as follows.

- Heaviest congestion is found at inbound at Bagamoyo Road in the morning peak hours, and outbound in the evening peak hours. It took about 2.5 hours for 30 km from Bunju or the City boundary to CBD in the morning peak. The average travel speed is only 10-15 km/h. Due to drastic increase of traffic volume at Bagamoyo Road, travel speed at morning peak hours were marked as slowest in Bagamoyo Road.
- Second heaviest congestion was marked at Nyerere Road. It is assumed that the on-going construction of Tazara fly-over affects the travel speed.
- Travel speed at Morogoro Road has not changed drastically since the previous traffic survey in 2007. It is due to the widening of the road and the starting of BRT operation in the same period.





Source: Travel Speed Survey on Feb.07, 2017, JST

Figure 2-10 Travel Time and Travel Speed (2007-2017)

3. Viewpoint of the Revision of M/P

Based on the traffic survey and current status of transport in DSM, the following viewpoints are set up:

- **Population**: Potential of future population growth shall be carefully estimated through the discussion with Tanzanian stakeholders, and data analysis referred to the various population projection methods. In addition, future framework in 2040 shall be developed based on the future appropriate population density and urbanised area.
- **Urban Structure**: Appropriate urban structure shall be reviewed based on the traffic survey results, current urban area expansion, urbanization speed and expansion of commuting area. Decentralization of the CBD functions shall be encouraged by on-going Satellite City projects and new Sub-centres set up based on the trend of on-going urban developments. The M/P developed the future framework for the urban structure based on the discussion with MOLHHSD, who initiates DSM Master Plan, the trend of actual land use pattern, and to smoothly promote the Urban Transport Master Plan. Ensuring the coherency and harmonization between M/P and the on-going DSM Master Plan by MOLHHSD is crucial. M/P team and MOLHHSD agreed on the reflection of future urban structure pattern of M/P onto the on-going DSM Master Plan.
- **Road and Public Transport Plan**: Traffic demand shall be forecasted from the long-term perspective based on the current trend of city expansion and population growth. Trend of the socio-economic and environmental changes shall also be considered in the development of road plan and public transport plan.

Table 3-1 Viewpoints of Revision of M/P

Viewpoints	Previous M/P (2008)	Revision of M/P (2018)
Population and GDP	• Population:5.8 million in 2030 • GDP annual growth rate: 5.5 % Between 2010 and 2030	• Population: reached 5.8 million in 2017 and estimated 12.0million in 2040 • GDP annual average growth rate: 6.8 % between 2010 and 2016, estimated 6.0 % between 2017 and 2040
Urban Structure	• Poly-Centric Satellite Pattern • (One CBD and Satellite cities) • Urban Corridor Development • (Radial corridors)	• Poly-Centric Satellite Pattern (One CBD, Four Sub-centers and Satellite cities) • Palm and Fingers • (Radial and Loop corridors)
Road Plan	• Focusing on the area within 10km away from CBD	• Focusing on the area within 30km away from CBD
Public Transport Plan	• Focusing on BRT	• Focusing on both Railway and BRT

4. Vision and Strategy

Sustainable Development

JICA Study Team initiates development concept of DSM Urban Transport as "Transit Oriented Mega City". It means DSM will become one of the Mega Cities with a population of more than 10 million in 2040 by promoting TOD approach. CBD shall be connected with Sub-centres and Satellite cities through five radial roads and one circular urban corridor. With these networks and urban structure, CBD function shall be decentralized, and DSM will transform from mono-centric to poly-centric city. Substantial size of compact cities shall be developed along urban corridors, as people commute mainly by public transport provided on the corridors. Those urban structures shall be sustainable and urban corridors shall be developed by TOD approach.

Equal Opportunities in the Society

DSM aims to be a sustainable Mega City in the future, through the development of reliable public transport network, well-built road infrastructure, and smart traffic management system. With those developments, the DSM citizens acquire the alternative options for the public transport mode or route, with safety, convenience, smooth, and reasonable fare. It contributes to providing equal opportunity for the society to get employment or education.

Efficiency in Economic Activities

As the international port city facing the Indian Ocean, DSM shall be developed by the inter-city railways and expressway network, which support long distance trips and logistics. Punctuality and mobility speed shall be improved; traffic congestion and economic loss shall be effectively decreased by these developments. It improves the efficiency of economic activities, and thus, lead the national economy.

Environmental Friendly

Implementation of M/P shall lead DSM to be an environmental friendly city. Future urban structure shall promote appropriate land use, balanced between development and environmental conservation, avoiding the destruction of nature; improve effective utilization of land use, and high mobility with environment friendliness.

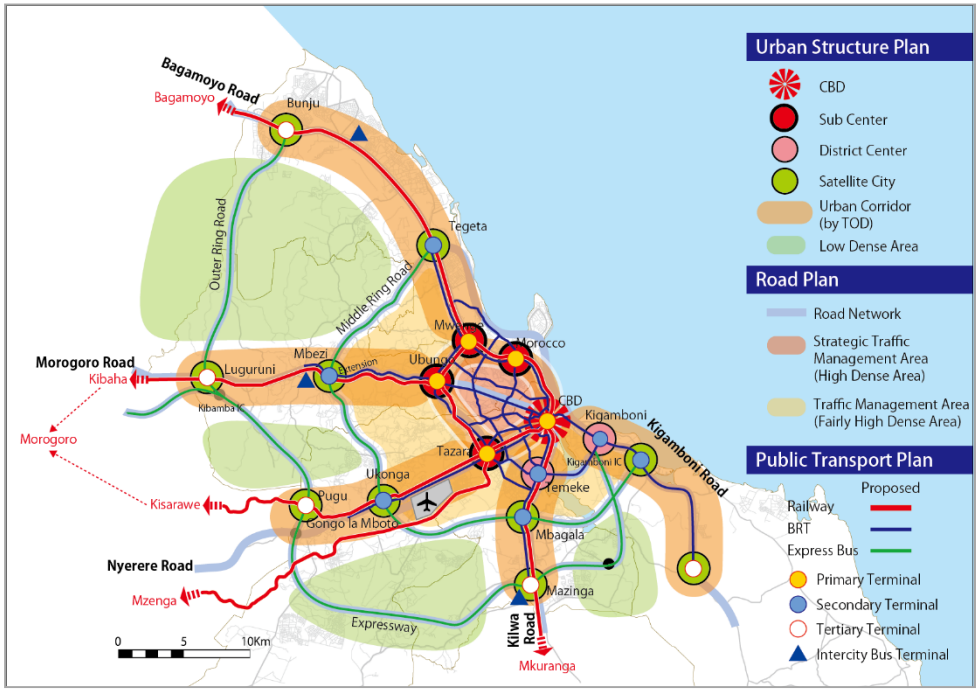


Figure 4-1 M/P Future Vision

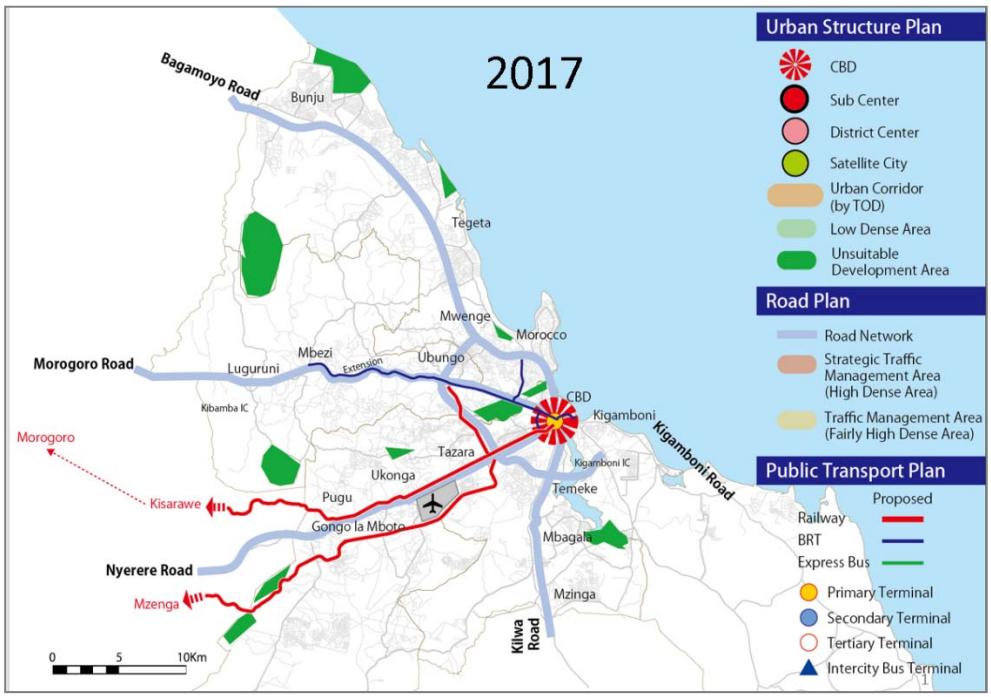


Figure 4-2 Current Condition Map (2017)

Table 4-1 Comparison of Transport Infrastructures between Current Condition and Future Plan (2017 and 2040)

	Current Status 2017	Future Vision 2040	Remarks
Railway Network	TRC (2 lines):31.7km TAZARA:18.0km	TRC (4 lines):101.4km TAZARA:18.0km	Additional 69.7km until 2040 Kilwa line with 15.0km after 2040
BRT Network	Phase 1 :20.9km	Phase 1 -7:163.1km	Additional 142.2km until 2040
Roads Network	Roads with 4-6 lanes:102km Roads with 2 lanes:536km Total length:638km	Roads with 4-6 lanes:372km Roads with 2 lanes:1,195km Total length:1,566km	4-6lanes roads: additional 270km 2 lanes roads: additional 659km Total length: additional 929km

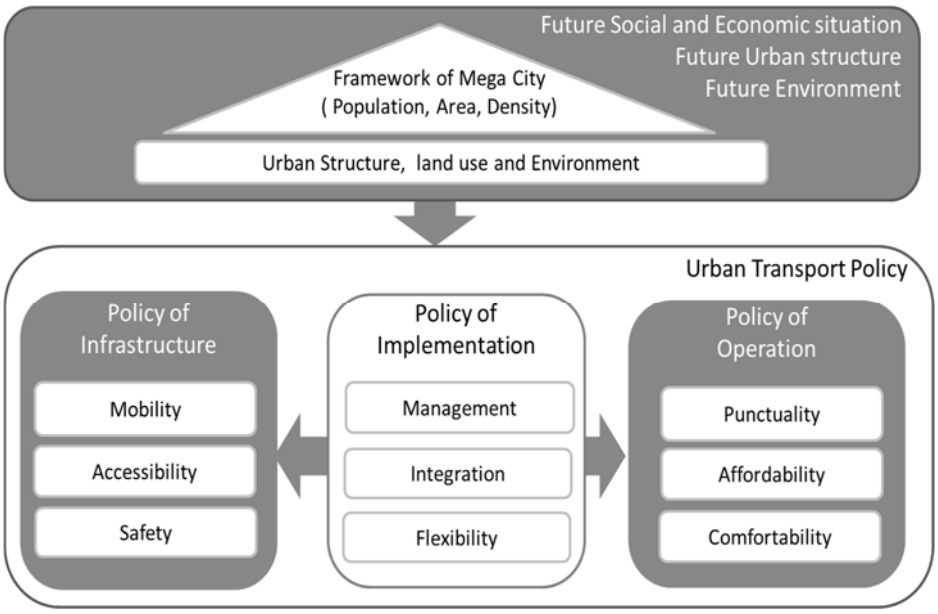


Figure 4-3 Basic Policies

Table 4-2 Basic Policy, Target and Strategy of M/P

Policy		Strategic Target and Indicators of outcome	Strategy
Policy of Infrastructure	Mobility	1. 1 hour in the city by public transport 2. 30 minutes in the central area including CBD and sub-centres by public transport 3. Congestion ratio with less than 1.25 on trunk roads 4. Average speed of cars per day are greater than 30km/h in DSM	1) Introducing high speed public transport network such as MRT and BRT 2) Introducing expressway for long distance trips 3) Enhancing feeder road network with higher density 4) Improvement of intersection to safer, smoother and more resilient structure 5) Introducing Traffic Control System 6) Punctual and frequent operation of Public Transport 7) Introducing elevated and tunnel structure of public transport 8) Establishing the staging plan based on the agreement among stakeholders 9) Establishing the Simple Coherent MP Management Mechanism 10) Enhancing urban Land Use system 11) Capacity development of TOD promotion 12) Introducing flexible transport system responding to additional traffic demand
	Accessibility	5. Within 1 km access to Public Transport route in suburb of DSM	
	Safety	6. Reducing Traffic accident especially at intersections on the trunk road 7. Reducing Flood disaster especially at intersections on the trunk road	
Policy of Operation	Punctuality	8. Reducing Delay Time within 15 minutes for Railway operation	
	Affordability	9. Affordable fare of public transport for low income workers and students at cheaper than gasoline cost per km	
	Comfortability	10. Crowded Ratio of Public Transport Vehicle less than 150%	
Policy of Implementation	Management	11. Steady Implementation along the staging plan	
	Integration	12. Integration of Land use plan, Road, Public Transport and Traffic management	
	Flexibility	13. Flexible supply responding to demand change and fluctuation	

5. Development Framework

JICA Study Team set the development framework for the target year of 2040 as shown below. Framework has been developed based on the analysis of (i) Trend of population increase in DSM, (ii) Trend of population growth in the worldwide Mega Cities, where population is more than 10 million, and (iii) Development of Transport infrastructure according the population growth.

Table 5-1 Development Framework

Item \ Year	a. 2017	b. 2040	Growth Rate Times(b/a) % : annual growth rate
Population	●5.8million in DSM ●6.2million in Greater DSM estimated by the trend between 2002 and 2012	●12 million in DSM ●15 million in Greater DSM Including 3million in neighboring wards outside DSM within 50km away from CBD	●2.07 times, 3.2% ●2.59 times, 4.2%
GDP Growth Rate in TZ	● 7 % Between 2013 and 2016 In statistics	● 6 % Between 2017 and 2040	●3.82 times, 6.0%
GDP per capita in DSM	●3.4 million Tsh estimated by the past statistics date	●6.3million Tsh	●1.85 times, 2.7%
Car ownership per 1,000 persons	●33 vehicles per 1,000 persons Based on the home interview survey in 2017	●75 vehicles per 1,000 persons	●2.27 times,3.6%

6. Urban Structure Plan

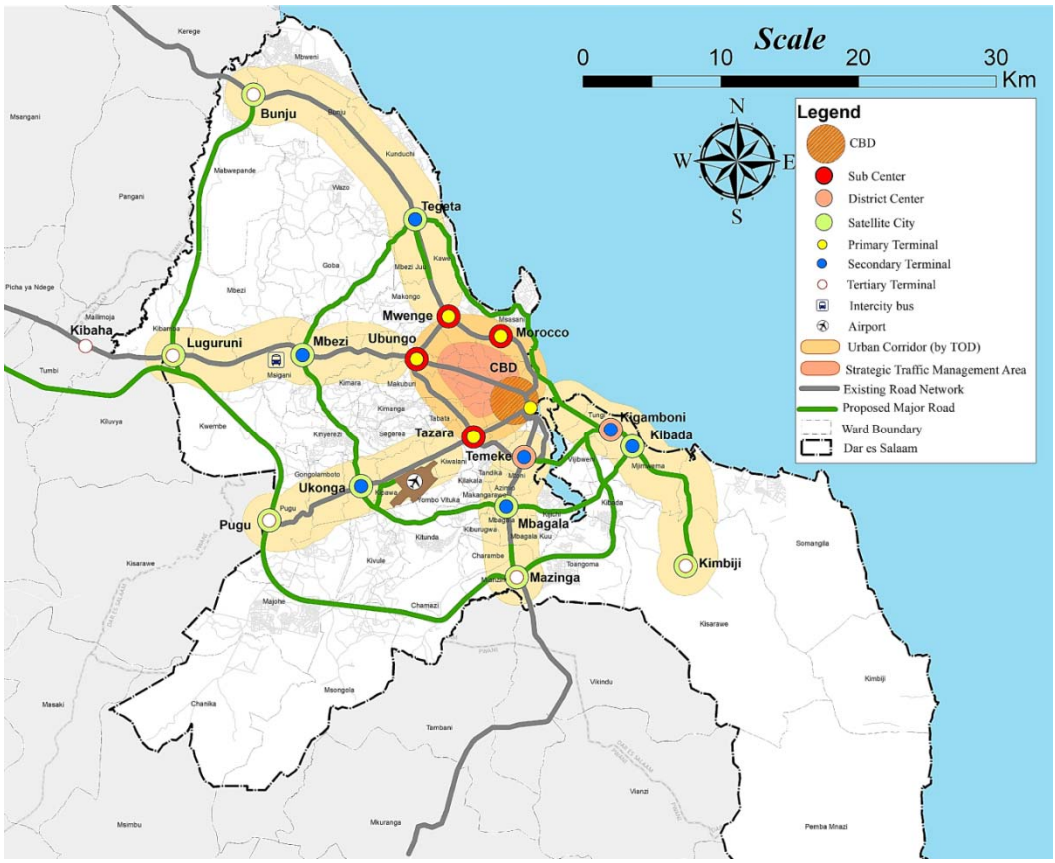


Figure 6-1 Urban Structure Plan "Palm and Fingers"

Since urban structure is closely related to several factors such as; traffic demand, traffic concentration point, and travel distance, it shall affect land use pattern and population density, traffic volume and choice of transport mode.

M/P initiates urban structure called "Palm and Fingers". The palm implies that CBD will be connected to four sub centres (Morocco, Mwenge, Ubango, Tazara) by a circular corridor, formulate high-density urban area inside the loop of 10 km in diameter. The fingers refer to the five radial corridors of Bagamoyo, Morogoro, Nyerere, Kilwa and Kigamboni Roads, forming a network of CBDs, sub-centres and satellite cities distributed within approximately 30 km.

Through the implementation of this urban structure, urban functions of CBD shall be decentralized and shared to the sub-centres and satellite cities, which shall be developed at the cross- point of five radial corridors and the circular corridor. It contributes to the traffic demand dispersion. The principal policy to harmonize urban structure plan, road and public transport plan, is set up as TOD development towards a Transit-Oriented Mega City.

Modal shift should be promoted through the urban structure plan, leads to promote the use of railway and BRT. In this respect, BRT development supported by World Bank also promotes TOD. Thus, TOD shall be practiced by collaboration of BRT and railway projects.

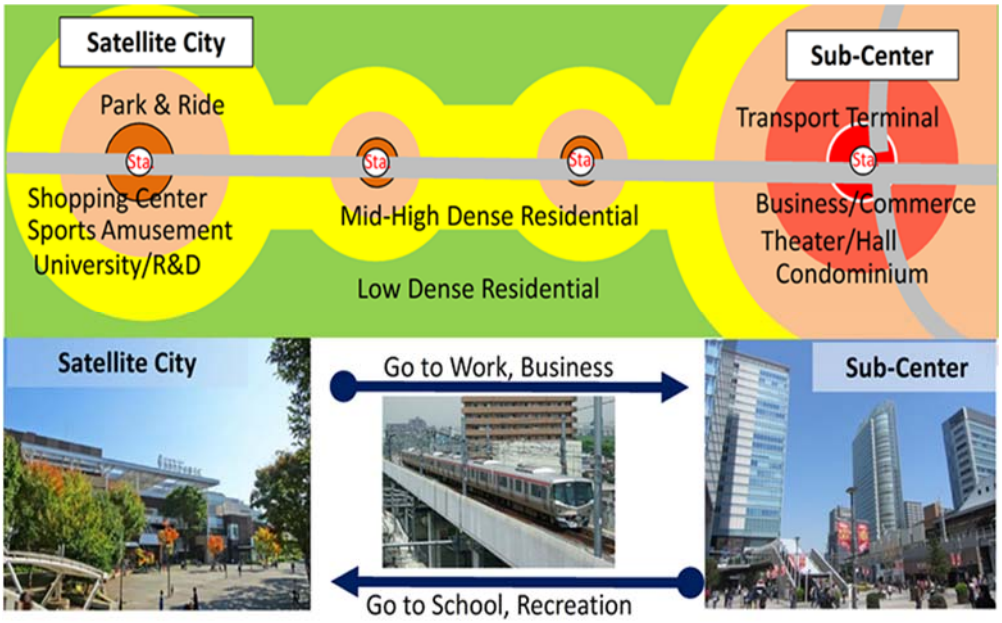


Figure 6-2 TOD Strategy

7. Road Plan

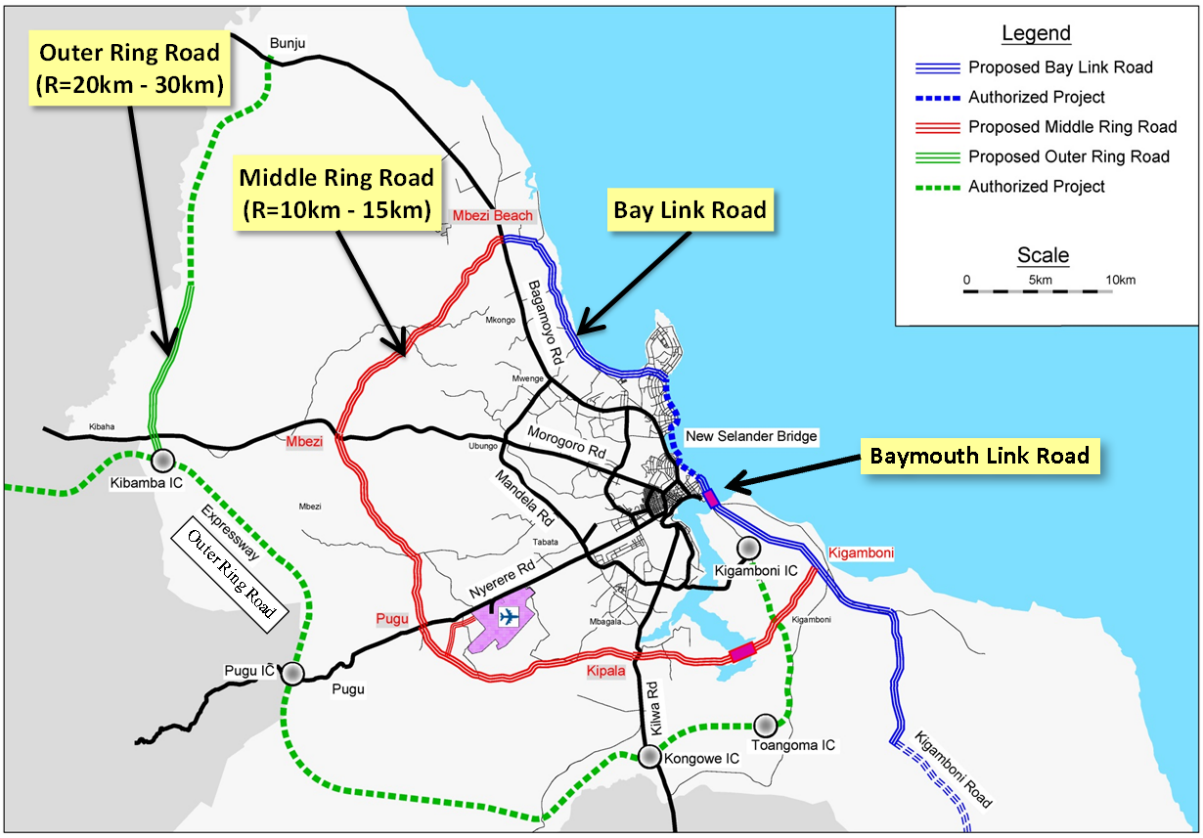


Figure 7-1 Road Network Plan

Figure 7-2 Current Road Network (2017)

Table 7-1 Comparison of Road Infrastructure between Current Condition and Future Plan (2017 and 2040)

Item	Current Condition (2017)	Future Plan (2040)	Remarks
Road Length	4-6 Lane Road:02km 2 Lane Road:536km Total:38km	4-6 Lane Road:372km 2 Lane Road:1,195km Total:1,566km	4-6 Lane Road:270km added 2 Lane Road:659km added Total:929km added

7.1 Arterial Road Network by Radial Road and Ring Road

Develop Outer Ring Road, Middle Ring Road, and Bay Link Road to create the road network of five radial roads and circular roads. Middle Ring Road shall be developed as the "Smart Road" by applying the advanced technology, such as flexible lane, auto-driving lane, and service parking areas. South part of Outer Ring Road consists partly of Expressway DSM Port to Chalinze. Bay Link Road, together with New Selander Bridge, shall formulate the part of road linking CBD and Kigamboni.

Creation of Radial-Circular road network shall establish the alternative routes, therefore, contributes to reduce congestion, accident, and flood risk. Middle Ring Road is recommended to develop with at least 6 lanes, to meet the new demand arising from port and new airport development, and future BRT plans.

【Major Proposed Projects for Road Plan】

- **<u>Outer Ring Road</u>**: Connecting radial trunk roads as same as Middle Ring Road and located at 20-30km away from CBD. Total length of 78km. The southern part of Outer Ring Road is part of Expressway DSM Port to Chalinze with six lanes. The northern part has four lanes.
- **<u>Middle Ring Road</u>**: The high standard ring road connecting Bagamoyo Road-Morogoro Road-Nyerere Road (incl. Airport access)-Kilwa Road-Kigamboni Road. Proposed location of middle ring road is approximately 15-20km away from CBD. Total length of 50km, with six lanes. Develop the "Smart Road" by applying advanced technology. Introduction of auto-driving lane, automotive logistics, and flexible lane of "Dynamic Lane Management", which contributes to smooth traffic flow for emergency vehicle, express buses, and VIP vehicles.
- **<u>Bay Link Road</u>**: Trunk road connecting Middle Ring Road with a new Selander bridge, Bay Mouth road and Kigamboni Road with a length of 47km, six lanes for BRT section and 4 lanes for other sections. Bay mouth road with length of 500-600m is proposed by either "Immersed Tunnel" or "Shield Tunnel", rather than the bridge. It is because the length of the approach shall be longer for the case of bridge structure. Therefore, a bridge structure is so not suitable for BRT route and shipment operation especially during the construction period.

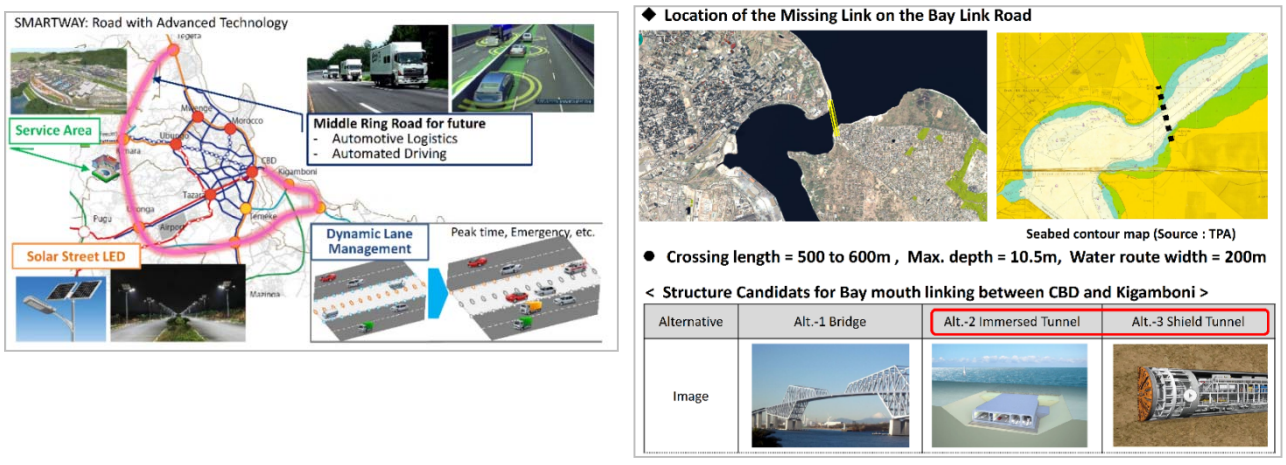


Figure 7-3 Middle Ring Road "Smart Way", and Bay Link Road (images)

7.2 Improvement of Density of Collector Roads

Target road density of the collector roads for the areas between three ring roads (Nelson Mandela Road, Middle Ring Road, and Outer Ring Road) is proposed as at least two lanes, paved and vertical slope less than 10% for the suburb area. Creating a standard road density for collector road shall contribute to substantial transport service delivery, by improving connectivity to the trunk roads, and enhancing feeder bus networks.

【Major Proposed Projects for Road Plan】

- Current road density of the collector road is rather low in suburbs; 1.5km/km^2 outside Nelson Mandela Road and 0.4km/km^2 outside the Middle Ring Road. It means more than 2 km away from the collector road under the density of 4km. The current situation provides insufficient service for people living in suburbs; making it difficult for emergency vehicles in-out flow, requiring more time to reach the nearest bus stops.
- In order to improve the situation, **target road density shall be developed** as more than 2km/ km^2 in the area between Nelson Mandela to Middle Ring Road, and 1km/ km^2 in the area between Middle Ring Road to Outer Ring Road.

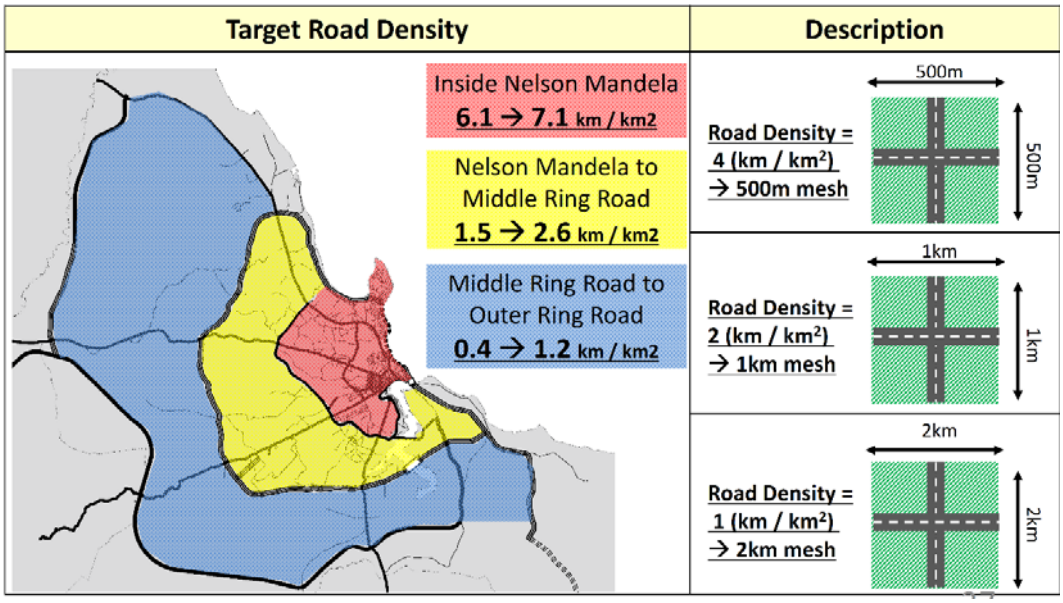


Figure 7-4 Target Road density by Area

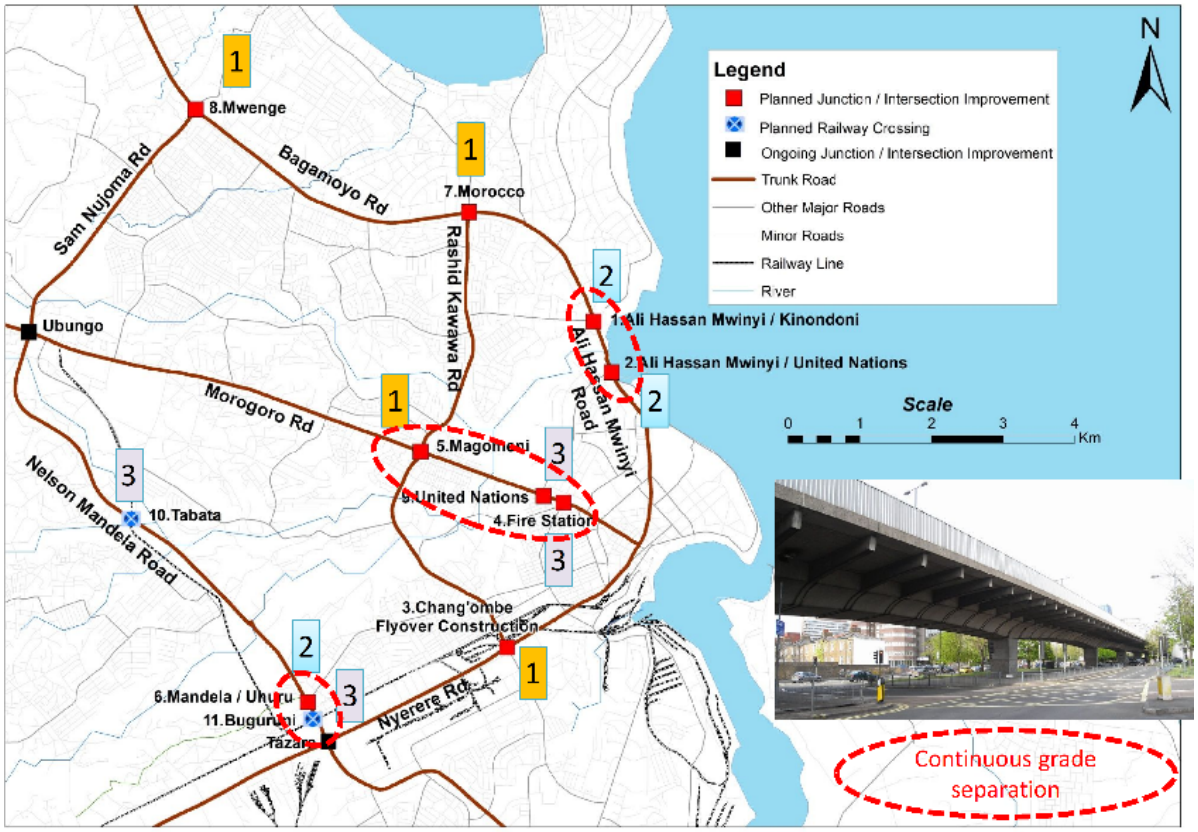
7.3 Improvement of Intersections

Bottleneck is found at the intersections; heavy congestion, accident, and flooding water-covered. Based on the analysis of the current issues and future demand forecast, M/P prioritized the improvement of intersections. Construction of Tazara fly-over will be completed in 2018 and following Ubungo intersection will launch its construction in the near future.

As a result, improvement of Mwenge, Morocco, Magomeni and Chang'ombe are highly prioritized.

【Major Proposed Projects for Road Plan】

- **<u>Improve 11 (eleven) intersections</u>** with grade-separation at Nelson Mandela Road and within.
- Mwenge and Morocco are highly prioritized. In order to prevent flooding, grade-separation, such as continuous fly-over structure, is recommended at Ali Hassan Mwinyi Road near Selander Bridge and Magomeni.



*Note: the number in the Map indicates the prioritization

Figure 7-5 Prioritization of Intersection Improvement

8. Public Transport Plan

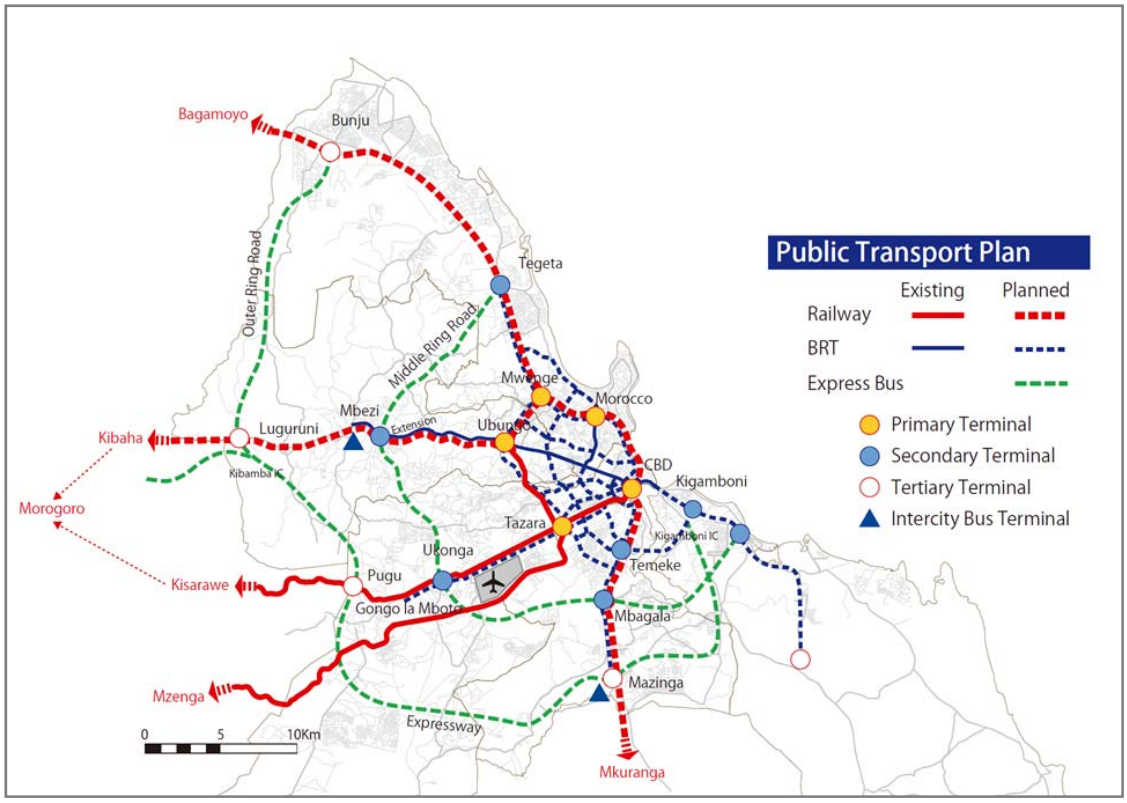


Figure 8-1 Public Transport Plan

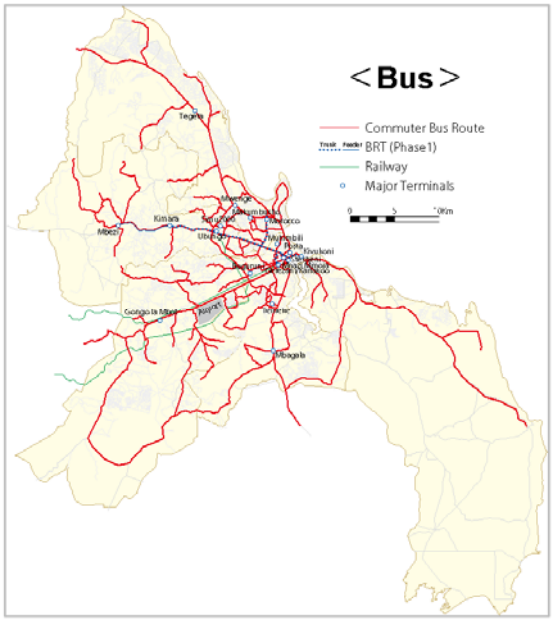


Figure 8-2 Current Public Transport Network Map

Table 8-1 Comparison of Public Transport Network between Current condition and Future Plan (2017 and 2040)

	Current Status 2017	Future Vision 2040	Remarks
Railway Network	TRC (2 lines):31.7km TAZARA:18.0km	TRC (4 lines):101.4km TAZARA:18.0km	Additional 69.7km until 2040 Kilwa line with 15.0km after 2040
BRT Network	Phase 1 :20.9km	Phase 1 -7:163.1km	Additional 142.2km until 2040

Improvement of the capacity and service standard of public transport is urgent issue. Improvement of public transport network with Mass Transit System is a counter measure for increasing population, expansion of urbanization, and motorization in DSM. The followings are the proposed projects as a solution.

8.1 Public Transport Network by Railway and BRT Collaboration

BRT phase-4 is scheduled to be completed by 2025, phase 5 and 6 shall be developed by 2030. Compared to the railway development, which requires large investment and longer time for construction, BRT network shall be developed in a shorter period, according to the road infrastructure development plan. Therefore, BRT shall be the main public transport mode in DSM until 2030, covering short-medium distance. After 2030, when railway is expected to start its operation, collaboration of railway and BRT, together with feeder buses shall create the public transport network, enhance service delivery for short-medium to long distance. While BRT delivers the transport service to meet the demand within 20 km away from CBD, railway delivers service to 30km or more to the City boundary. Collaboration of various transport modes shall share the transport service to meet the boosting traffic demand in the future.

Pugu line, Ubungo line, and TAZARA railway are under operation as the current existing railway lines. Pugu line and Ubungo line provide the commuter service with three times respectively in the morning and evening peak hours. Those commuter railway operations have punctuality, and provide satisfactory services. In order to improve the service standard to meet the demand, it is required to increase the frequency of the operation, improve the deteriorated railway infrastructure and develop the electrified sections and double-trucks. By 2025, existing lines shall be improved.

Tegeta line, Morogoro line, and loop line shall be developed until 2030, covering 20 km away from CBD. Until the target year of 2040, railway network shall be connected to existing lines, covering 30 km away from CBD. Kilwa line is recommended to develop after 2040, depending on the volume of traffic demand.

8.2 Railway Plan (MRT)

Railway is planned with the scheduled speed at 35-45km/h, capacity of 20,000-60,000 passenger volume per day per direction, variety of structures at ground, elevated, and underground. As shown in the Figure below, the structure of elevated rail section is proposed at viaduct pier within 3m for elevated rail section, width of 10m, minimum height of 8m from the ground. Railway stations are set up at approximately 2-3km distance, platform length is 200m to accommodate future expansion to 10 cars in a train set.

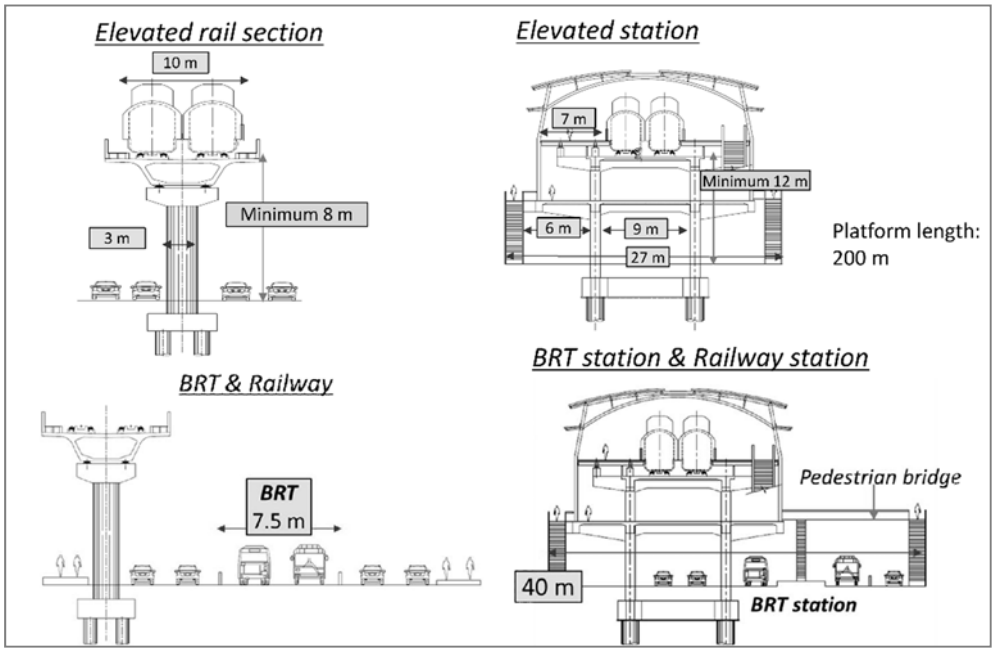


Figure 8-3 Typical Cross Section and BRT Parallel Section for Railway Project

Rehabilitation and double truck of existing line are assumed to be completed by 2030. New railway projects of Tegeta line (Tegeta-Aga Khan), Morogoro line (Mbezi-Ubungo), loop line (Ubungo-Mwenge) shall be developed until 2030.

Total length of railway network is 117km (85km for proposed new railway network, 32km for rehabilitation and improvement of existing lines), will be established with the loop line including underground section. After these developments, extension of the lines at Tegeta line and Morogoro line shall be considered. Loop line is planned to connect CBD to four proposed Sub-centres with the operation distance of 27km, elevated section of 13.2km, tunnel section of 4.7km and ground level of 9.2km.

Tegeta line was selected as the target area of Pre-F/S, covering 21.7km between Tegeta – Aga Khan. Criteria for the selection of candidate line have been established as: volume of congestion, future potential for the urban development by TOD and demand forecast. Tegeta line was selected for Pre-F/S. M/P proposes all elevated structures for Tegeta line, with the consideration of road space availability and to minimize the compensation.

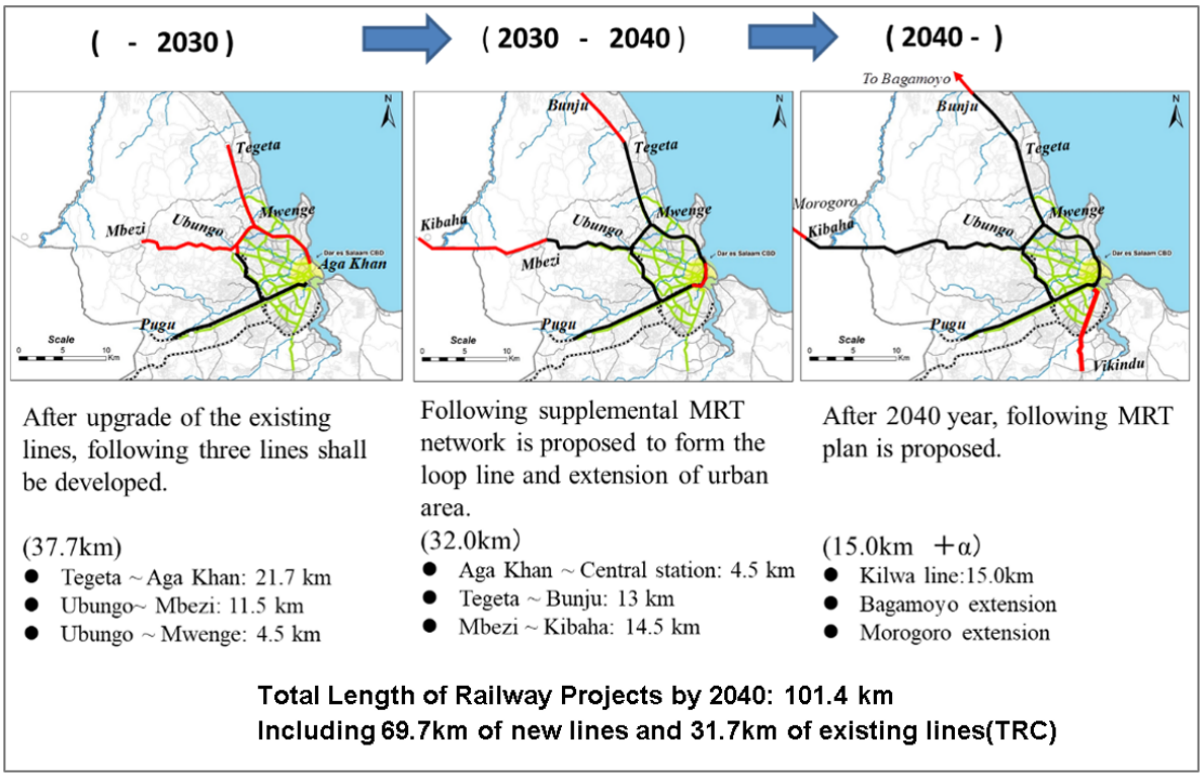


Figure 8-4 Staging Plan for Railway Project

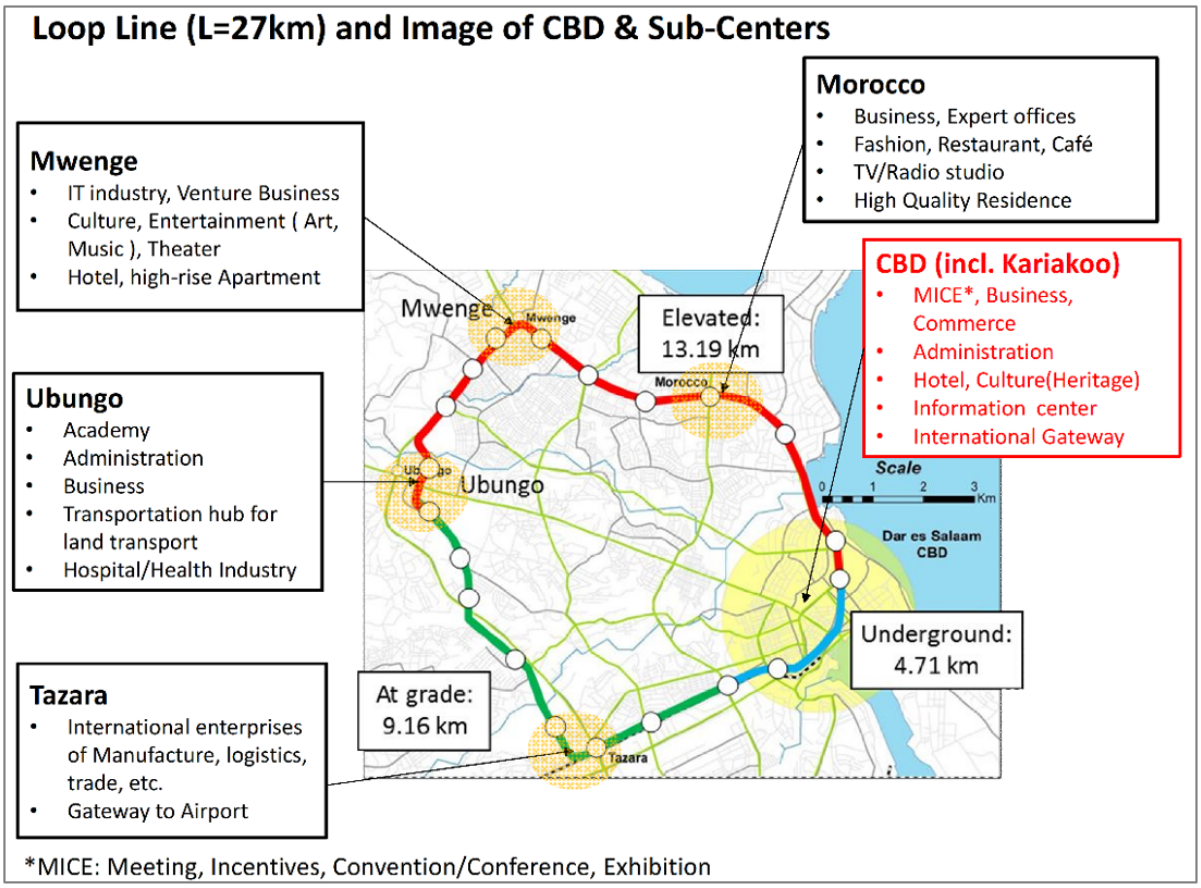


Figure 8-5 Development Plan for Loop Line

Tegeta line connecting from Aga Khan in CBD to the center of Tegeta is to completed between 2025 and 2030.

Total length: 21.7 km
- All elevated

Nos. of station: 13
- All elevated

Opening year:
2025- 2030
- Tegeta ~ Aga Khan

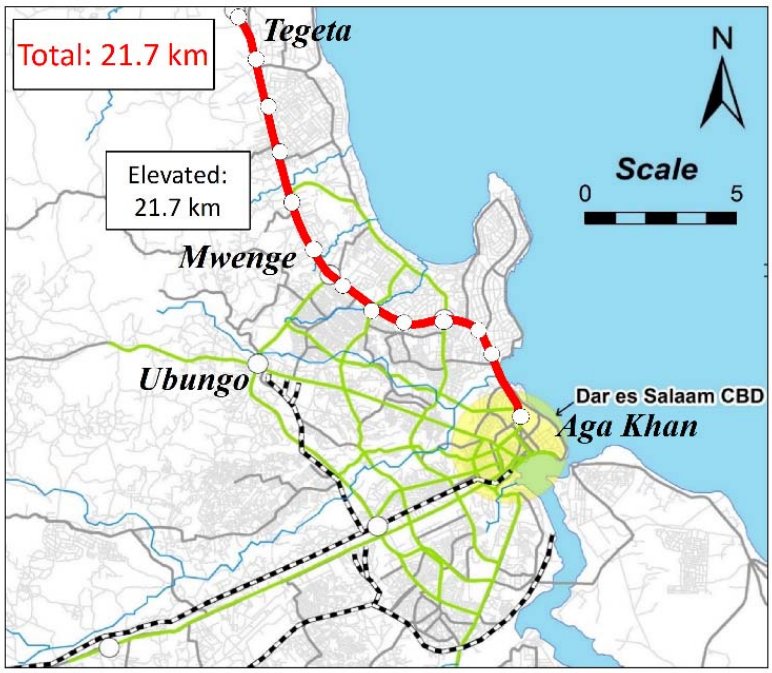


Figure 8-6 Target Area for the Pre-F/S (Railway Tegeta Line)

8.3 Transport Plan for BRT, Feeder Bus, and Terminals

BRT

M/P recommends BRT operation of Phase-4 by 2025, Phase-5 and 6 by 2030, and Phase-7 by 2040. Total distance of BRT service delivery shall be 143km in 2040, including Phase-1 which is currently operating.

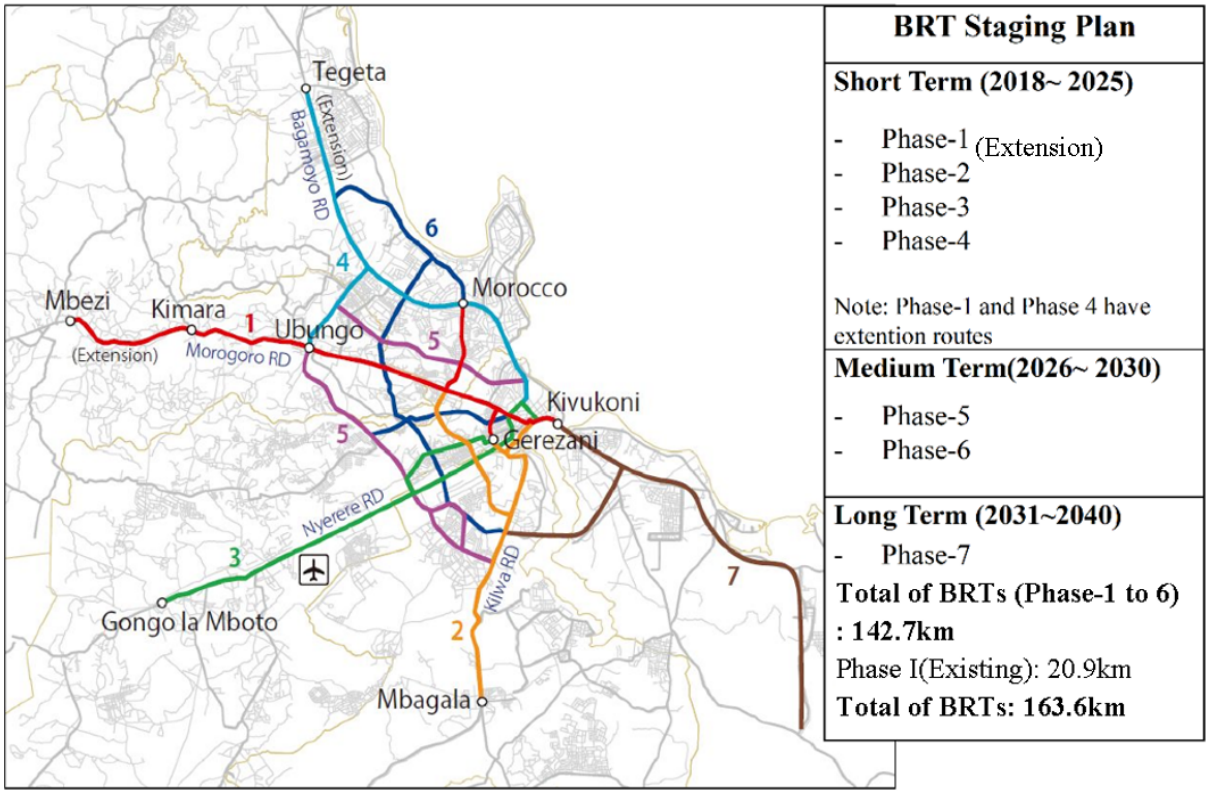


Figure 8-7 BRT Plan

Feeder Bus Services

In addition to railway and BRT, substantial service delivery of feeder bus is required to enhance total capacity of public transport. M/P proposed feeder buses connecting CBD to Sub-centre and satellite cities, while express bus operates at the Middle and Outer Ring Road to meet the demand for long-distance trip.

Modal shift shall be effectively promoted through the improvement of public transport network. M/P set the strategic target as reachable within "one hour in the City by public transport", which shall be a part of the outcomes to attain the M/P concept "Transit Oriented Mega City".

Terminals

Development of transport terminal shall contribute to improve accessibility, mobility and connectivity of various public transport uses. Terminal plan should be developed by integrating the individual plans of railway, BRT, and feeder buses. Type of Feeder bus route is divided into three; direct feeder bus system, as an extension section, transfer system with feeder circulation route and supplementary bus between railway or BRT stations. These feeder bus network will be improved through provision of collector road infrastructure.

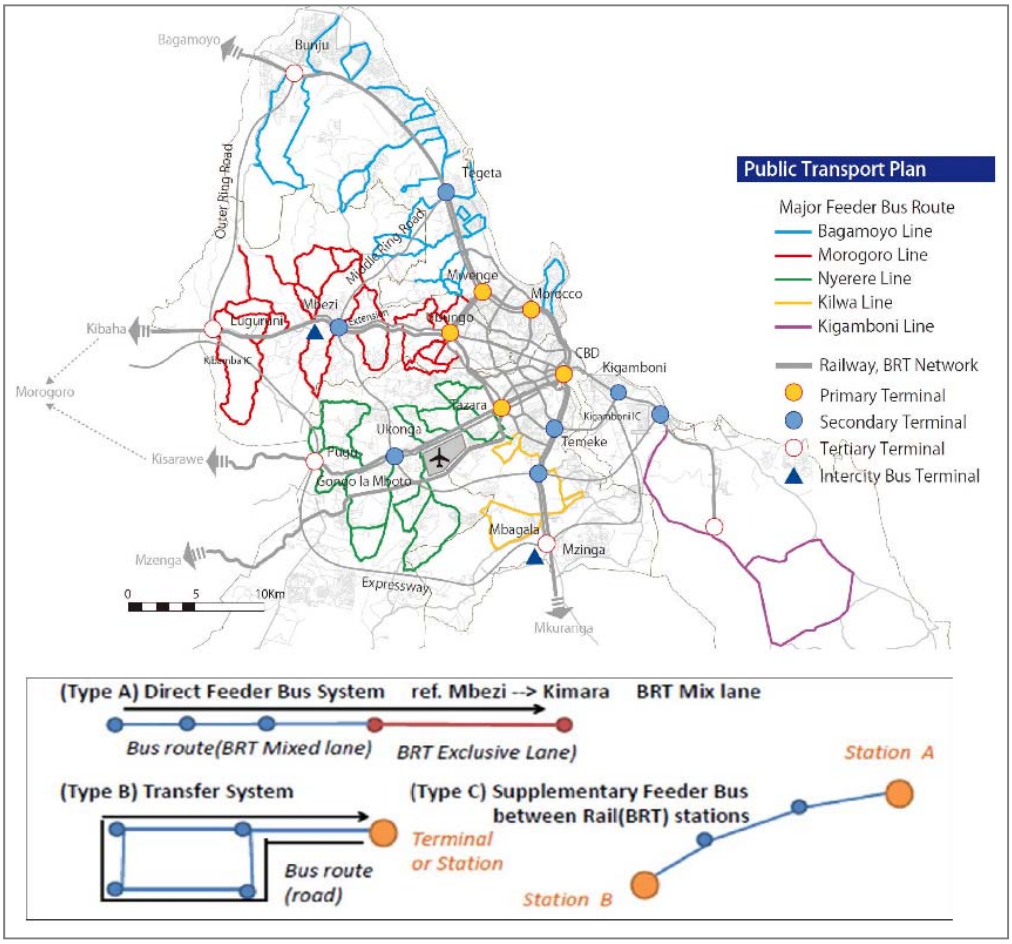


Figure 8-8 Transport Plan for Feeder Bus and Terminals

9. Traffic Management Plan

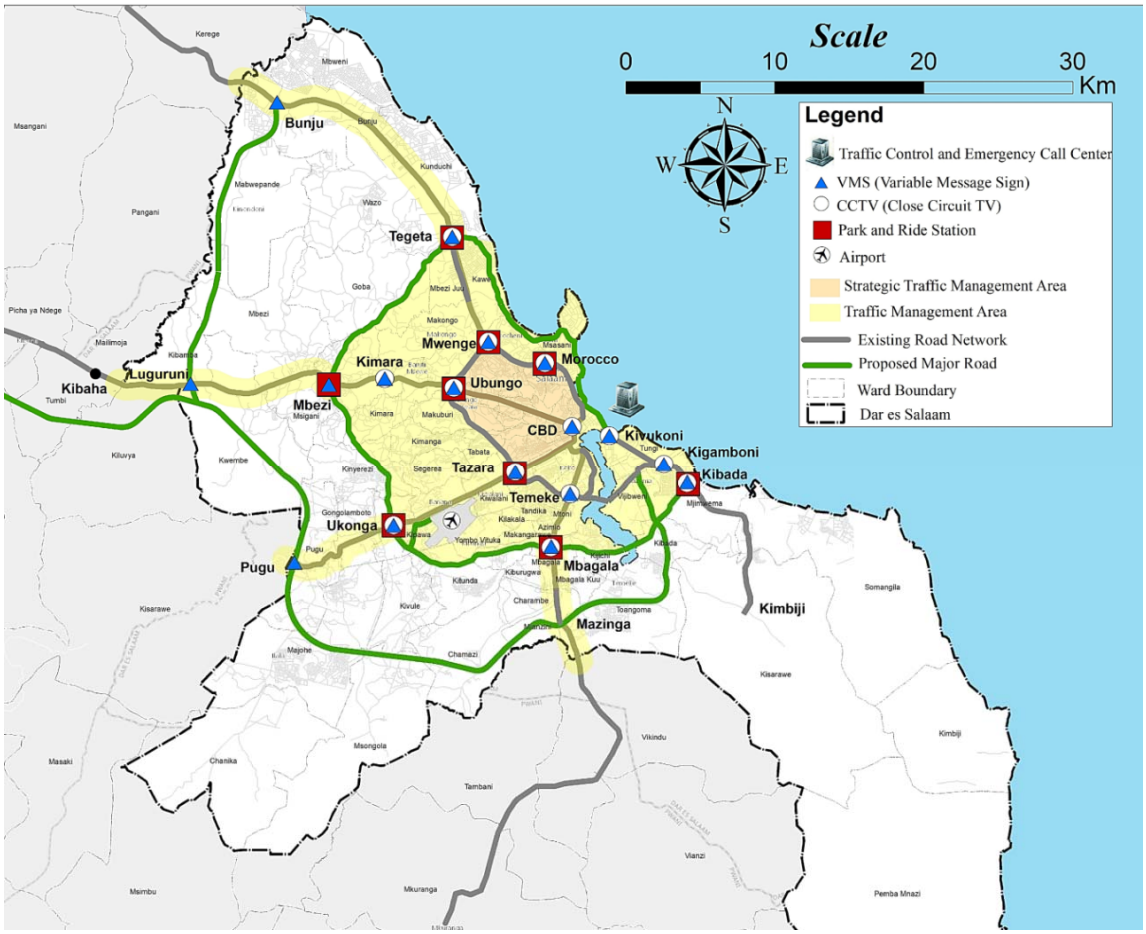


Figure 9-1 Traffic Management Plan

Traffic management system in DSM is urgently required to be introduced. To meet the increasing traffic demand, establishment of appropriate traffic management system is one of the main counter measures until 2030.

9.1. Introduction of Traffic Management System

M/P plans establishment of Traffic Management System, which enables to control the traffic mobility by signal ("Dynamic Signal Optimization System"), and Real-Time Traffic Information System, which provides information of congestion, accidents, and travel time. Introduction of traffic management system shall contribute to smoother inner-city movement and result in maximization of infrastructure utilization. Public Transport Priority System (PTPS) is also proposed in consideration of implementation of BRT future phase and new railway projects. Parking management and mobility control, including Park and Ride, shall be developed under M/P implementation.

【Major Proposed Projects for Traffic Management】

- **Real-Time Traffic Information System** : Real-time traffic information provision is one of the major projects using intelligent transport systems (ITS). ITS assists in effective utilization of existing road traffic infrastructure using information and telecommunication technology. All information on road traffic: congestion, accidents, and flood, is acculturated to the traffic control centre, which provides real-time information to the road traffic users. Information on alternative

routes, travel time, options of other transport modes shall be available to the public. It reduces congestion and accidents, thus, improving traffic movement effectively.

- **Dynamic Signal Optimization System(DSOS) and Public Transport Priority System (PTPS)** : The system provides the most effective signal control. In situations of congestion or BRT approaching, censors detect the situation, and then automatically provide the effective signal control.

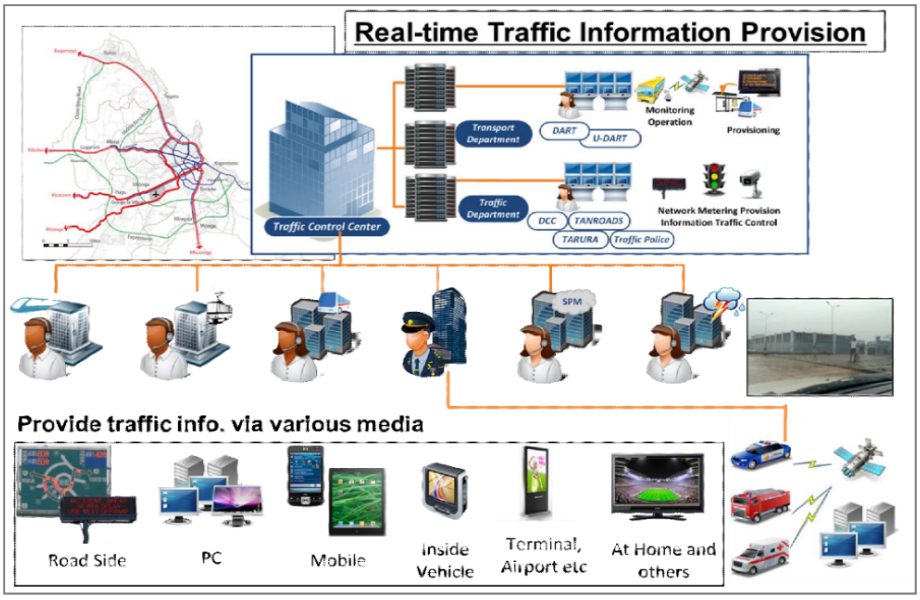


Figure 9-2 Real-time Traffic Information System

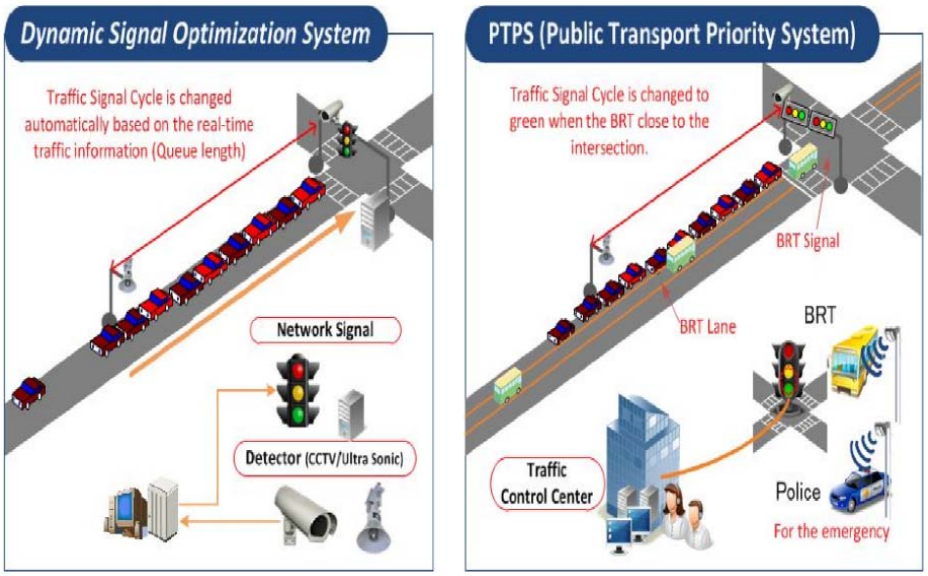


Figure 9-3 Dynamic Signal Optimization System(DSOS) and Public Transport Priority System (PTPS)

9.2 Strategic Traffic Management Area

Strategic Traffic Management Area is set up to strengthen traffic management for a short term. The target area is inside Nelson Mandela Road, where there are high density urban areas and high traffic concentration. Until the development of Middle Ring Road, Nelson Mandela Road is the only one

which has the function of circular traffic movement. After 2030, when Middle Ring Road connects to Bagamoyo Road, Morogoro Road, and Nyrerere Road, target area of strategic traffic management shall be set inside Middle Ring Road to smoothen the traffic flow.

Regarding mobility management, "Park and Ride system (P&R system)" in the suburbs and Parking Management System in CBD and Sub-centers are main measures. Mobility management is to deal with a trip from origin to destination and to promote public transport use and non-motorized means.

9.3 Non-Motorized Transport (NMT) Plan

NMT shared 40% out of total movement in DSM. Improvement of the areas for NMT is crucial to promote modal shift. Without improvement of the circumstances for NMT, users of private car or motorcycles might not be reduced. Pedestrian bridges or sidewalks shall be developed specially near the public transport stations and terminals in order to ensure the safe and convenient accessibility.

In the suburbs, the NMT circumstance is quite poor: unpaved and narrow roads, hilly collector roads, and far from bus stops. Improvement of collector roads in suburbs with the appropriate road density at least 1km/km^2 will contribute to improve safety and convenient accessibility for pedestrians, cyclists, and feeder bus users.

10. Demand Forecast

It is forecasted that the number of generated trips per weekday in Dar es Salaam in 2040 will be 19.2 million trips. This is equivalent to 2.2 times of trips in 2017. In CBD, although the number of commuting trips will slightly increase, the share of CBD in commuting trips in the entire city will fall from 19% in 2017 to 12% in 2040. This can be the effect of the trip distribution being dispersed as a result of forming sub-centres and the satellite cities by realizing the urban structure proposed by M /P. Compared with the case of the trend of urban expansion, as an effect of the M/P urban structure it will reduce the average trip length by 14%.

As public transport is improved, private transport trips by cars and motorbikes will also decrease. In the current situation, the share of cars and motorcycles is 14.3% (2017), but in the future when doing nothing (Do-nothing Case) will increase to 19.1% by 2040. As a result, almost all the trunk roads will become congested. On the other hand, when the M/P is realized, the share is forecasted to decrease to 13.1%, the total of cars and motorcycles and the road congestion sections will be greatly reduced.

Regarding public transport, the realization of the M/P will lead to the increase of the number of passengers, roughly equivalent to the transport capacity on all railway lines/BRT lines in 2040. JICA Study Team estimated the railway passengers at 42,000 to 55,000 per hour per direction (PHPDT) at peak hours, while BRT passengers at 14,000 to 26,000 PHPDT. Even in the section where railway and BRT operate in parallel, both transport modes are expected to have a sufficient number of passengers, and it can be said that the formation of a public transport network by collaboration between railway and BRT is indispensable in Dar es Salaam. Regarding road traffic, in the Do-nothing Case the average travel speed is expected to drop to 10.7km/h in 2040 and 30.9 km / h in the M/P case, resulting in a speed difference of 20km/h. Figure 10-1 shows the number of Trips generated by trip purpose (Left) and the share of CBD in commuting trips in the City (Right, 2017-2040).

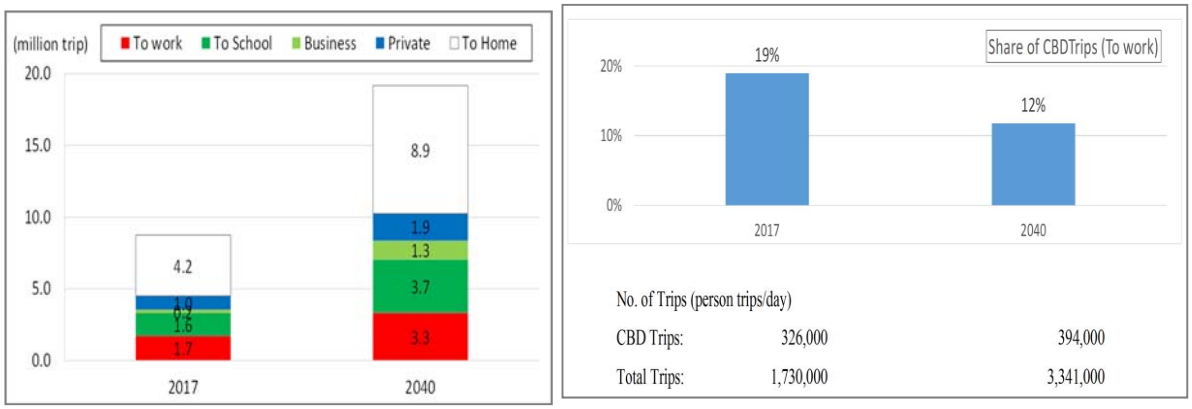


Figure 10-1 Trips Generated by Trip Purpose and the Share of CBD in Commuting Trips (2007-2017)

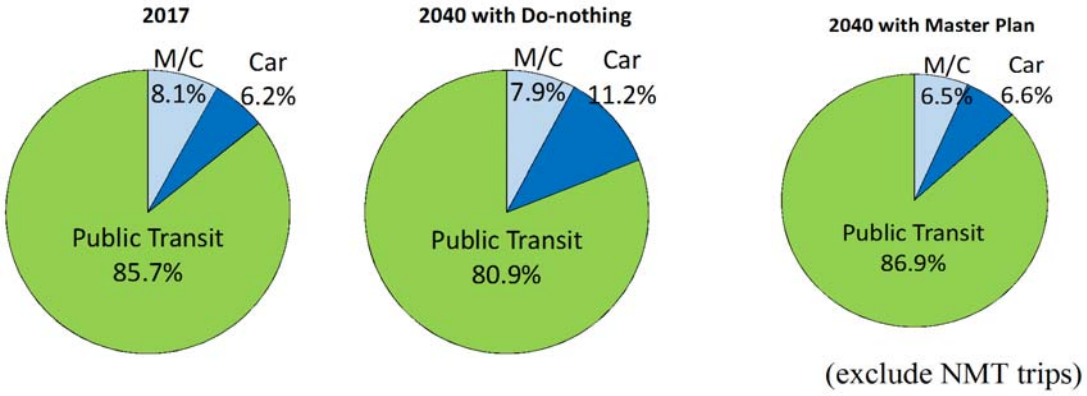


Figure 10-2 Results of Modal Share in Motorised Transports forecasted in 2040

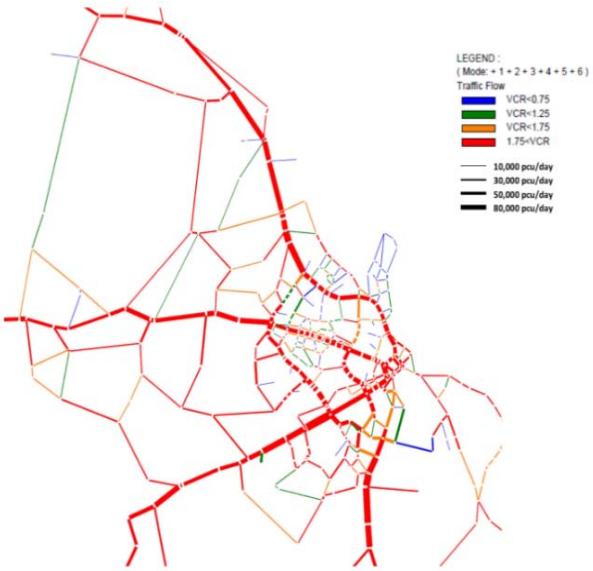
Table 10-1 Result of Forecasted Ridership of Railway (MRT) and BRT in 2040

MRT	Section	No. of Passenger /day	PHPDT*
Loop Line	Central-Ubungo-Mwenge-Morocco	428,000 ～ 844,000	42,200
Bagamoyo Line	Mwenge-Bunju	673,000 ～ 1,029,000	51,450
Morogoro Line	Ubungo-Kimara	912,000 ～ 1,113,000	55,650

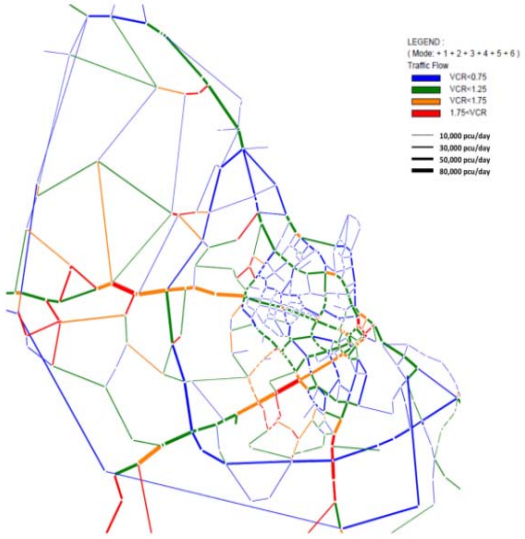
*PHPDT: Peak Hour Peak Direction Traffic

BRT	Section	No. of Passenger /day	PHPDT*
Phase-1	Morogoro Rd	251,000～ 522,000	26,100
Phase-2	Kilwa Rd	229,000～ 470,000	23,500
Phase-3	Nyerere Rd	164,000～ 379,000	18,950
Phase-4	Bagamoyo Rd	276,000～ 358,000	17,900
Phase-5	Nelson Mandela Rd	160,000～ 317,000	15,850
Phase-6	Old Bagamoyo Rd	248,000～ 287,000	14,350

*PHPDT: Peak Hour Peak Direction Traffic



＜ 2040 Do nothing Case ＞



＜ 2040 Master Plan Case ＞

	2040_Do-nothing Case		2040_Master Plan Case	
Total vehicle kilometer	19,471,942		16,866,595	
Total vehicle time	1,811,605		545,036	
Average Congestion Ratio	1.97		0.61	
Average Speed (km/h)	10.7		30.9	
Road Length by Congestion Rank	Length (km)	Ratio	Length(km)	Ratio
Less than 0.75	183	0.22	602	0.58
0.75 - 1.25	105	0.13	259	0.25
1.25 - 1.75	126	0.15	86	0.08
Over 1.75	403	0.49	94	0.09

Figure 10-3 Future Traffic Volume Assignment

11. Implementation Plan

11.1 Staging Plan

M/P proposes the staging plans for the project implementation. Projects shall be implemented until 2025 for "Short-Term", until 2030 for "Medium-Term" and until 2040 for "Long-Term"

- **Short-Term(until 2025)**
  - Policy: To improve traffic movement by appropriate traffic control system
  - Major Proposed Project: BRT Phase-2, 3, and 4, Improvement of existing railway lines, Traffic Management, improvement of the intersections

- **Medium-Term(until 2030)**
  - Policy: To create public transport network by collaboration of BRT and railway (MRT) to meet the increasing traffic demand of the estimated population of 10 million. Public transport network will deliver the transport service up to 15-20km away from CBD. Major Proposed Project : BRT Phase-5 and 6, Railway projects for Tegeta line, Morogoro line, and part of loop line (incl. operation), middle ring road

- **Long-Term (until 2040)**
  - Policy: Public transport network shall extend the service delivery to 30km away from CBD. With the completion of substantial public transport network, one hour access within the City shall be realized. Palm and Fingers urban structure shall be developed.
  - Major Proposed Project : Three Rind Roads (Nelson Mandela Road, Middle Ring Road, and Outer Ring Road), Operation of railway Loop Lines, extension of railway lines, BRT Phase-7 (Kigamboni)

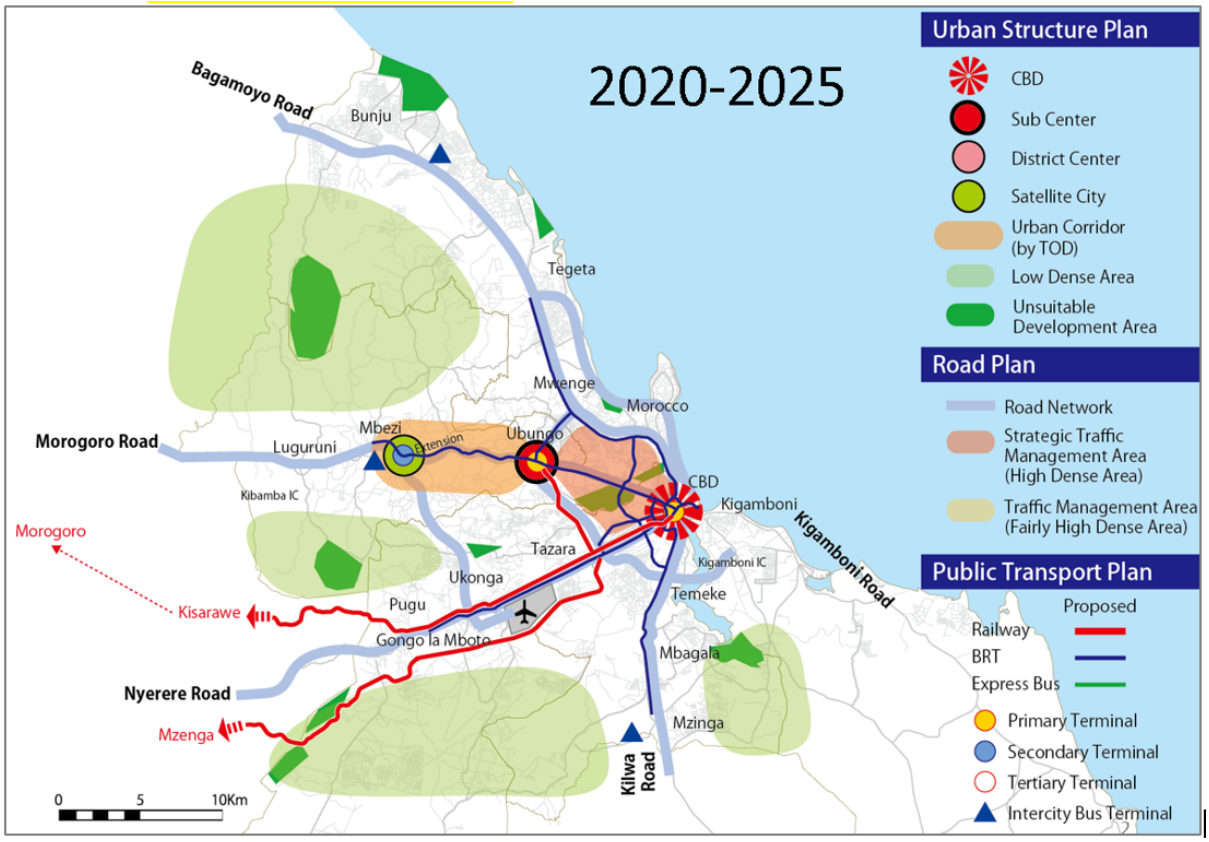


Figure 11-1 Development Plan for 2025

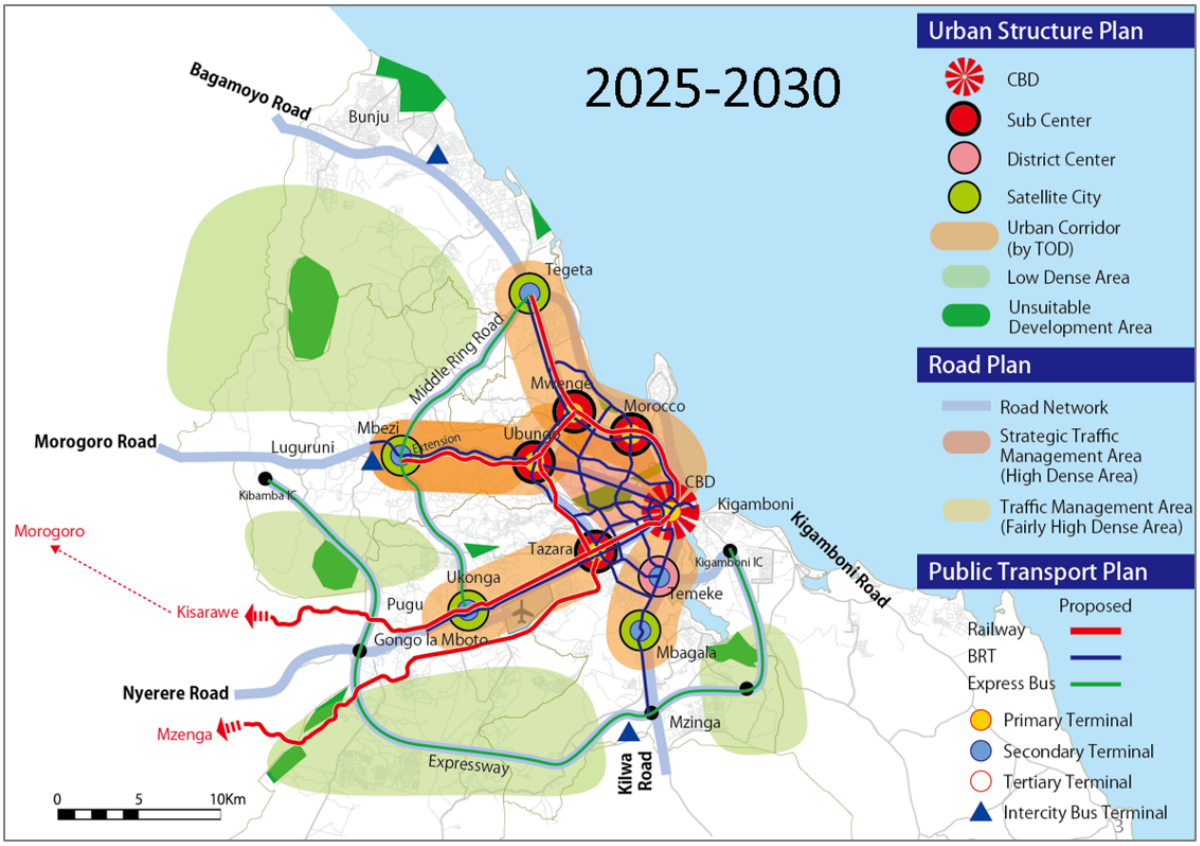


Figure 11-2 Development Plan for 2030

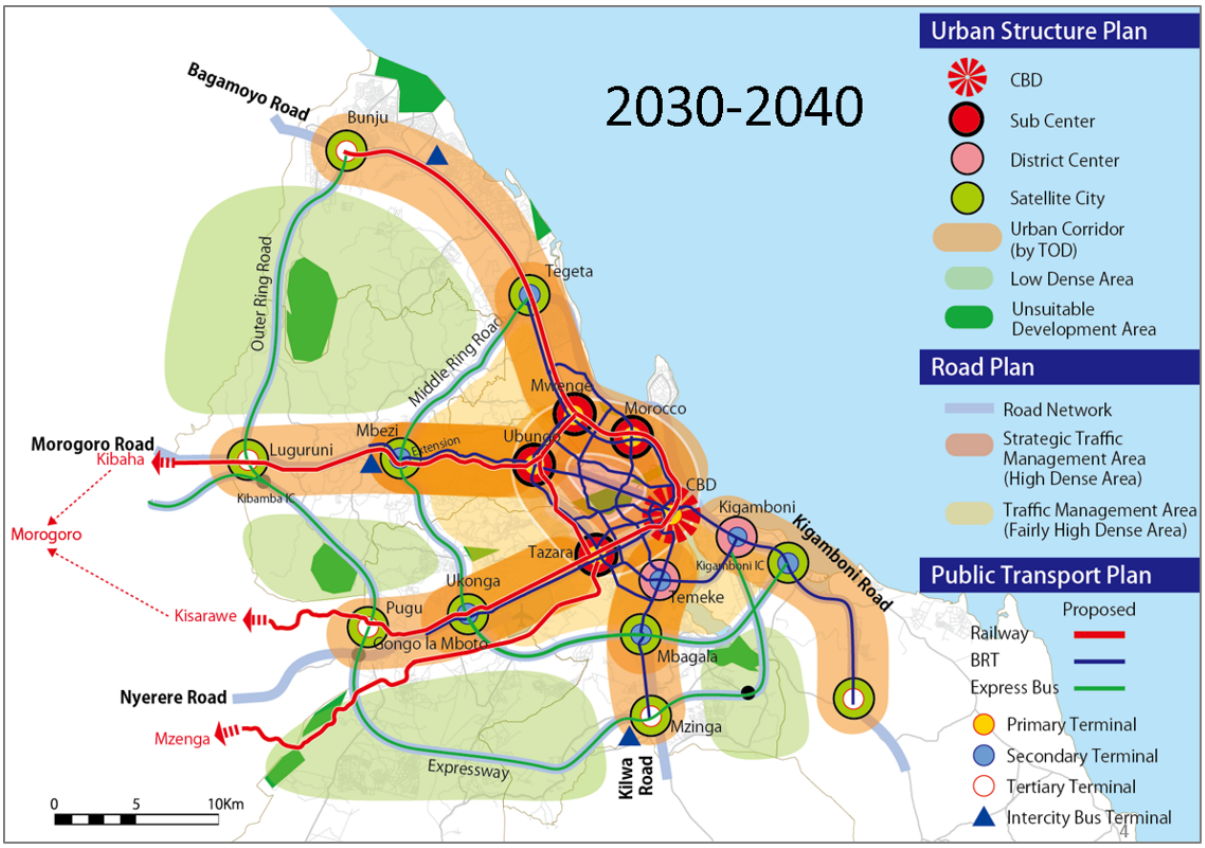


Figure 11-3 Development Plan for 2040

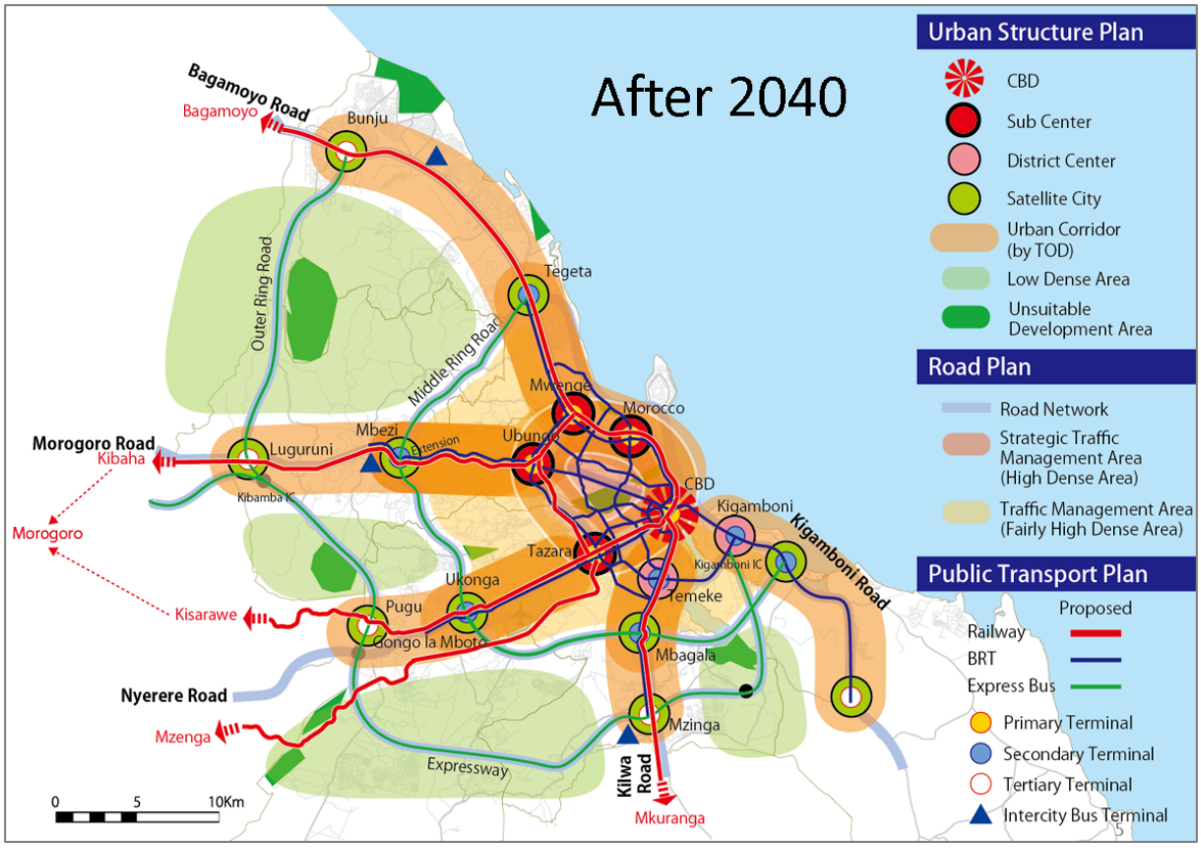


Figure 11-4 Development Plan after 2040

12. Capacity Development Plan

12.1 Proposal for the Practical Project Implementation

In order to strengthen the capacity for the operation and implementation of M/P projects, the following capacity development plans are proposed.

- Establishment of the Simple Coherent Management Mechanism, Clarifying the Ownership Responsibility, and Preparation for DUTA Establishment

  Organizational structure for the management of M/P is urgently required to be established. DCC as the owner of M/P, supported by PO-RALG, is required to coordinate with the various stakeholders to implement the M/P projects until DUTA establishment in the near future.

  After DUTA has been successfully established, it is expected to manage and coordinate the plans, implementation, and operation of railway, BRT and buses.

- Establishment of DSM Development Information Centre

  In order to invite private investment and implementation of M/P projects, all relative information, such as population, land use, traffic statistics, transport development plan, and PPP urban development plan, shall be accumulated and integrated into one information centre.

  Capacity development for the establishment of DSM Development Information Centre shall include the operation and management of the centre, database establishment with GIS and updating, data distribution by WEB site, public relations etc.

- Technical Development to Promote TOD Approach

  TOD approach requires balancing between urban development and transport infrastructure development. It results in increasing the number of public transport users, promoting modal shift, increasing the value of land along transport corridors, thus benefitting the stakeholders of transport agencies, urban developers, and railway users. Purpose of the TOD is to restore the profits from the developments to the infrastructure investment.

  Technical Development to promote TOD shall include the creation of the systems or organizational structure for the transport operation, urban development, and investment fund in Tanzania.

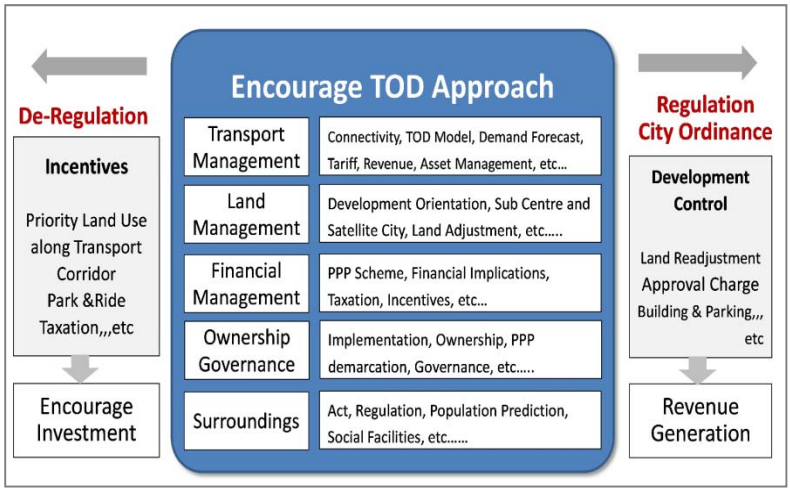


Figure 12-1 Capacity Development Plan for encouraging TOD

12.2 Estimation of the Development Profits of Tegeta railway Line by TOD Approach

TOD can promote urban development around the stations on the route of public transport in the central area and suburb with the development of public transport infrastructure. As a result, TOD can increase public transport users and promotes modal shift. It can be possible to increase the revenue from ridership. At the same time, it is possible to acquire the land around the station before railway provision, to obtain the profit from selling of the land after railway provision. Its capital gain can be used as redemption of infrastructure development and as the next investment fund. In other words, by simultaneously proceeding railway infrastructure and urban development in parallel, it is an excellent method where revenue from various businesses can be expected.

In the case of a residential area, the rise of land price can be expected by shortening the time required from the city centre to the place. For example, you can calculate how much developmental benefit will be obtained if you estimate how much the difference in the value of land is between one hour when there is no railway and 30 minutes when the railway is serviced. As for real estate investment, the future price increase will be determined depending on where and how much land to purchase.

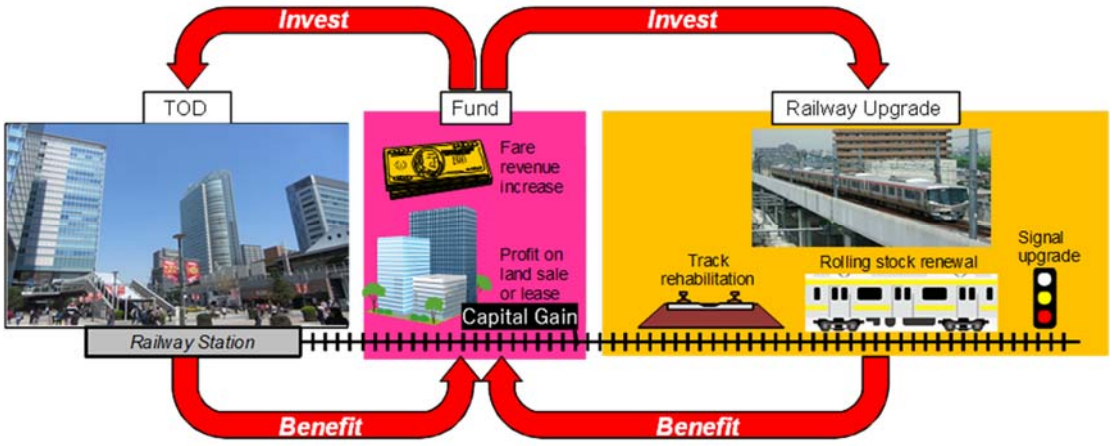


Figure 12-2 Land Value Capture with TOD and Railway Development

In the graph below, the travel time is shown on the horizontal axis and the land price is on the vertical axis. The graph shows how to calculate the price increase gain of the land as a result of the shorter travel time. The Tegeta line project is applied to analyze the development capital gains by utilizing actual 2016 land value data.

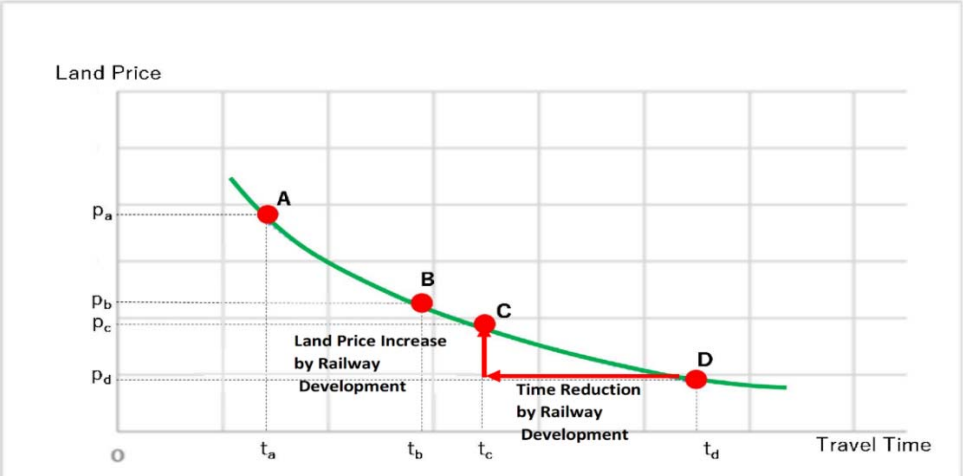


Figure 12-3 Image of Capital Gain from Land Development by Railway project

At Tegeta, which is located about 20 km away from CBD, it assumes that it takes about 80 minutes to CBD at the speed of about 15 km/h. It is supposed that when the railway is provided here, it can move at least 30 km/h or more and it will take about 40 minutes to CBD. Then it will be in the same time zone as the current location near Mweng. By creating a land price formula by travel time, Tegeta's land price would be doubled. Using the formula, it estimated the case of acquiring a total of about 150 hectares of land around the planned 13 stations on the Tegeta line (assuming 2 to 4ha near the central ares and 20ha in the suburbs). The land acquisition cost is about 300 million US dollars, but the land value will be 600 million dollars after railway provision. Approximately 300 million US dollars will be calculated solely by the land price gain. These 300 million US dollars corresponds to about 20% of the initial investment cost of the Tegeta line. Simply, if acquiring twice the area, collection of 40% worth can be obtained.

In this way, when investing in expensive infrastructure such as railway, the pre-purchase of the land along the planned routes is an extremely effective funding method. Moreover, it is also extremely reasonable to apply TOD to the railway development project, which has great financial merit. Considering the method of future railway development projects in Dar es Salaam, TOD is a useful project method for encouraging private investment. It is desirable to carry out a feasibility study on Tegeta Line project from the viewpoints of engineering, economics and finance including a study of TOD approach.

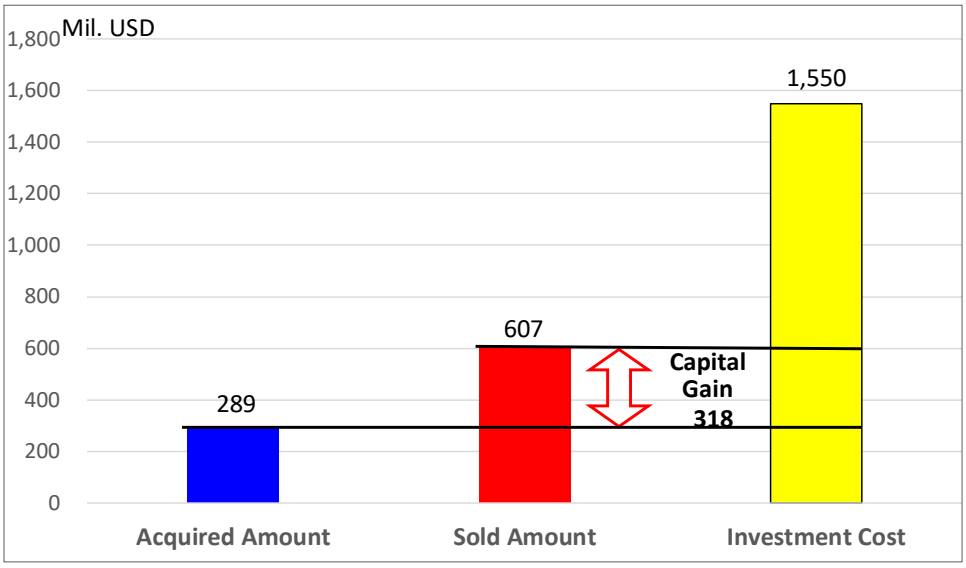


Figure 12-4 Result of Case Study for Capital gain by Tegeta line project

13. Economic and Financial Evaluation

13.1 Proposed Projects

M/P proposed 79 projects in total. Proposed projects are summarized by sector and by terms as follows.

Table 13-1 Summary of Proposed Projects

Category		Number of Proposed Components	Number of Projects	Short term until 2025	Medium term until 2030	Long term until 2040	Across the term	After 2040
Road Plan		5	29	7	8	9	5	0
Public Transport	Railway (MRT)	6	8	2	3	2	0	1
	BRT	7	7	4	2	1	0	0
	Transport Terminal	3	7	2	2	3	0	0
	Feeder Bus	5	5	-	-	-	5	0
	Waterway	1	1	1	0	0	0	0
Traffic Management		3	7	1	-	-	6	0
Urban Management		3	8	3	2	1	1	1
Capacity Development		4	7	1	-	-	6	0
Total		**37**	**79**	**21**	**17**	**16**	**23**	**2**

13.2 Project Cost and Economic Evaluation

Total project cost, including construction, rolling stock and facilities for the railway project, compensation for land acquisition, is estimated 10billion USD (equivalent for 23,024 billion TZS) for 22 years (2018-2040). The railway project shares 45% of the total project cost, while the share of the road project is 37%.

Result of economic evaluation shows EIRR is 32.3%, which is exceeding the social discount rate of 12%. B/C rate of 2.72 is bigger than 1.0. From the sensitive analysis, EIRR remains more than 20%, in the case setting of Cost range for +20%, Benefit range for -20%. This result indicates the implementation of M/P proposed projects is appropriate and feasible from the economic point of view.

Table 13-2 Summary of Proposed Project Cost

Project		Quantities	USD (million)
A. Road Project	01. Middle Ring Road	50.9 km	903
	02. Bay Link Road	46.7 km	707
	03. Outer Ring Road	77.5 km	664
	04. Flyover	11 nos	987
	05. Collector Road	L.S	460
	Total		**3,721**
B. Railway Project *1	01. Upgrade of Ubungo line	11.7 km	207
	02. Track doubling of Pugu line	20.0 km	231
	03. Tegeta Line (Aga Khan-Tegeta)	21.7 km	1,196
	04. Extension line between Mwenge and Ubungo	4.5 km	151
	05. Morogoro line	26.0 km	1,216
	06. Extension line between Aga Khan and Central	4.7 km	999
	07. Extension line between Tegeta and Bunju	13.0 km	517
	Total		**4,517**
C. BRT Project	01. BRT Lane Construction *2	72 km	**249**
D. Terminal	01. Public Transportation Terminal	17 nos	**33**
E. Traffic Management	01. ITS Facilities and Signals *3	1 nos	**78**
F. Waterway	01. Pier Construction	1 nos	10
	02. Boat Purchase	2 nos	13
	Total		**23**
Total Construction Cost			**8,621**
Others			**1,724**
Initial Cost			**10,345**

*1: excluding Kilwa line (construction after 2040)
*2: excluding phase-1 (Extension) - phase 4
*3: including ITS and Signal only, excluding other facilities
Source: JST

Table 13-3 Result of Economic Evaluation

< Result of Economic Analysis for UTMP until 2060>

EIRR	B/C	NPV (million USD)
32.3%	**2.72**	**5,923**

< Result of Sensitivity Analysis for UTMP >

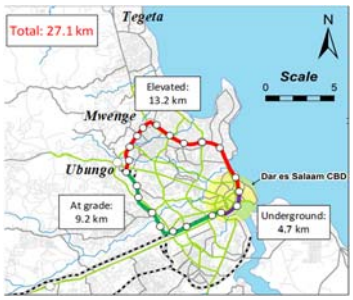
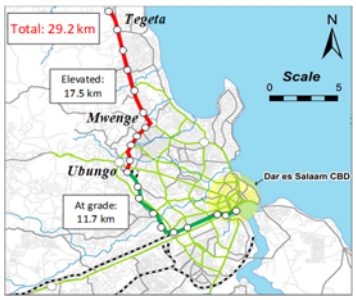
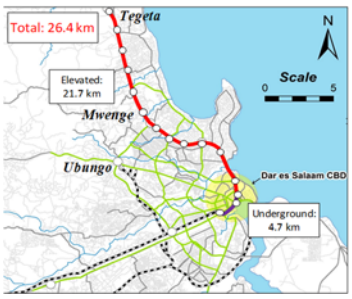
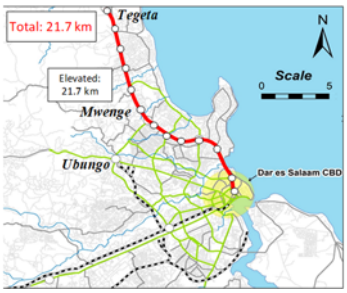
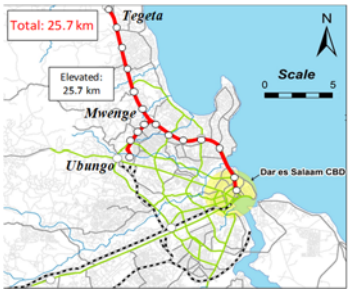
		Benefit		
		0%	-10%	-20%
Cost	0%	32.3%	28.9%	25.6%
	+10%	29.2%	26.2%	23.3%
	+20%	26.7%	24.0%	21.4%

14. Pre-Feasibility Study

14.1 Case Setting

The following five cases are selected from the Projects proposed by the Master Plan for the selection of a pre-feasiblity project. These are selected routes among the railway projects which would attract higher demand of passengers and would reduce traffic congestion on Bagamoyo Road.

Table 14-1 Case Setting

Case 1  Loop Line (At grade, Elevated, Underground) **improvement of the public transport user's service within Nelson Mandela Road. Existing rail section will be upgrade (from single track to double track, SGR and Electric Multiple Unit).*	Case 2  Half Loop and Tegeta Line (At grade, Elevated) **combination of existing rail line and new elevated section. Existing rail section will be upgrade (from single line to double line, SGR and Electric Multiple Unit).*	Case 3a  Tegeta Line (1) (Underground, Elevated) **all new railway, combination of elevated and underground section.*
Case 3b  Tegeta Line (2) (Elevated only) **all new railway, all elevated section and no underground section*	Case 4  Tegeta Line and Loop (Mwenge-Ubungo) (Elevated only) **all new railway, all elevated section and no underground section*	

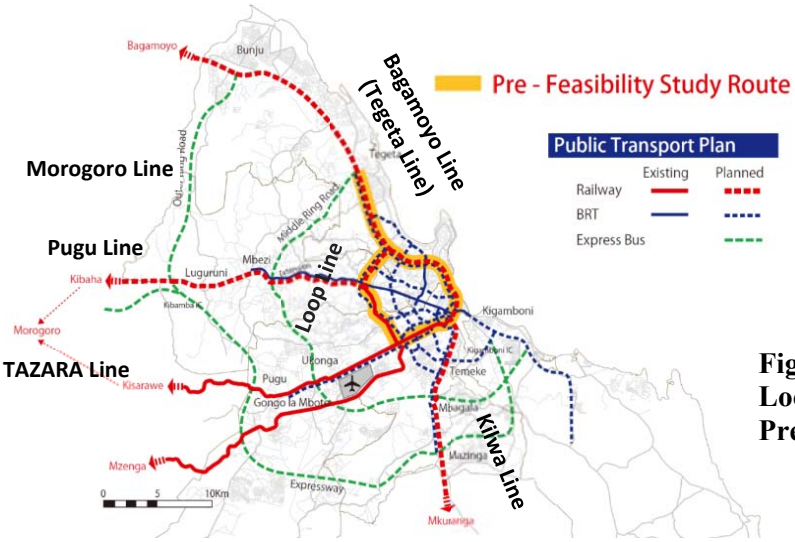


Figure 14-1 Location of Pre-Feasibility Project

14.2 Evaluation of Cases

Case 3b was selected as recommended based on the following result of project evaluation including ten indices.

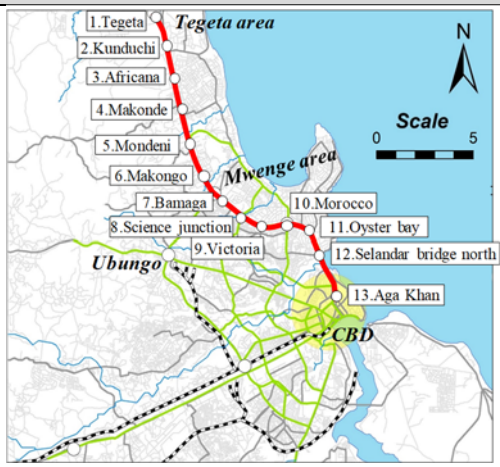
Table 14-2 Evaluation of Cases

Evaluation Items	**Case1: Full Loop Line**	**Case 2:Half Loop +Tegeta**	**Case 3a :Tegeta**	**Case 3b : Tegeta (No CBD)**	**Case 4: Tegeta (No CBD)+loop**
	Underground, at grade, Elevated	At grade, Elevated	Underground, Elevated	Elavated Only	Elevated Only
1) EIRR	26.2% (0.82) Good	30.1% (0.93) Good	25.4% (0.79) Fair	32.3% (1.00) Very Good	28.6% (0.89) Good
2) FIRR	1.1% (0.13) Fair	6.9% (0.84) Good	3.8% (0.46) Fair	8.2 % (1.00) Very Good	8.2% (1.00) Very Good
3) Ridership Y2030	1.47 Mil. (0.99) Very Good	1.48 Mil. (1.00) Very Good	1.32 Mil. (0.89) Good	1.29 Mil. (0.87) Good	1.40 Mil. (0.95) Good
4) Investment Cost	2.47 Bil. USD (1.59) Fair	1.63 Bil. USD (1.05) Good	2.94 Bil. USD (1.90) Fair	1.55 Bil. USD (1.00) Very Good	1.80 Bil. USD (1.16) Fair
5) O&M Cost/year	71.1 Mil. USD (1.02) -	71.2 Mil. USD (1.02) -	71.8 Mil. USD (1.03) -	69.5 Mil. USD (1.00) -	72.6 Mil. USD (1.04) -
6) Impact of Natural Environment	Tunnel-Waste soil & Groundwater Msimbazi river – mangrove Fair	No Tunnel Very Good	Tunnel-Waste soil and Groundwater Msimbazi river – mangrove Fair	No Tunnel Msimbazi river – mangrove Good	No Tunnel Msimbazi river – mangrove Good
7-1) Number of Affected Buildings	137 (1.39) Fair	114 (1.01) Very Good	113 (1.00) Very Good	113 (1.00) Very Good	192 (1.70) Fair
7-2) Land Acquisition Area	18,300 m^2 (2.23) Fair	8,200 m^2 (1.00) Very Good	16,100 m^2 (1.96) Fair	8,600 m^2 (1.05) Very Good	13,800 m^2 (1.68) Fair
8) Construction Period Risk	Tunnel-Waste soil & Groundwater Msimbazi river – mangrove Fair	No Tunnel Very Good	Tunnel-Waste soil and Groundwater Msimbazi river – mangrove Fair	No Tunnel Msimbazi river – mangrove Good	No Tunnel Msimbazi river – mangrove Good
9) Contribution of Urban Development	CBD:1 Sub-Centre:4 Total: 5 (1+4) Very Good	CBD:1 Sub-Centre:3 Satellite City:1 Total:5 (1+3+1) Good	CBD:1 Sub-Centre:2 Satellite City:1 Total 4 (1+2+1) Good	Sub-Centre:2 Satellite City:1 Total 3v(0+2+1) Fair	Sub-Centre:3 Satellite City:1 Total 4 (0+3+1) Good
10) Others	Many illegal buildings are within the existing Rail ROW. It may take time to negotiate with local settlers. **(Fair)**		Whole section is new line. During construction, it does not disturb the present rail operation. It is good for rail operator and rail users**. (Very Good)**		
Evaluation					
Very Good(+1)	2	5	2	**7**	3
Good(0)	1	4	2	2	4
Fair (-1)	7	1	6	1	3
Score (Ranking)	-5 (5th)	4 (2nd)	-2 (4th)	6 (1st)	0 (3rd)
				Recommended	

14.3 Summary of Selected Railway Project

Project summary of Case 3b which was selected as the pre-feasibility project is shown below. The project cost of Case 3b is estimated at 1,555 million USD. In case the feasibility study for the project began in 2018, the detailed design of the project would be finished in 2023. After that, if the construction period is assumed at five years, the project would be in operation between 2026 and 2029.

Table 14-3 Summary of Selected Railway Project

Route Profile	Items	Specification
	Gauge	1,435mm
	Number of Tracks	Double track
	Rolling Stock	EMU (Electric Multiple Unit)
	Design Speed	100km/h
	Minimum Curve Radius	200m
	Maximum Gradient	3.5 %
	Electric Power Supply	AC 25,000V, Overhead catenary system
	Signalling System	CBTC (Communication-Based Train Control)
	Telecommunication System	Radio communication system, CCTV system
	Railway Track	Ballast-less track for main line Ballast track for Depot
	Station Facility	AFC (Automatic Fare Collection)

Source: JST

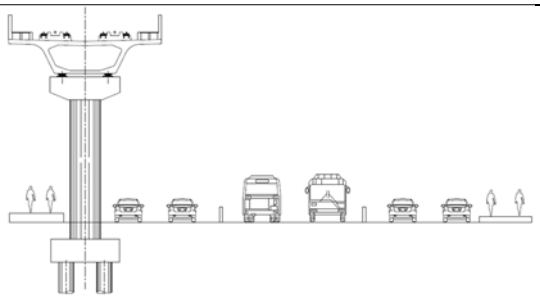


Image of Elevated Railway and BRT at grade Section

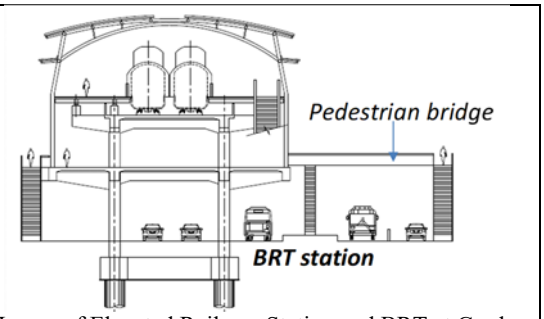


Image of Elevated Railway Station and BRT at Grade Section

Source: JST

Figure 14-2 BRT Parallel Running Section and Station

Table 14-4 Project Cost of Selected Railway Project

Item	Million USD
Civil, Architect and Track	654
Rolling stock	328
Electric & Mechanical	93
Signal & Telecommunication	120
Total of construction/procurement cost	**1,196**
Indirect cost	359
Grand Total	**1,555**

Source: JST

14.4 Economic and Financial Evaluation for the Selected Railway Project

Tegeta line as the selected priority project is assumed to be in operation by 2030. Based on the result of traffic demand forecast in case the Dar es Salaam Urban Transport M/P is implemented by staging plan for 2030 and 2040, some sufficient demand level of 20,000-33,000 PHPDT is forecasted and road congestion on Bagamoyo road is reduced sufficiently. As a result, economic benefit is represented as 32.3% of EIRR and feasible enough for public investment.

Financial evaluation result shows that the project is not enough to be on feasible level of PIRR. Although the number of passengers is sufficient, it is calculated with inexpensive pricing assumption that anyone can use at affordable fare, and toll revenue does not become sufficient project or financial internal rate of return corresponding to project cost.

If the government carries out infrastructure development and the government supports 50% of the rolling stock cost, if it is maintenance and management by the private sector, the internal rate of return of the project would be 24.78%, which can be a nearly reasonable PPP project.

As shown in 12.2, when implementing real estate development at the same time as TOD, there is a high possibility of earning profits such as capital gains in addition to toll revenue. According to the estimation of 12.2, it shows that profit equivalent to rolling stock cost can be obtained from the Tegeta railway line project

Table 14-5 Evaluation of the Selected Railway Project, Tegeta line

Item		figure	Notes
Project Cost(CAPEX)		1,555million USD	
Operation & Maintenance		78million USD	5% of CAPEX
Future Demand in 2030		20,000-33,000 PHPDT	BRT:10,000-17,000 PHPDT
Total Revenue between 2030 and 2060		7,397million USD	Average annual revenue for 30 years : 247million USD
Economic Evaluation	EIRR	32.3%	Calculation between 2018 and 2060
	B/C	2.72	
	NPV	5.9 billion USD	
Financial Evaluation PIRR/FIRR	1)Public Sector Project	8.24%	
	2)PPP-1 : Rolling Stock invests 100% by Private, with Revenue Share to Public (25% of Net Operating Profit)	14.93%	
	3)PPP-2: Rolling Stock invests 50% by Private, with Revenue Share to Public (25% of Net Operating Profit)	24.78%	

15. SEA

Implementation of the proposed Urban Structure and Transport Network shall become the trigger for the environment and society in DSM. SEA was conducted by complying with the official requirements of GOT and JICA. As a result, proposed projects would deliver environmental friendly urban transport system. Moreover, M/P implementation will bring a positive impact on the socio economy in DSM. In order to improve the sustainability of social welfare, economic growth, and environmental quality of DSM, it is required to pay enough attention to the comments raised as follows.

- Detailed Feasibility Study for the Practicality of the proposed development
- Environment Social Impact Assessment for the proposed urban structure
- Establishment of the organization which is responsible for coordinating stakeholders and harmonization
- Capacity development for the proposed infrastructure operation and management
- Minimize the land expropriation and compensation

16. Recommendation for Short Term Action

1) Reflecting M/P Proposal into the Relative Policy and Plans

The concept of this M/P is "Transit Oriented Mega City". Key strategy is to establish "Palm and Fingers" urban structure by applying TOD development, through improving capacity and service standard of the public transport by networking various transport modes, railway and BRT.

Concept shall be well known and shared among the stakeholders. In order to promote harmonization of the number of related plans and policies, it is requested for PO-RALG to ensure M/P contents is reflected into National, Regional and City plans and policies, specially to Dar es Salaam Master Plan (2012-2032, MOLHHSD), National Transport Policy (Transport-MOWTC), and the upcoming National Five-Year Development Plan (FYDP, MOFP).

2) Promoting Appropriate Land Use by the Regulation

It is surely assumed that the population of Dar es Salaam will continue to increase in the following years. Overcrowding invites various negative impacts and risks, such as traffic congestion, natural disasters, hygiene, security, and natural environment destruction. In order to prevent such a situation, it is necessary to focus on the effective investment for the transport infrastructure to guide appropriate inhabitants to five urban corridors (Bagamoyo, Morogoro, Nyerere, Kilwa, Kigamboni).

Hilly suburbs between the five corridors should be controlled within the zones and development any large-scale residential or commercial buildings should not be allowed. For that purpose, it is recommended to formulate appropriate land development regulation and standards. On-going DSM Master Plan undertaken by MOLHHSD shall be completed in a short period and is expected to act as the land use regulation for DSM to guide the City in the appropriate manner.

Land use regulation shall be formulated in consideration of population increase and population density in the future. Population of DSM is estimated at 12 million in 2040, thus, preventing

overcrowding, risk of degrading sanitation, disaster and environmental damage shall be important issues. To guide appropriate land use to meet the increasing population in the future, population density of the City shall be set as less than 10,000 people / km^2.

3) Promoting TOD through Networking Railway and BRT Collaboration

Along the five urban corridors, it is recommended to invite the private sector for the constructive urban development. Promoting modal shift by improving the capacity and service standard of public transportation will contribute to decrease the traffic congestion and reduce the number of cars used. Networking railway and BRT in the future will be the main transport mode to promote TOD. Applying TOD approach shall improve revenue for the operating agencies by increasing number of users, and drastically reduce road congestion.

Proposed railway project with the elevated structure enables to provide high speed, frequent and mass transit services. It shall dramatically increase the value of land along the railway line. New business model shall be developed through TOD approach by revenue generation with sale of land around the station, development of commercial, business, residential area, etc. In addition to passenger revenue, such development projects lead to early recovery of infrastructure investment for the transport operation agencies. This business model is particularly noticeable as the good practice in Japanese railway business.

Virtuous circle towards TOD Mega City shall be created by applying TOD which has a wide range of spin-off effects in railway business, to generate revenue from various fields of development. Additional railway infrastructure shall be implemented with this business model and invite an increase of transportation users.

It is necessary to develop such business management in Tanzania. Establishing a legal framework and systems for TOD, creation of public-private funds is recommended through technical cooperation.

4) Developing Radial-Circular Road Network for Logistics

Outer Ring Road, Middle Ring Road and Bay Link Road shall be newly developed to connect to Bagamoyo Road, Morogoro Road, Nyerere Road, Kilwa Road, and Kigamboni Road. Those roads shall form a new bypass route complementing the traffic volume of Nelson Mandela Road. It shall improve the traffic flow in the suburbs. In the future, three ring roads connect five radiating trunk roads. Creation of entire road network is crucial to meet the large demand of road traffic, and to ensure the safety.

New development of high standard roads in the suburbs is becoming difficult in DSM, since a number of houses are built every year. However, in Dar es Salaam where the expansion of urban area is proceeding, the proposed ring roads are indispensable to ensure safe, convenient, comfortable circumstances for the quality of life. It also prevents situations such as large cargo trucks overflowing on radial arterial roads, traffic congestion and accidents becoming chronic, cargo vehicles entering quiet environment areas in the suburbs.

Numbers of freight traffic from the industrial areas of DSM Port and the Nyerere Road shall shift to circled-bypassed road network, when proposed M/P project of Nelson Mandela Road (connecting 10 km away from CBD), middle ring road (20 km zone away from CBD) and outer ring road (30km zone away) are developed. In addition to promote modal shift of long-distance freight to railways from trucks, development of road capacity by ring road is crucial for cargo transport in DSM, Tanzania's largest consuming area. This is recommended as the priority action to be undertaken in the short-term period.

5) Early-Engagement for the Prioritized Project: F/S for Tegeta Railway Line

Tegeta railway line is recommended as one of the prioritized projects based on the Pre-F/S result, due to high traffic demand and effect on reducing congestion. Tegeta line connects Aga Khan in CBD and Tegeta town in suburb. This section consists partly of the proposed Bagamoyo railway line. Railway Morogoro line, connecting Ubungo and Movezi, is also a highly prioritized project, due to high traffic demand. Linkage of these two railway lines at an early stage shall significantly enhance the capacity of the entire public transportation network and contribute to improve the public transport service standard.

Tegeta railway line is appropriate for TOD, because of higher potential for urban development, reasonable land prices, and it is less difficult for technical railway construction due to topographical conditions, and low population density. For those reasons, it is recommended to engage F/S for Tegeta railway line early. While the case study is being carried out at Tegeta line, technical cooperation is recommended to support capacity development for TOD implementation, institutional arrangement of PPP, and establishment of investment fund.

- **Attachment : Proposed Projects List**

【Road Plan】

1. Road Development Project											
Components	Project Name	Project No.	Length (km)	Location / Road Name	Term	Short	Medium	Long	after 2040	Construction Cost (Billion TZS)	Executive Agencies
1	Middle Ring Road (incl. Airport Access Road)	1-1-1	13.2	Morogoro Rd - Nyerere Rd	Short	▬				435	TANROADS
		1-1-2	13.6	Bagamoyo Rd - Morogoro Rd	Medium		▬			449	TANROADS
		1-1-3	10.3	Nyerere Rd - Kilwa Rd	Long			▬		340	TANROADS
		1-1-4	9.8	Kilwa Rd – Bay Link Road	Long			▬		323	TANROADS
		1-1-5	1.5	Second Kigamboni Bridge	Long			▬		341	TANROADS
		1-1-6	2.5	Middle Ring Road - JNIA	Short	▬				122	TANROADS
2	Outer Ring Road	1-2-1	22.2	Bunju - Kibamba IC	Long			▬		424	TANROADS
		1-2-2	55.3	Dar Es Salaam - Chalinze Expressway	Medium		▬			1,054	TANROADS
3	Bay Link Road	1-3-1	6.23	New Selander Bridge	Short	▬				234	TANROADS
		1-3-2	1.7	Undersea Tunnel (New Selander Bridge - Kigamboni)	Long			▬		1,064	TANROADS
		1-3-3	6.5	Widening of Old Bagamoyo Road (North)	Short	▬				8	TANROADS
		1-3-4	3.4	Widening of Old Bagamoyo Road (South)	Short	▬				5	TANROADS
		1-3-5	28.9	Kigamboni	Long			▬		263	TANROADS
4	Flyover	1-4-1	-	Ali Hassan Mwinyi / Kinondoni	Long			▬		187	TANROADS
		1-4-2	-	Ali Hassan Mwinyi / United Nations	Medium		▬			187	TANROADS
		1-4-3	-	Chang'ombe Fly over Construction	Short	▬				141	TANROADS
		1-4-4	-	Fire Station	Medium		▬			270	TANROADS
		1-4-5	-	Magomeni	Medium		▬			270	TANROADS
		1-4-6	-	Mandela / Uhuru	Long			▬		109	TANROADS
		1-4-7	-	Morocco	Long			▬		218	TANROADS
		1-4-8	-	Mwenge	Short	▬				218	TANROADS
		1-4-9	-	United Nations	Medium		▬			270	TANROADS
		1-4-10	-	Tabata	Medium		▬			218	TANROADS
		1-4-11	-	Buguruni	Medium		▬			109	TANROADS

1. Road Development Project contd.												
Components	Project Name		Project No.	Length (km)	Location / Road Name	Term	Short	Medium	Long	after 2040	Construction Cost (Billion TZS)	Executive Agencies
5	Widening Trunk/Collector Road	Ilala Municipality Project	1-5-1	-	Ilala MC Area	Short- Medium-Long					1,024	TANROADS
		Temeke Municipality Project	1-5-2	-	Temeke MC Area	Short- Medium-Long						TANROADS
		Kinondoni Municipality Project	1-5-3	-	Kinondoni MC Area	Short- Medium-Long						TANROADS
		Ubungo Municipality Project	1-5-4	-	Ubungo MC Area	Short- Medium-Long						TANROADS
		Kigamboni Municipality Project	1-5-5	-	Kigamboni MC Area	Short- Medium-Long						TANROADS
Total Cost for Road Development (billion TZS)											**8,283**	

【Public Transport Plan—Railway】

2. Public Transport Project (Railway Project)												
Components	Project Name		Project No.	Length (km)	Location / Road Name	Term	Short	Medium	Long	after 2040	Construction Cost (Billion TZS)	Executive Agencies
1	Ubungo Line	Upgrade of Ubungo line Project	2-1-1	11.7 km	Ubungo Line(CBD-Ubungo)	Short					461	TRC
2	Pugu Line	Track doubling of Pugu line Project	2-2-1	20 km	Pugu Line(CBD-Pugu)	Short					514	TRC
3	Bagamoyo Line	Tegeta line Project	2-3-1	21.7 km	Tegeta Line(Aga Khan-Tegeta)	Medium					2,662	TRC
		Extension line between Tegeta and Bunju Project	2-3-2	13 km	Tegeta line(Tegeta-Bunju)	Long					1,151	TRC
4	Loop Line	Extension between Mwenge and Ubungo Project	2-4-1	4.5 km	Loop Line(Mwenge-Ubungo)	Medium					336	TRC
		Extension between Aga Khan and Central Project	2-4-2	4.7 km	Loop Line(Aga Khan-CBD)	Long					2,224	TRC
5	Morogoro Line	Morogoro lineProject	2-5-1	26 km	Morogoro Line(Kibaha-Ubungo)	Medium					2,707	TRC
6	Kilwa Line	Kilwa line Project	2-6-1	15 km	Kilwa Line(CBD-Vikindu)	After 2040					1,685	TRC
Total Cost for Railway Projects (billion TZS)											**11,740**	

【Public Transport Plan—BRT】

3. Public Transport Project (BRT)											
Components	Project Name	Project No.	Length (km)	Location / Road Name	Term	Short	Medium	Long	after 2040	Construction Cost (Billion TZS)	Executive Agencies
1	BRT Phase-1	3-1-1	6.5km	Morogoro Road	Short	■				53	DART
2	BRT Phase-2	3-2-1	20.1km	Kilwa Road	Short	■				158	DART
3	BRT Phase-3	3-3-1	22.6 km	Nyerere Road	Short	■				174	DART
4	BRT Phase-4	3-4-1	20.8km	Bagamoyo Road, Sam Nujoma Road	Short	■				171	DART
5	BRT Phase-5	3-5-1	24.3km	Nelson Mandela Road etc.	Medium		■			178	DART
6	BRT Phase-6	3-6-1	30.2km	Old Bagamoyo Road	Mesium		■			223	DART
7	BRT Phase-7	3-7-1	17.7km	Kigamboni Area	Long			■		154	DART
Total Cost for BRT Projects (billion TZS)										**1,111**	

【Public Transport Plan—Transport Terminal】

4. Public Transport Project (Transport Terminal)											
Components	Project Name		Project No.	Length (km)	Location / Road Name	Term	Short	Medium	Long	after 2040	Construction Cost (Billion TZS)	Executive Agencies
1	Terminal (Primary)	T-1(CBD), T-3(Ubungo)	4-1-1	10,000m2	CDB	Short	■				5.0	TBD
		T-2(Tazara), T4(Mwenge)	4-1-2	10,000m2	Tazara	Medium		■			5.0	TBD
		T-5(Morocco)	4-1-3	10,000m2	Morocco	Long			■		2.5	TBD
2	Terminal (Seondary)	T-1(tegeta), T-3(Ukonga), T-4(Temeke), T-6(Mbagla)	4-2-1	80,000m2	Tegeta	Medium		■			20.0	TBD
		T-2(Mbezi)	4-2-2	20,000m2	Mbezi	Short	■				5.0	TBD
		T-5(Kigamboni1), T-7(Kigamboni2)	4-2-3	40,000m2	Kigambonil	Long			■		10.0	TBD
3	Terminal (Tertiary)	T-1(Bunju), T2(Luguruni), T3(Pugu), T4(Kigamboni), T-5(Mazinga)	4-3-1	100,000m2	Bunju	Long			■		25.5	TBD
Total Cost for Transport Terminal Projects (billion TZS)											**73**	

【Public Transport Plan—Feeder Bus】

5. Public Transport Project (Feeder Bus)											
Components	Project Name	Project No.	Length (km)	Location / Road Name	Term	Short	Medium	Long	after 2040	Construction Cost (Billion TZS)	Executive Agencies
1	Bagamoyo Line	5-1-1	-	Bagamoyo Road's Suburb Area	Short- Long	▬	▬	▬		-	Private Bus Operator
2	Morogoro Line	5-2-1	-	Morogoro Road Road's Suburb Area							
3	Nyerere Line	5-3-1	-	Nyerere Road's Suburb Area							
4	Kilwa Line	5-4-1	-	Kilwa Road's Suburb Area							
5	Kigamboni Line	5-5-1	-	Kigamboni Road's Suburb Area							
Total Cost for Feeder Bus Routes Projects (billion TZS)										-	

【Public Transport Plan—Waterway】

6. Public Transport Project (Waterway)											
Components	Project Name	Project No.	Length (km)	Location / Road Name	Term	Short	Medium	Long	after 2040	Construction Cost (Billion TZS)	Executive Agencies
1	Piers Construction	6-1-1	1 Pier Construction	CBD-Bahari	Short	▬				51	TBD
			2 Boats Purchase								
Total Cost for Waterway Projects (billion TZS)										**51**	

【Traffic Control Plan】

7. Traffic Management Project												
Components	Project Name		Project No.	Length (km)	Location / Road Name	Term	Short	Medium	Long	after 2040	Construction Cost (Billion TZS)	Executive Agencies
1	Mobility Management	Promoting Modal Shift	7-1-1	-	Whole City	Short- Long (Perioadically)					6.5	DCC, MCs
		Parking Management: Study for parking management	7-1-2	-	CBD, Sub Center, District Center, Satellite City	Short					1	DCC, MCs
		Parking Management: Implementation				Medium					2.5	DCC, MCs
		Event for promoting NMT	7-1-3	-	Whole City	Short-Long (Periodically)					0.4	DCC, MCs
2	Improvement of Traffic Circulation	Traffic Signal Optimization: Construction and Instillation	7-2-1	-	Strategic Traffic Management Area	Short					28	PO-RALG, MOWTC, DCC, MCs
				-	Traffic Management Area (Inside Middle Ring Road)	Medium					20	PO-RALG, MOWTC, DCC, MCs
				-	Traffic Management Area (Outside Middle Ring Road)	Long					18	PO-RALG, MOWTC, DCC, MCs
		Intersection Improvement	1-5	-	Mentioned in the Road Development Plan (Flyover Project)	-					-	-
		Area Restriction for Truck and Car	7-2-2	-	Whole City	Short					1	MOWTC, DCC, MCs
		Real-time Traffic Information Provision: ITS Study, Installation	7-2-3	-	Strategic Traffic Management Area	Short					48	PO-RALG, MOWTC, DCC, MCs
				-	Traffic Management Area	Medium-Long					32	PO-RALG, MOWTC, DCC, MCs
3	Traffic Safety Program: Action Plan, Construction, Installation, Publication		7-3-1	-	Morogoro, Bagamoyo, Nyerere road.	Short					8.13	MOWTC, DCC, MCs, TANROADS
						Medium-Long					8.1	DCC, MCs, TANROADS
Total Cost for Traffic Management Projects (billion TZS)											**174**	

【Urban Structure Plan】

8. Urban Management Projects												
Components	Project Name		Project No.	Length (km)	Location / Road Name	Term	Short	Medium	Long	after 2040	Project Cost (Billion TZS)	Executive Agencies
1	Palm and Finger Plan (Urban Corridor)	Dar es Salaam Master Plan	8-1-1	1,393 km^2	Whole Area of DSM	Short	■				-	DCC
2	Sub-Centers	Ubungo Sub-center Development Project	8-2-1	75ha	Ubungo,	Short	■				-	Ubungo MC
		Mwenge, Tazara, Morocco Sub-center Development Project	8-2-2	225 ha	Mwenge, Tazara, Morocco	Medium		■			-	Kinondoni MC, Ilala MC
3	Satellite Cities	Mbezi Satellite City Development Project	8-3-1	500 ha	Mbezi	Short	■				-	Ubungo MC
		Kawe Satellite City Development Project	8-3-2	75 ha	Kawe	Short-Medium	■	■			-	NHC
		Tegeta, Ukonga, Mgbagala Satellite City Development Project	8-3-3	2,500 ha	Tegeta, Ukonga, Mbagala	Medium		■			-	Kinondoni MC, Temeke MC, Ilala MC
		Bunju, Luguruni, Pugu, Mzinga, Kisarawe2 Satellite City Development Project	8-3-4	4,000 ha	Bunju, Luguruni, Pugu, Mzinga, Kisarawe2	Long			■		-	Kinondoni MC, Ubungo MC, Ilala MC, Temeke MC, Kigambini MC
		Somangila, Pemba Mnazi Satellite City Development Project	8-3-5	2,000 ha	Somangila, Pemba Mnazi	After 2040				■	-	Kigamboni MC

【Capacity Development Plan】

9. Capacity Development Projects												
Components	Project Name		Project No.	Length (km)	Location / Road Name	Term	Short	Medium	Long	after 2040	Project Cost (Billion TZS)	Executive Agencies
1	Management Mechanism Project		9-1-1			Short					-	DCC,MCs, DSM-RS, PO-RALG
2	DSM Information Centre Project		9-2-1			Short -Medium					-	DCC,MCs, DSM-RS, PO-RALG
3	Promote TOD Approach Project		9-3-1	21.7	Case study at Kinondoni MC. Projects includes the establishment of supportive regulation or legal framework.	Short -Medium					-	DCC, MCs, TRC, PO-RALG, MOWTC
4	Technical Development	Monitoring System Development Project	9-4-1			Short-Medium-Long					-	DCC, MCs, DSM-RS, PO-RALG
		MRT Operation and Maintenance Project	9-4-2			Medium-Long					-	TRC, MOWTC (T)
		Road Management and Maintenance Project	9-4-3			Short-Medium-Long					-	TANROADS, MOWTC (W), TARURA
		Traffic Management Project	9-4-4			Short-Medium-Long					-	TANROADS, DCC, MOWTC (W), TARURA, Police