No.

Dar es Salaam City Council

The United Republic of Tanzania

Dar es Salaam

Transport Policy and System Development

Master Plan

Technical Report 9

Pre-Feasibility Studies

June 2008

JAPAN INTERNATIONAL COOPERATION AGENCY

PACIFIC CONSULTANTS INTERNATIONAL

CONSTRUCTION PROJECT CONSULTANTS

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Chapter 1 Natural Condition

1.1 Climate and Weather Condition

This region is close to the equator (7 degrees South in latitude) with the climate of tropical forest zone.

Since the region faces the sea (Indian Ocean), it has the characteristics of marine climate in which relatively comfortable wind (not extremely hot) blows from the sea.

1.1.1 Temperature

It is almost stable through the year. Averages of the maximum and minimum temperature are 31°C and 19°C respectively. Rainy season (March, April and May) becomes hot; the maximum temperature is over 32°C. On the other hand, dry season becomes relatively cool; the maximum one is lower than 30°C.

1.1.2 Rainfall

Annual rainfall is 1,124 mm in total. The season divided into two, namely, the rainy and dry season. March, April and May are the rainy season, 2/3 of the month is rainy days and the rainfall in this season occupies approximately 55% of the annual rainfall.

On the other hand, the season from June to February belongs to the dry season. Rainy days in a month during the dry season are 5 days in average. Especially from June to September it becomes very dry, during which period the rainfall is less than 30 mm per month.

Table 1.1.1 Climate and Weather Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°C)												
Max	31.5	32.2	32.2	30.7	29.8	29.2	28.8	29.3	30.1	30.9	31.3	31.6
Min	23.2	23.1	22.6	22.4	21.1	19	18.2	18.1	18.4	19.7	21.3	22.8
Humidity (%)												
9:00 a.m.	79	78	82	87	86	84	85	84	78	74	75	78
3:00 p.m.	64	62	67	73	66	58	56	54	53	76	62	65
Rain-day (No. of Days)												
	7	5	12	19	13	5	5	4	5	6	8	7
Rainfall (mm)												
	81.8	57.4	130.4	263.3	178.9	37.3	28.8	26.5	26.1	60	120.8	112.6
											Total	1124

Source: Statistical Abstract 2002, National Bureau of Statistics (2003)

1.2 Topographical Condition

1.2.1 Regional Topography

The topographic morphologies of the region including Dar es Salaam are classified into 5 types as follows.

(1) Lowland (elevation of lower than 5 m above sea level)

Lowlands distribute at the bay area, river mouth and the hinterland along the coast. In these lowlands, marsh areas (so called back marsh) and swampy areas are widely spread where soft soil is thick and drainage condition is rather bad.

(2) Plain / Terrace (5 ~ 20 m above sea level)

Flat plain and terrace areas are observed in the area of above seal level between 5 to 20 m. These areas with some minor local hollows extend along the coast with some kilometers wide. Geologically, its origin was a coastal plain associated with the local terrace (Msasani Peninsula for example) which was formed due to past time marine backward.

(3) Terrace / Hill (20 to 60 m above sea level)

Gentle hilly areas are observed in the area of seal level between 20 to 60 m, which is dominant part of the residential area of Dar es Salaam. Ground surface consists of residual weathered limestone (local name: Murram- earth material).

Many terrace areas of 500 to 1,000 m width observe around banks of the rivers in Dar es Salaam. These are tracks of the flood storage in the past.

(4) Hill (60 to 150 m above sea level)

The hilly zone extends in the Southwest of the study area. The origin of these hills is raised coral reefs.

Undulation in these areas changes from gentle to steep in accordance with the weathering degree.

(5) Mountain (150 m or more above sea level)

Mountainous areas can be observed in the western area of Dar es Salaam at around approximately 30 km inland area from the coast. It is rather undulated mountainous area being composed of limestone associated with sandstone of the older geological era. Steep and rigid slope and some peaks are formed in these areas.

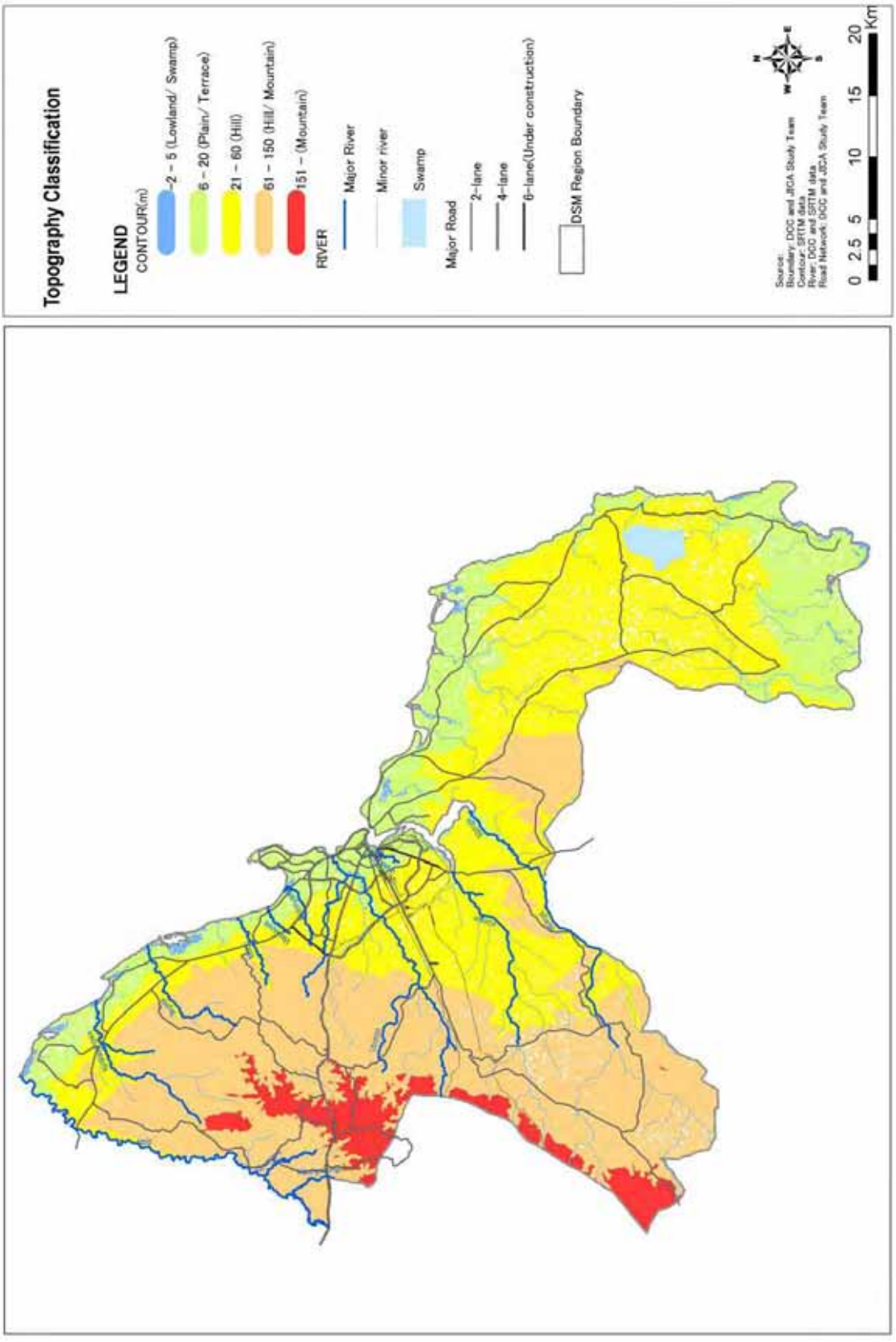


Figure 1.2.1 Topography Classification

1.2.2 Topographical Condition of Arterial Road

The table below shows topographical condition of arterial road.

Table 1.2.1 Topographic Condition of Arterial Road

Road	Topographic Classification	Characteristics
Bandari	Coastal Terrace	Flat and wide terrace, gentle undulation
Kilwa	Coastal Terrace Lowland	Flat and wide, gentle slope partly Gerezani Creek area, swampy lowland elevation 0 to 4 mi influenced by high tide
Kawawa	Coastal Plain And/or Terrace	Flat and wide, gentle slope near River Msimbazi
Nyerere	Coastal Terrace	Flat land extends widely, gentle slope in some plases
Mandera	Coastal Terrace	Flat and gentle slope extensively spreads Slightly undulated near River Msimbazi and Ubongo
Morogoro	Coastal Terrace River Plain	Flat and wide land extends toward inland River Msimbajzi area, flat plain (flood storage) 1 km wide is distributed
Old Bagamoyo	Coastal Plain Lowland	Flat and wide plain connected from beach Msasani area, swampy lowland elevation 4m below
New Bagamoyo	Coastal Terrace	Flat and wide terrace relatively high in elevation
Ocean Road	Coastal Plain and Beach	Flat ground close to beach, elevation 2 to 5 m
Kenyatta Drive South	Coastal Plain and Beach	Located in mouth of River Msimbazi. Flat and relatively low ground elevation 3 to 5 m extended from coral reef and lagoon

Source: JICA Study Team

1.3 Geological Condition

1.3.1 Regional Geology

The geological basement of Tanzania consists of igneous, sedimentary and volcanic complex of the old geological era. It makes a backbone mountain range of inland Tanzania which connects to the tectonic line extending from Lake Victoria. Mt. Kilimanjaro is one of the representative's locality.

On the other hand, the study area is located close to the coastal line. The sandstone layer of Tertiary in the Geological era is the base in this region, which occurs around the western mountain zone. A limestone layer (Old Quaternary in the Geological era) is widely distributed around the hinterland of the city from the coast to its back, forming terrace and hills. Msasani peninsula located in the west side of Oyster Bay is a typical terrace. Ground surface of the limestone hill decomposed into soil due to weathering, but deeper layer is still fresh. Weathered surface soil is used for earth material, called

murram, and deeper fresh rock is used for cement material (for example, at Wazo Hill cement factory, 25 km Northwest from the city center).

Another limestone of coral reef and lagoon (Late Quaternary in geological era) is scattering along the coast beach and the islands in offshore, which represents a typical tropical marine view.

In addition to the limestone layer, alluvial layer is widely distributed in or around coastal line and river basin. Beach-sand, back marsh deposit and flood plain sediment belong to this alluvial layer. White sand beach composed of fine sand mixed with coral fragment exists in some places, especially in the South West region, much broader beaches are scattering. Marsh deposit and plain sediment are composed of fine soil. Major marsh deposits are found in the southwest region as well as broad sand beach, and plain sediment is found out around the large rivers like Msimbaji, Kizinga and Mzinga.

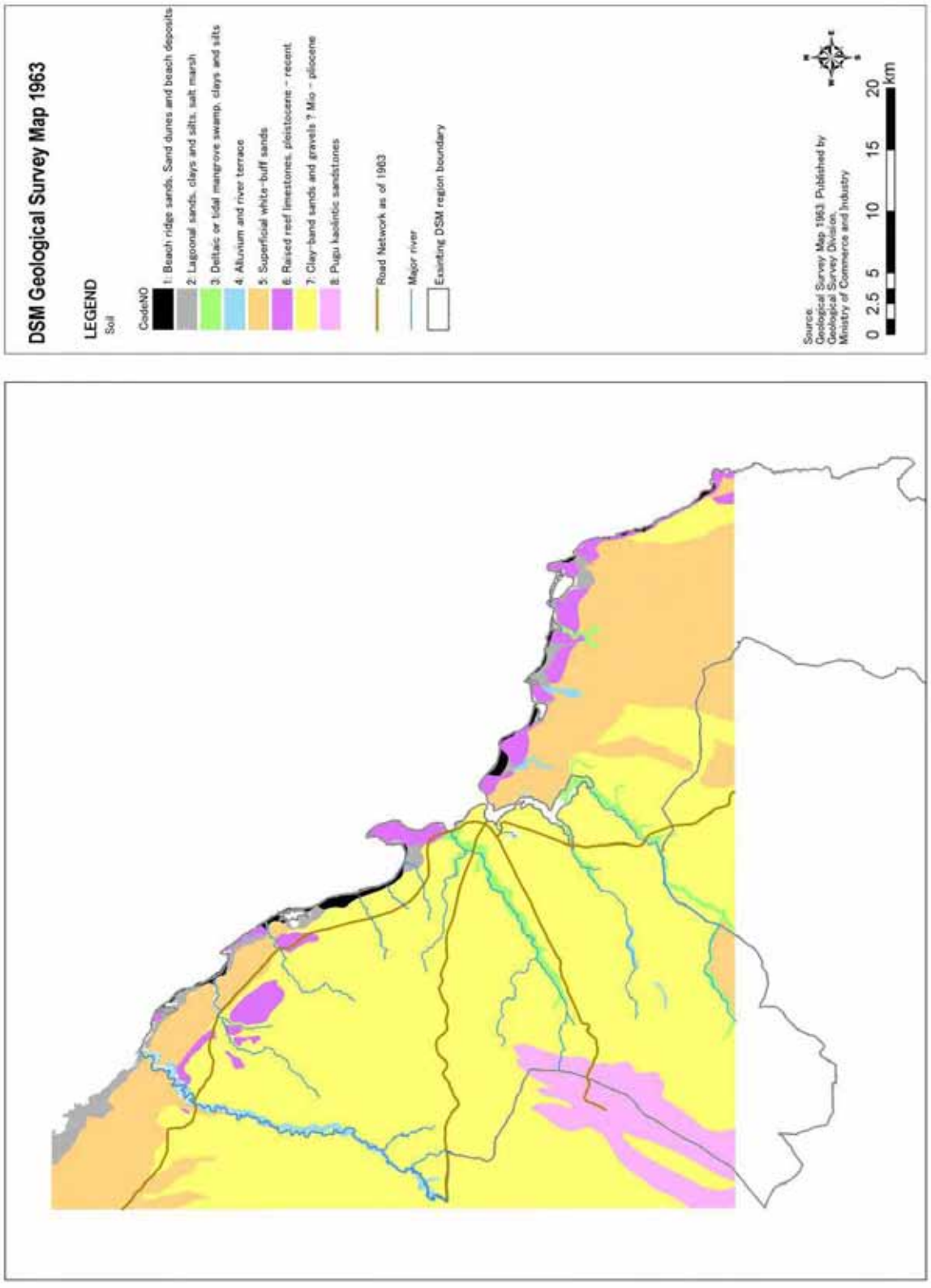


Figure 1.3.1 DSM Geological Survey Map

1.3.2 Geological Condition of Arterial Road

In the previous study (Dar es Salaam Road Development Plan, JICA.1995) boring investigations (20 m depth drill in each) were carried out at seven locations (Shown in the Figure 3.2.1). These boring locations are (1) Kivukoni Sea Front, (2) Gerezani Creek (Bandari Road) (3) Bandari Bridge (Bandari Road) (4) First Msimbazi C-box (Kawawa Road) (5) Second Ubungo C-Box (Kawawa Road and relates to Morogoro Road)) (6) Sinza C-Box (Kawawa Road and relates to Bagamoyo Road) (7) Nierere Road near Illala, relates to Nelson Mandera Road.

Current field survey and these boring data present the summary of geological condition of the major road in the following table.

Table 1.3.1 Summary of Geological Condition of Arterial and Major Road (1/2)

Road	Composition of Layer	Characteristics	Depth of baring layer for foundation
Bandari	Sand Gravel	Fine grain and medium stiff	
Bandari Bridge	Sand and Limestone	0 to 14 m sand with boulders and Below 14 m Coral limestone	14 m Limestone
Kilwa	Sand	Gravel mix, medium stiff	
Kilwa/Bandari Gerezani Creek	Clay/Sand	0 to 5 m Soft clay 5 to 20 m Sand loose in stiffness 20 to 30 m Sand gravel medium stiff	30 m assumed Sand gravel or Limestone
Kawawa	Sand	Gravel mix sand, loose to medium stiff	
Kawawa River Msimbazi	Clay Sand gravel	Soft clay covers the ground surface 3m 3 to 16 m sand medium stiffness 16 m below stiff sand gravel	16 m Sand gravel
Mandera	Sand gravel or limestone	Medium stiff sand overlies ground Limestone is interlaid below 14m deep	14m Sand gravel or Limestone
Morogoro	Sand/Gravel	Medium stiff sand	

Table 1.3.1 Summary of Geological Condition of Arterial and Major Road (2/2)

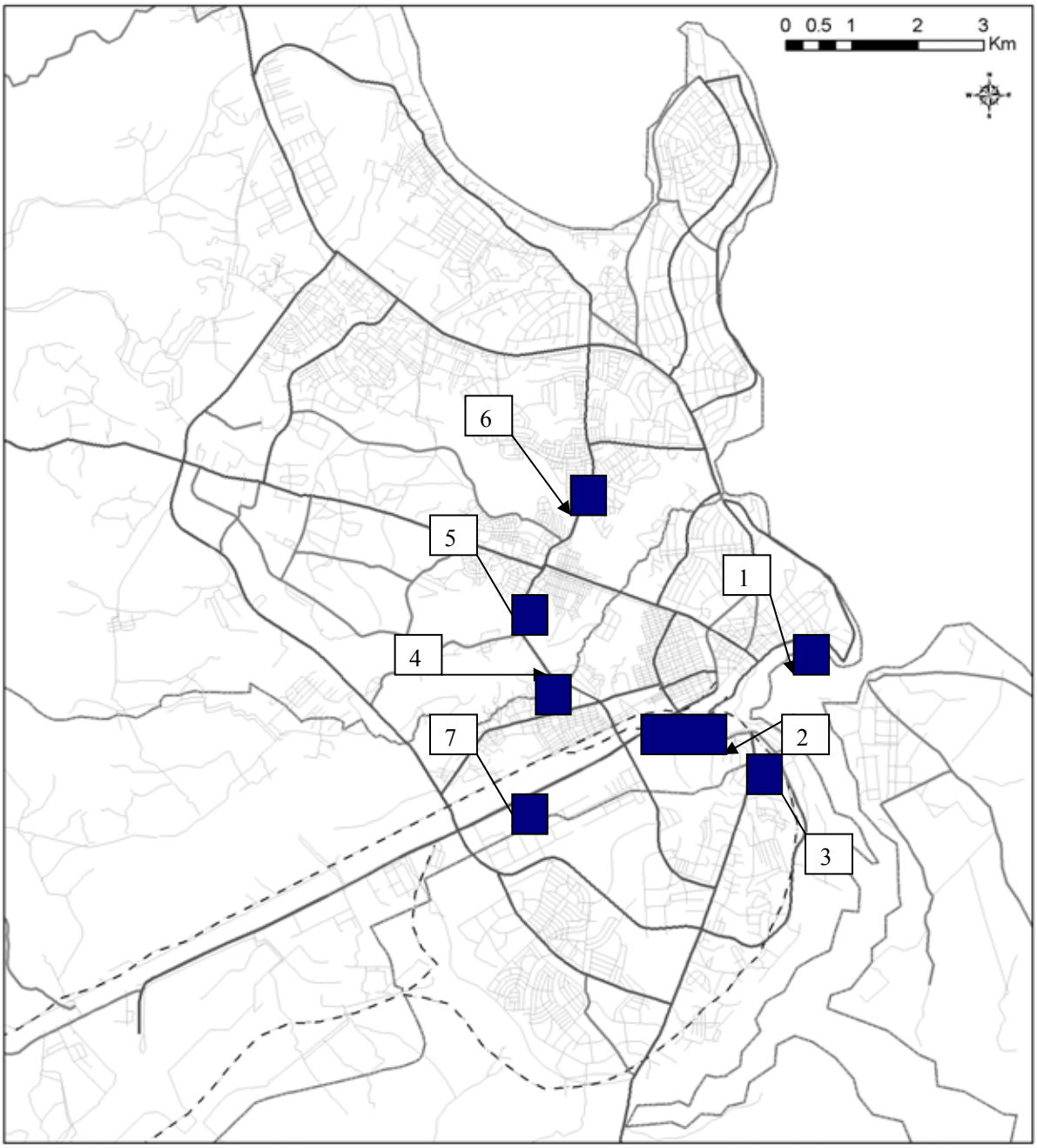
Road	Composition of Layer	Characteristics	Depth of baring layer for foundation
Morogoro River Msimbazi	Clay/Sand	River deposit (loose sand) is thick and transferred to medium stiff sand	25m Assumed Sand gravel
Old Bagamoyo	Sand	Clay mix fine grain sand. Loose to medium stiffness	
Old Bagsamoyo Msasani area	Clay/Sand	0 to 5m deep soft clay 5 to 25m fine sand loose to medium in stiffness	25m Assumed Sand gravel
New Bagamoyo	Sand/Gravel	Fine grain sand in majority, Medium stiffness	
New Bagamoyo River Kijitonyama	Sand/gravel	0 to 20 m deep loose sand clay mix 15m below transferred to stiff sand gravel layer	20 m Sand gravel
Ocean	Sand	Fine grain sand medium stiffness	
Kenyatta Drive South	Sand and Limestone	Gravel mix medium stiffness Coral limestone spreads around the area for reclamation candidate	

Note: 1. Composition of layer shows geological type respectively in river area and except river area.
2. Regarding geological type in the river area, especially describes deeper and bearing layer in relation to the drainage structure.

Source: JICA Study Team

Geological implications for road planning are itemized as follows.

- Sand gravel layer (good for road construction) distributes in major part of the road except river area.
- Soft clay overlies surface in the river area. Those locations are (1) Bandari road – Gerezani creek (2) Kawawa and Morogoro road – River Msimbazi. (3) Old Bagamoyo road Msasani area – River kijitonyama.
- One of the key facter is depth of bearing layer in relation to the drainage structure.
- Bearing layer underlies deep level at two locations. Location and bearing layer depth are respectively, (1) Bandari road – Gerezani creek 30 m deep and Morogoro road – River msimbazi 25 m deep.



Note: Location 1 Kivukoni Sea Front. 2 Gerezani Creek. 3 Bandari Bridge 4 First Msimbazi C-box 5 Second Ubungo C-box 6 Sinza C-box 7 Nyerere Road (Near Ilala)

Source: Dar es Salaam Road Development Plan, JICA ,1995

Figure 1.3.2 Location of Boring Investigation

1.4 River and Drainage Condition

There are 50 or more rivers and streams in the study area. A total of 7 major rivers was investigated to identify major flood and drainage problems in this study. River location is shown in the Figure 1.4.1.

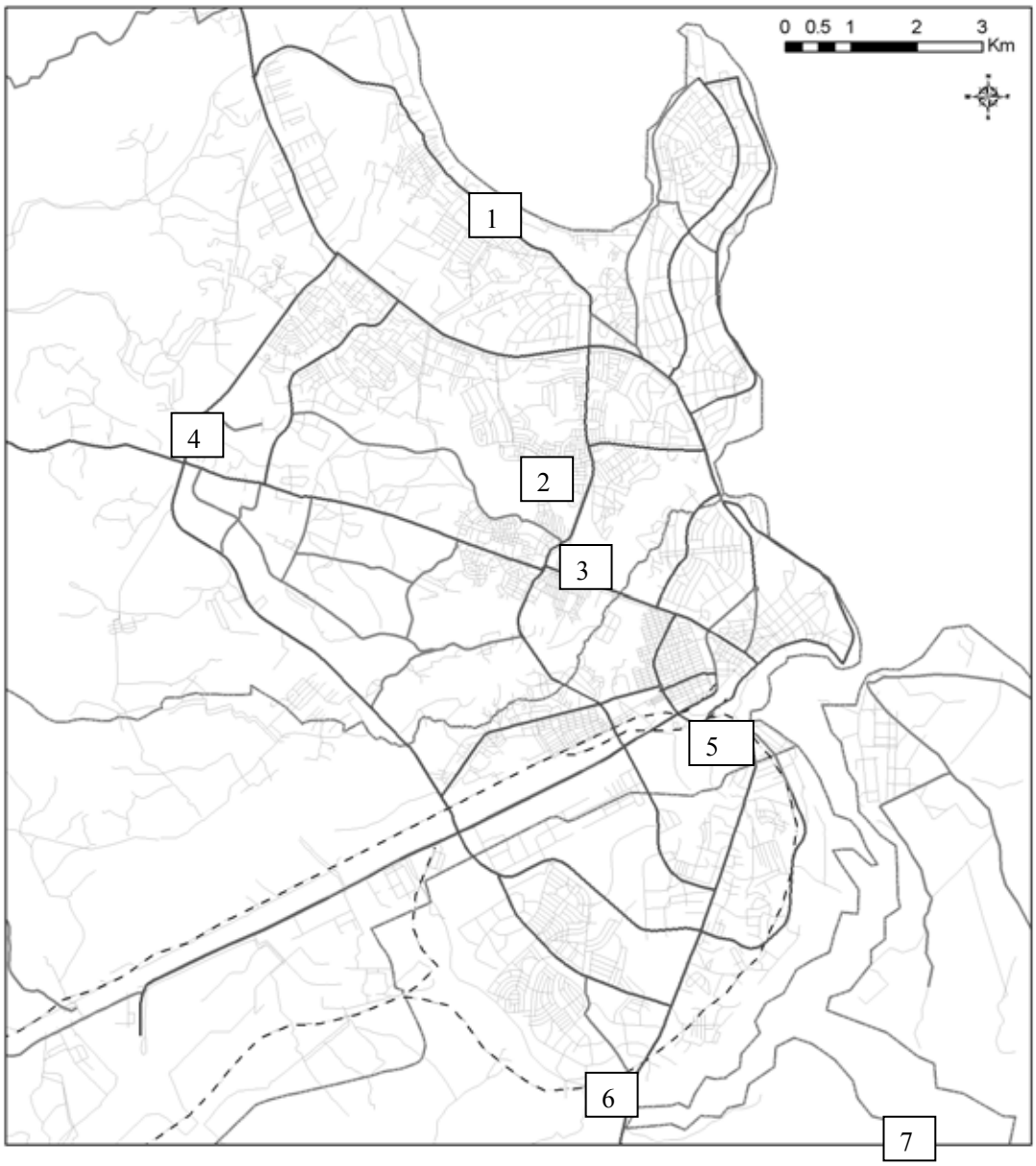
Table 1.4 summarizes main features of the seven rivers. River Msimbaji, Kizinga and Mzinga have much broader basin and wider flood storage plains and it is observed that sediment has been increasing, which will lead to poor drainage condition in the area.

Table 1.4.1 River and Drainage Condition

River	Basin Area (km^2)	Length (km)	Discharge Dry Season (m^3/sec)	Discharge Flood (m^3/sec)	Features	Drain Condition
Kijitoyama	4	6	0.1	37	Flat Grade	Bad
Sinza	25	8	0.2	69	Flat Grade	Bad
Msimbaji	240	60	0.5	387	Flat Grade Meandering Big Storage	Bad
Ubongo	35	6	0.2	75	Flat Grade	Bad
Gerezani Creek (River Name Unknown)	3	2	0.5	20	Origin Small Stream	Bad
Kijinga	370	80 +	0.5	596	Flat Grade Meandering Big Storage	Bad
Mzinga	670	100 +	0.5	1080	Flat grade Meandering Big Storage	Bad

Note: 1. Sinza and Ubongo are tributary of River msimbazi
2. Drain condition
Bad : Sediment ratio to Drain space more than 50 %
In case of no sediment Drain space is 100 %.

Source: Dar es Salam Road Development Plan JICA.1995



1 Kijitonyama 2 Sinza (Tributary of Msimbazi) 3 Msimbazi 4 Ubongo (Tributary of Msimbazi)
5 Gerezani Creek 6 Kizinga 7 Mzinga

Source: JICA Study Team

Figure 1.4.1 Location of main river in the study area

Figure 1.4.2 Photograph Kijitonyama River

Figure 1.4.3 Photograph Sinza River

Figure 1.4.4 Photograph Msimbazi River from Morogoro Road

Figure 1.4.5 Photograph Msimbazi River from Selander Bridge

Figure 1.4.6 Photograph Ubungo River

Figure 1.4.7 Photograph Gerezani Creek

Figure 1.4.8 Photograph Kizinga River

Figure 1.4.9 Photograph Mzinga River

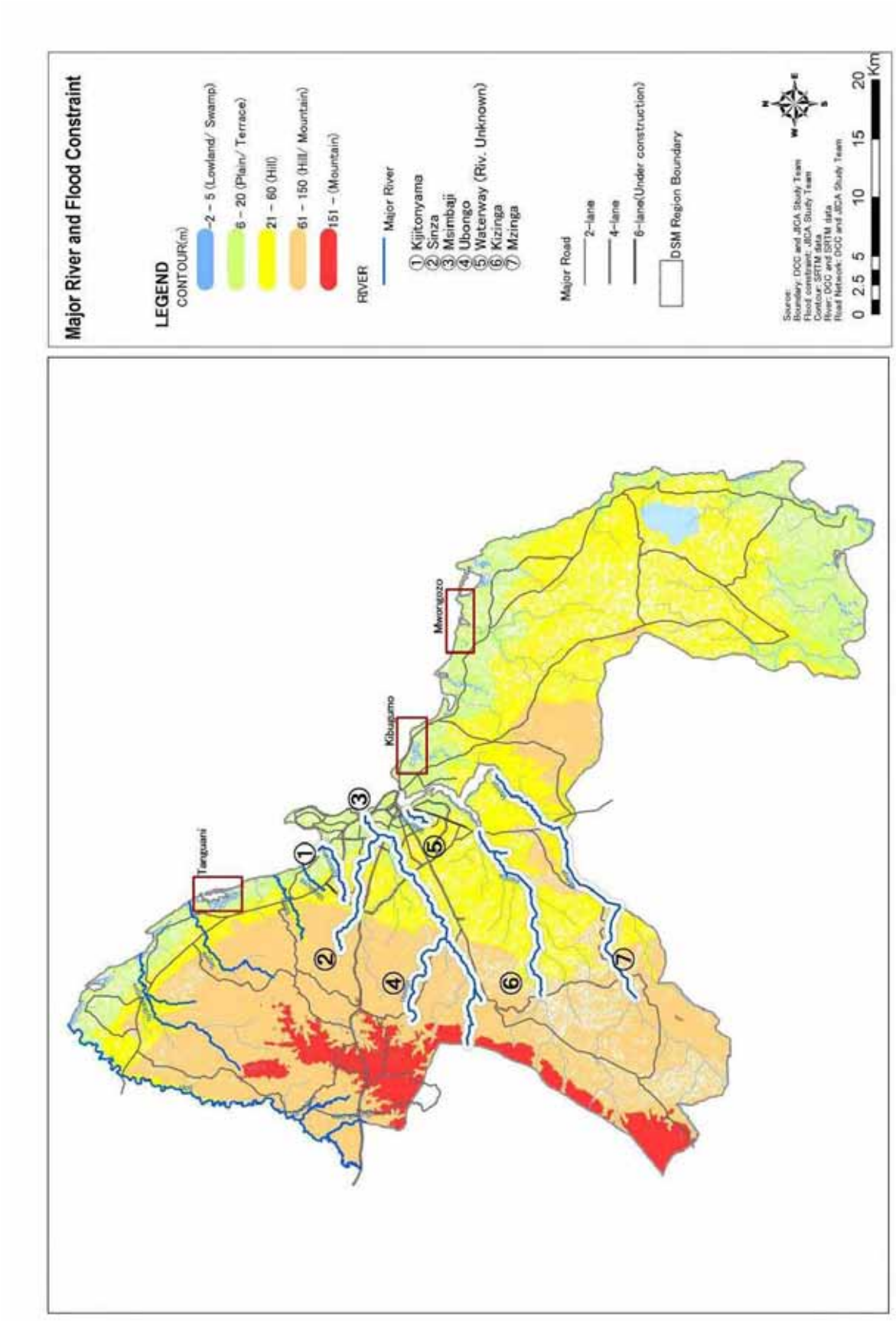


Figure 1.4.10 Major River and Flood Constraint

1.5 Coast Condition

Coast condition is investigated in the site and marine data is collected by hearing from the port authority of Dar es Salaam (Engineering Division). The table below shows actual condition

Table 1.5.1 Coast Condition

Item	Condition and Characteristics
1. Water Depth	Navigation Route: 10 to 12 m Transfer Zone to Tidal Range: 5 to 10 m Tidal Range toward the shoreline: 0 to 5 m Width of Tidal Range: 100 m
2. Geological Type in sea bottom	Navigation Route: Sand Transfer Zone to Tidal Range: Sand Tidal Range: Coral Reef and Lagoon
3. Tide Level	High Tide 3.6 m Clearance Height to the Land 1.0 m Low Tide 0.4 m
4. Wave Height	Usual Time: Lower than 1 m (Calm condition) Irregular Time: 2.5 m Extraordinary TSUNAMI 1 m (Dec 2004)
5. Sedimentation	Up-to-date Dredging Year 1998 Current condition: Navigation Route: Slightly increase Fish Market Front: Much increase Rear Quay Position: Much increase
6. Scouring and Erosion	West side of the Port Inlet: Slightly scouring (Small influence) Ocean road front: Scarcely (Natural barrier of coral reef) Outlet of Msimbazi River: Scarcely scouring (Coral reef) Westside of Msasani Peninsula: Slightly big scouring (small influence).Cliff-like coast

Source: JICA Study team (Hearing Data from Port Authority of Dar es Salaam Engineering Division)

1.6 Development Constraints

1.6.1 Flood

The detailed field survey identified that the tipical flood condition at the main river of the arterial roads. They are summarized as follows;

- River Msimbaji and its tributary Sinza usually overflow at Rashidi Kawawa Road.
- River Kizinga is also flood occurring river and it overflows at Kilwa Road.
- Gerezani creek overflows often in the lowland area of Bandari Road.
- River KIjitonyama causes chronically overflow at old and new Bagamoyo road in Msasani ward.

Major flood problems will be anticipated, around large rivers including River Msimbaji, Kijinga and Mzinga along which wider flood storages (track of large flood) are found by the field survey. Table 1.6.1 summarizes the field observation result in relation to arterial road by the JICA study team.

Table 1.6.1 Actual Flood Condition of Arterial Road

Road	River (Location)	Flood Level from Riverbed	Clearance to Road	Overflow Frequency
Kilwa Bandari	Gerezani Creek	1.5 m	None	Often
Kawawa	Sinza	2.0 m	0.2 m	Often
	Msimbazi	2.0 m	0.3 m	Often
Mandera	Ubongo	2.5 m	1.0 m	Rarely
	Msimbazi	2.0 m	1.0 m	Rarely
Morogoro	Msimbazi	2.0 m	0.3 m	Sometime
Old Bagamoyo	Kijitonyama (Msasani)	2.0 m	None	Often
New Bagamoyo	Msimbazi (Selender Brdg)	3.0 m	0.5 m	Rarely
	Kijitonyama	1,5 m	None	Often
Kilwa	Kizinga	2.0 m	0.2 m	Sometime
	Mzinga	1.5 m	2.0 m	Rarely

Note: Overflow Probability:
Often: return period of 3 years, Sometime: return period of 10 years, Rarely: return period of 50 years

Source: JICA Study Team

1.6.2 Sedimentation and Drainage Condition

River sedimentation continues to increase and it influences the drainage facilities. Therefore scrutinizes actual situation in situ. The following table shows survey result of river drainage in the arterial roads.

Table 1.6.2 Actual River Sedimentation and Drainage Situation in Arterial Road

Road	Name	Sediment Ratio (%)	Influence to Drainage	Overflow Frequency
Bandari	Gerezani Creek	70	Big	Often
Kawawa	Sinza Msimbazi	70 30	Big Ordinal	Often Sometime
Nelson Mandera	Ubongo Msimbazi	20 30	Small Ordinal	Rarely Rarely
Morogoro	Msimbazi East C box Msimbazi West C box	10 70	Small Big	Rarely Often
Old Bagamoyo	Kijitonyama Msasani	70	Big	Often
New Bagamoyo	Msimbazi (Selender Bridge) Kijitonyama	20 50	Small Big	Rarely Often
Kilwa	Kizinga Mzinga	50 20	Big Small	Sometime Rarely

Note: Overflow Probability:
Often: return period of 3 years, Sometime: return period of 10 years, Rarely: return period of 50 years

Source: JICA Study Team

1.6.3 Erosion

The land use map prepared by SUDP suggests that the some wide areas of erosion prone in Dar es Salaam. To confirm the SUDP information, an intensive field investigation was made by the JICA study team. The field investigation suggests that the erosion condition of the designated areas by SUDP may not be serious (Refer to table below).

Table 1.6.3 Condition of Erosion

Location	Area, Range	Characteristic, Cause of Erosion	Impact Degree
Wazo Hill 25 km NW of DSM	10 km, Sporadic	Track of Quarry and Borrow Pit Wave Erosion	Very low
Msasani Peninsula 2 km N of DSM	3 km, Coast Line	To Limestone Terrace Beach Scouring	Low
Kibungo 3 0km SE of DSM	15 km, Coast line	Due to ebb tide	Low

Note: Impact Degree
Low: Erosion width less than 5 m and height less than 3 m. Very low: Erosion Width less than 2 m and height less than 1 m

Source: JICA Study Team

Detailed field survey clarified the followings:

- Wazo Hill is dotted with track of rock quarry and borrow pit of earth material. It forms bare ground and appears to be eroded, but erosion is not caused actually.
- Msasani peninsula is a terrace of limestone. The east coast of the peninsula (Oyster Bay side) is slightly eroded due to waving, but the degree of impact is low.
- Erosion in Kibungo district is due to scouring by ebb tide. Erosion height is at most 50 cm and its impact is small.

In conclusion, no serious erosion occurs in the study area.

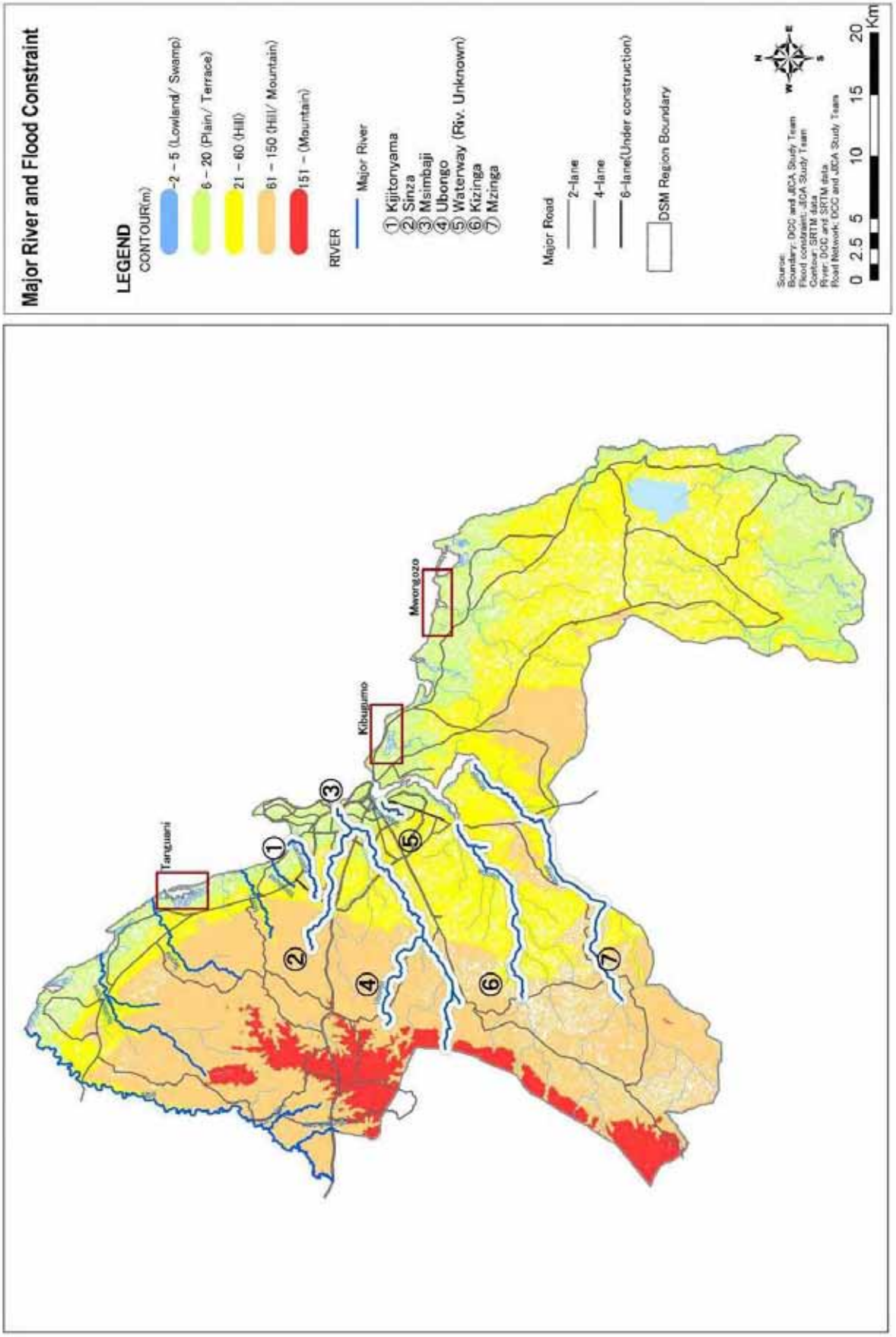


Figure 1.6.1 Land Use and Erosion

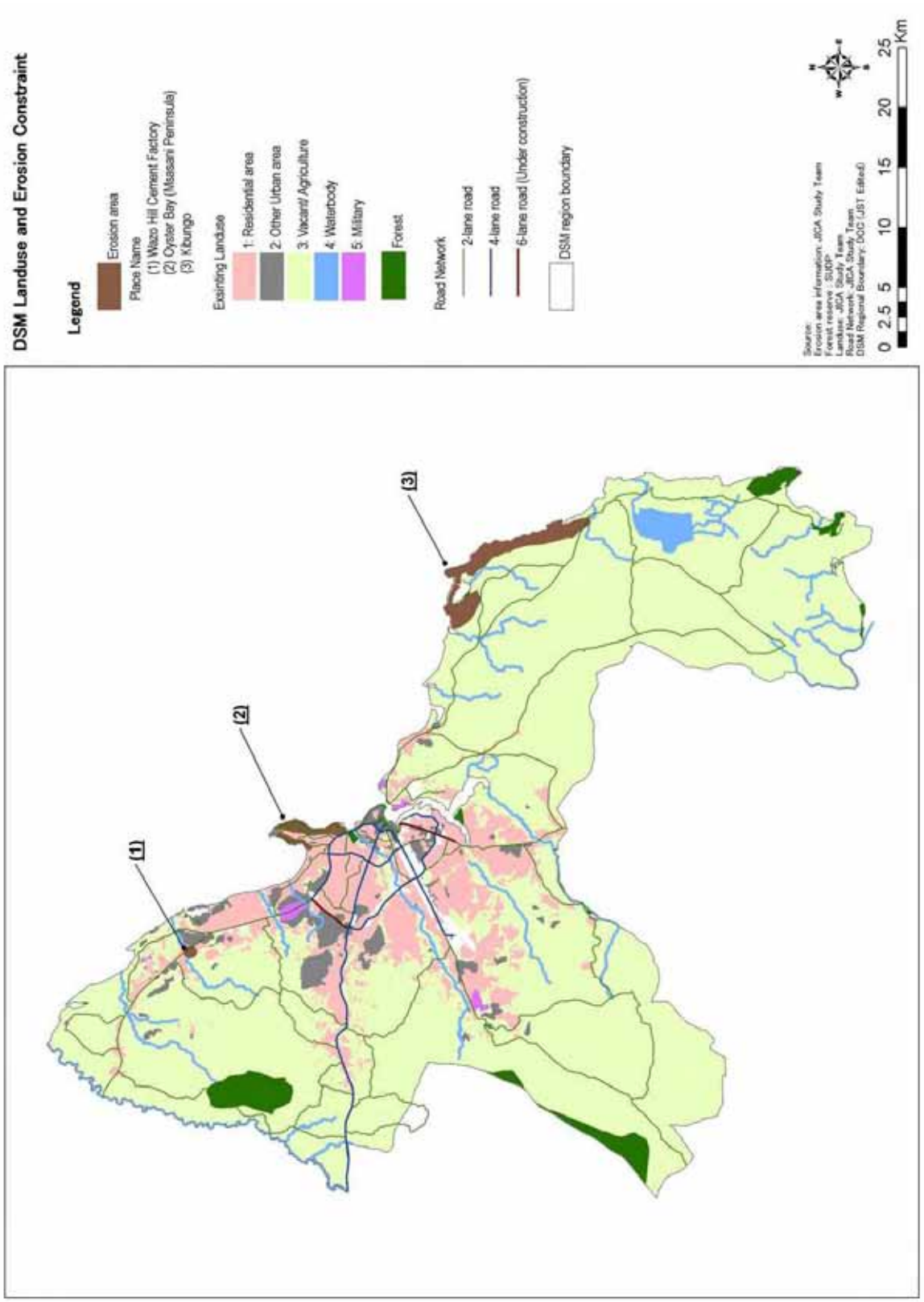


Figure 1.6.2 DSM Landuse and Erosion Constraint

1.7 Major Findings and Considerations

1.7.1 Natural Constraint for Urban Development

Current study clarified natural constraint items for urban development described as follows.

- Serious constraint is flood including river sediment and it causes drainage problems.
- Soft soil is another constraint in terms of construction works.
- The lowland areas along the major rivers (Msimbaji, KIzinga and Mzinga) are not suitable for urban development due to the frequent floods.
- Lowland marsh/swamp is also unsuitable area for urban development due to its nature, that is, soft soil and drainage problem. Locations of these low land marsh / swamp are:
  - Tanguani Beach 20 km Northwest from the city center.
  - Kibugumo Marsh 10 km Southeast from the city center, and
  - Mwongozo Marsh 20 km Southeast from the city center.

1.7.2 Natural Constraint in arterial road

Field investigation clarifies natural constrains of arterial road in relation to road net work plan.

Drainage in the river cross is major element and will require sufficient drainage capacity in four roads, Bandari,.Kawawa, Old Bagamoyo and New Bagamoyo Roads.

Following table shows the result.

Table 1.7.1 Natural constrain and Assessment to Arterial Road

Road	Constraint Factor and Influence to the road	Evaluation of Existing Drainage
Kilwa	Flood in River Kizinga and Mzinga. Small influence	Fair
Bandari	Flood, Sedimentation and Drainage at Gerezani creek Bad drain due to sediment increase often causes water flow stop.	Bad
Kawawa	Flood including sedimentation at both River Sinza and Msimbazi. Sedimentation increases and chokes up the river. Overflow occurs often	Bad
Nierere	Nothing particular	Good
Nelson Mandera	Nothing particular	Good
Morogoro	Flood, Sedimentation and Drainage at River Msimbazi South Sedimentation increases. Small influence	Ordinary
Old Bagamoyo	Flood and drainage due to big sedimentation at Kijitonyama river in Msasani ward Overflow occurs frequently.	Bad
New Bagamoyo	Flood, Sedimentation and Drainage at River Kijitonyama Sedimentation nearly chokes up drain facility and flood overflow often happens	Bad

Note: Evaluation of existing drainage
Good: Sedimentation ratio to Drain space 0 to 20 % Fair: Sedimentation ratio to Drain space 20 t0 30 %
Ordinary: Sedimentation ratio to Drain space 30 to 50 % Bad: Sedimentation ratio to Drain space more than 50 %

Source: JICA Study Team

1.7.3 Considerations for Road Network Plan

The key factors of natural condition in relation to Road Network Plan are (1) Bearing Layer for bridge foundation (2) Drainage and (3) Conditions for reclamation.

(1) Bearing Layer for Bridge Foundation

Bearing layer is one of the key elements to be considered for bridge design in relation to soft soil layer treatment. The following table shows bearing layer in each bridge site including new candidate.

Table 1.7.2 Bearing layer and foundation type for bridge design

Location Name	Road	River	Bearing Layer and Depth	Recommended Foundation Type
Gerezani	Bandari	Gerezani Creek	Sand gravel 30m	End bearing Pile
Port Yard (Grezani)	Bandari Kilwa Candidate	Gerezani Creek	Sand gravel 30m	End bearing Pile
Tazara Intersection	Mandera Nyerere Candidate	No River	Sandgravel or Limestone 15m	End bearing Pile
Mtoni Mandera South East	Mandera South East Highway Candidate	Kljinga Mizinga	Sand gravel or Limestone 25m	End bearing or Friction Pile
Msasani	Old Bagamoyo	Kljitonyama	Sand gravel 25m	End bearing or Friction Pile
Msimbazi Riiverside	Riverside Highway Candidate	Msimbazi	Sand gravel 25 to 30 m	End bearing Pile

Source: JICA Study Team

(2) Drainage

Serious drainage condition is observed in the four rivers which requires improvement of existing drainage facility. and condition for the design is shown as follows.

Table 1.7.3 Condition for Drainage Design

Location	Road	River	Characteristics	Drainage Volume for Design
Gerezani	Bandari	Gerezanu Creek	Big sediment and choked up	20 m^3 / sec
Magomeni East	Morogoro	Msimbazi	Flat and wide flood storage	387 m^3 / sec
Hananasif	Kawawa	Sinza	Big sediment Flat grade	69 m^3 / sec
Msasani	Old Bagamoyo New Bagamoyo	Kijitonyama Do	Big sediment and choked up	28 m^3 / sec Do

Source: Dar es Salaam Road Development Plan JICA.1995

(3) Condition for Reclamation

Reclamation in river mouth area of Msimbazi River is proposed and its validity is expected. Coral reef (natural barrier against wave) widely spreads in the area and reclamation work easy. Following table shows the summary for reclamation design.

Table 1.7.4 Conditions for Reclamation in the Msimbazi River Mouth

Item for Design	Condition and Characteristics
1. Water Depth(Reclamation Depth)	4 m
2. Embankment Height	5 m = Water depth + 1 m (Up toe existing road level)
3. Embankment Area	1000 m long and 80 m wide from shoreline toward offshore (Keep 20 m wide clearance inside coral reef from the edge of deep zone of the sea)
4. Geological type of the bottom	Coral reef limestone, hard enough for embankment
5. Embankment Material	Laterite mix soil (Weathered limestone) Location of borrow area is in 5km from Kongowe to Kigamboni Road (distance 20 km)
6. Treatment of River Msimbazi outlet	Open channel 80 m long and 40 m wide

Source: JICA Study Team

Figure 1.7.1 Proposed Reclamation Area – Selander Bridge Area

Chapter 2 Environmental Study

2.1 Introduction

2.1.1 Objectives

The objective of this preliminary environmental study is to carry out baseline environmental information collection through technical site visits and relevant environmental studies for the two selected priority projects: Gerezani Area Transport Enhancement Project and Tazara Intersection Improvement Project. It is also expected to identify potential environmental issues to be caused by the implementation of these projects.

During course of the study, three time stakeholder meetings, as per the JICA's guideline for social and environmental consideration (hereinafter referred to as JICA Guideline), were held in order to enhance the public involvement and develop common understanding of these projects among various stakeholders. Entire framework of this stakeholder meeting and summaries of minutes of meeting of each stakeholder meeting are described in Chapter 3 of this technical report.

2.1.2 Outline

The current public administration and legal system that is relevant to the environmental management is summarized first in Section 2.2. Section 2.3 discusses an initial environmental examination (IEE) of the two priority pre-F/S projects, including site specific environmental information. Based on the result of Section 2.3, Section 2.4 addresses preliminary environmental impact assessment (Pre-EIA) and Terms of Reference (ToR) for the environmental studies to be conducted at the two sites. Outline and major results of each field surveys are presented in Section 2.5. In Section 2.5, several relevant environmental prediction studies such as roadside noise/vibration and vehicular emission loading are carried out. Based on these study results, environmental benefits and /or damages to be induced by the proposed projects are discussed. Section 2.6 summarizes properties to be expropriated by the proposed projects. Basic principles and directions of the preparation of the impact mitigation program are summarized in Section 2.7. Sections 2.8 and 2.9 summarize key concepts and directions of the environmental management and monitoring plan which should be followed to ensure that the project will cause the least environmental damage.

2.1.3 Engineering Options

Outlines of the engineering options are presented in Table 2.1.1. There are four options (Options A, B, C and D) for Gerezani Area Transport Enhancement Project (as of December, 2007), while a flyover on Nelson Mandela road is the only option for Tazara Intersection Improvement Project. More detailed descriptions of those projects are summarized in Technical Report 2 and Pre-FS reports of this Master Plan study..

Table 2.1.1 Engineering Options prepared for pre-FS

Engineering Options	Project Outline
Gerezani Area Transport Enhancement Project	
A	Junction of Kilwa and Bandari – Kariako Bus Terminal, 3 lane x 2 (Widening) Nyerere Fly Over
B	Junction of Kilwa and Bandari – Kariako Bus Terminal, 3 lane x 2 (Widening) Sokoine Road BRT to DCC BRT Station, 2 lane x 2 Nerere Flyover
C	Junction of Kilwa and Bandari – Kariako Bus Terminal, 3 lane x 2 Sokoine BRT, 2lane (one way: No-Widening)
D	Junction of Kilwa and Bandari – Junction of Nyerere and Gerezani Roads, 2 lane x 2 Harbor Crossing Bridge & Port Link Road to BRT Station (Widening)
Tazara Intersection Improvement Project	
Grade separation - Intersection Structure: Grade separation Fly over, L = 600 m, is to be constructed along Nelson Mandela Road. - Road Structure: 2 lanes x 2	

Source: JICA Study Team, 2007

2.2 Environmental Administration and Legal Framework

2.2.1 Environmental Organization

Upstream organizations in the field of environmental administration in Tanzania include National Environmental Advisory Committee and the Minister of State Responsible for Environment. These two belong to Vice President Office. At present there is no line ministry which is directly responsible for the environmental administration at national level. Instead, the Minister of State Responsible for Environment commands and supervises following two environmental sub sections: i.e., (i) Division of Environment, and (ii) National Environment Management Council. Major roles and functions of each organization are briefly described separately.

(1) National Environmental Advisory Committee

This committee is an advisory body to the Minister of State Responsible for Environment and/or Sector Ministry on any environmental issues at national level.

(2) Minister responsible for Environment

The Minister has overall responsibility for protection and management of the environment in Tanzania. The Minister may issue general guidelines to the Sector Ministries, Government Departments, the Council, National Environment Advisory Committee, City, Municipal or District Environmental Management Committee, agency or any other public or private institution for the successful implementation of the environmental management Act, 2004 (No. 20 of 2004), described later.

(3) Division of Environment

Division of Environment is responsible for coordination of various environmental management activities being taken by other agencies and the integration of environmental considerations into development policies, plans, programs, strategies, projects and undertaking strategic environmental assessment (SEA).

(4) NEMC (National Environment Management Council)

This Council is to undertake enforcement, compliance, review and monitoring of the environmental impact assessment (EIA), and, in this regard, shall facilitate public participation in environmental decision making, exercise general supervision and coordination over all environmental issues.

2.2.2 Environmental Laws

(1) Summary of Current Environmental Codes

GN. No. 20 of 2004, described later is a core environmental code in Tanzania. Based on this code, two more relevant environmental laws: GN. No. 348 of 2005 and GN. No.349 of 2005 are issued. No environmental standard exists in Tanzania, yet, although the draft for the implementation of Tanzanian environmental standards is ready for approval at the parliament (as of November 2007, Sosovele, personal communication, 2007). Also, no law that would specify the actual implementation of SEA, but, by the same token, a draft of SEA implementation for all development plans is ready for approval, too (as of November 2007, Sosovele, personal communication, 2007).

(2) The Environmental Management Act, 2004 (G.N. No. 20 of 2004)

This law consists of 20 Parts. Outline of the environmental approval process for infrastructure development projects and its relevant EIA are described in Part VI. Also, general descriptions about SEA are provided in Part VII.

(3) The Environmental Regulations, 2005 (G.N. No. 348 of 2005)

This law consists of 7 Parts and describes a registration system of environmental experts to be in charge of EIA studies. It shall be noted that all official EIS documents, described later, shall be prepared and submitted to NEMC by a registered EIA consultant. Otherwise, the project owner can not apply for the official environmental license application of the project of concern. The entry and

the validity of the registration is specified in Part V.

(4) The Environmental Impact Assessment and Audit Regulations, 2005 (G.N. No. 349 of 2005)

This law consists of 12 Parts and describes more detailed EIA study procedures and its approval process. Project registration and its preliminary screening is specified in Part III while ToR development process with NEMC is in Part IV.

2.2.3 Environmental License

Environmental License and its relevant EIA examination process in Tanzania consists of following four (4) steps; i.e., (i) the project registration and screening, (ii) ToR development and its approval (iii) relevant environmental studies and the preparation of EIS report, and (iv) EIS evaluation and its license approval. Followings are the outline of this IEE/EIA Examination steps.

1) Submit an official application form for an environmental impact assessment certificate to NEMC with a project brief that summarizes the project outline and its surrounding bio-physical and socio-cultural environment. This project brief shall be prepared by registered EIA experts.

2) NEMC starts the screening of the project brief and will evaluate the magnitude of possible negative impacts to be caused by the proposed project. This project brief evaluation takes at most forty five (45) days.

3) If NEMC concludes that the proposed project will not cause severe negative environmental impacts, or the environmental mitigation program attached therein is comprehensive and sufficient, NEMC may recommend the Minister responsible for Environment (hereinafter referred to as Minister) to approve the project.

4) If NEMC concludes that the proposed project will cause significant negative environmental impacts, and/or environmental mitigation program, described in the project brief, is not sufficient, then, NEMC will ask the project owner to conduct either of (i) Preliminary Assessment, or (ii) full-scale EIA, depending the temporal and spatial scale of the possible negative environmental impacts to be caused by the implementation of the proposed project. It shall be noted that Preliminary Assessment is equivalent to IEE used in general EIA-related terminology.

Preliminary Assessment

5) ToR of environmental studies to be required for this preliminary assessment does not need an approval from NEMC prior to its implementation, whereas mandatory for a full-scale EIA study. So, upon reviewing the guideline for the preliminary assessment specified in GN. NO. 349 of 2005, the project owner can start relevant environmental studies and submit documentations required for the approval.

6) If NEMC concludes that the proposed project will not cause severe negative environmental impacts and the environmental mitigation program attached therein is comprehensive and

sufficient, NEMC may recommend the Minister to approve the project. Otherwise, NEMC will inform the project owner to undertake a full-scale EIA.

Full-scale EIA

7) The project owner shall obtain an approval of ToR of relevant EIA-related environmental studies from NEMC, and this ToR development shall be conducted through a series of consultation process with NEMC. This EIA study shall be conducted by registered EIA experts.

8) During the EIA study period, the project owner shall conduct relevant PAPs identification work and discuss the necessity of public meetings with NEMC.

9) Based on the EIA study, the project owner shall prepare the environmental impact statement (hereinafter referred to as EIS). This EIS shall be signed by each of the individuals involved the assessment works. The project owner shall submit fifteen (15) sets of original copies and one (1) electronic copy of an EIS to NEMC.

10) Examination of submitted EIS report is to be conducted by a cross-sectoral technical advisory committee set up by NEMC. Within the fourteen (14) days of the receipt of the EIS report, NEMC submit a copy to any relevant Ministry and public institutes. Also, NEMC will notify the public announcement for the public review and invite general public for their comments. To summarize this, entire examination of submitted EIS is to be done by Advisory Committee, line ministry, public institution and general public, separately. Within thirty (30) days of receipt of the EIS, NEMC also has to decide whether or not to convene a public hearing.

11) Comments from line ministry and public institutes are to be summarized within thirty (30) days of the receipt of the EIS report. Upon considering the overall features of proposed project, this examination period may be extended by NEMC.

12) NEMC will undertake the review of the submitted EIS. Meantime, NEMC may arrange on-site technical visits with the project owner. It should be noted that its travel expense and the per diem shall be paid by the project owner.

13) Upon completion of all review processes, NEMC will prepare a review report on the submitted EIS, and submit this report to the Minister. Consequently, the Minister will give his decision on the submitted EIS within thirty (30) days of receivinbg recommendations from NEMC.

Figure 2.2.1 shows the schematic diagram of the entire environmental license approval system in Tanzania.

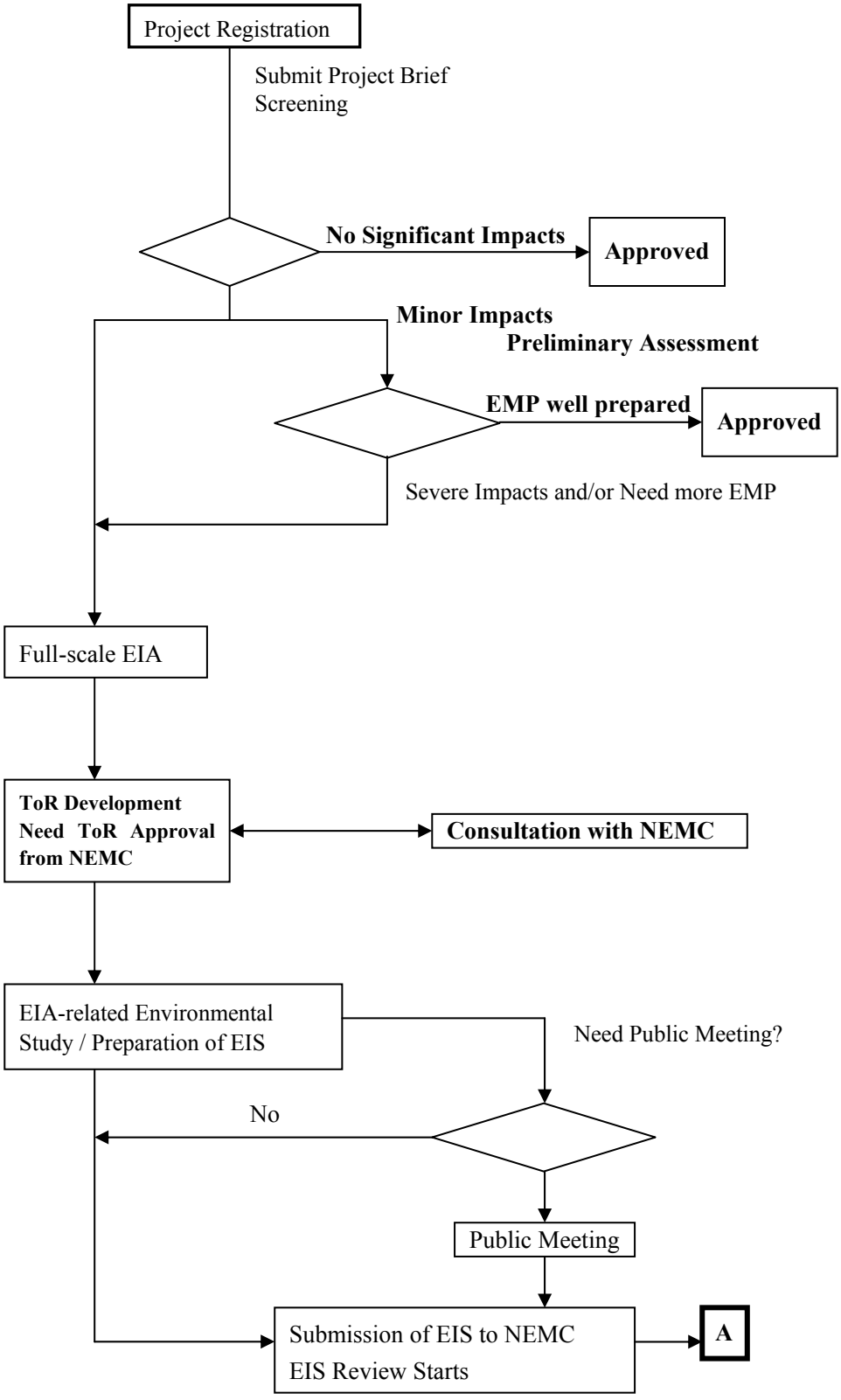


Figure 2.2.1 Environmental License Approval Process in Tanzania

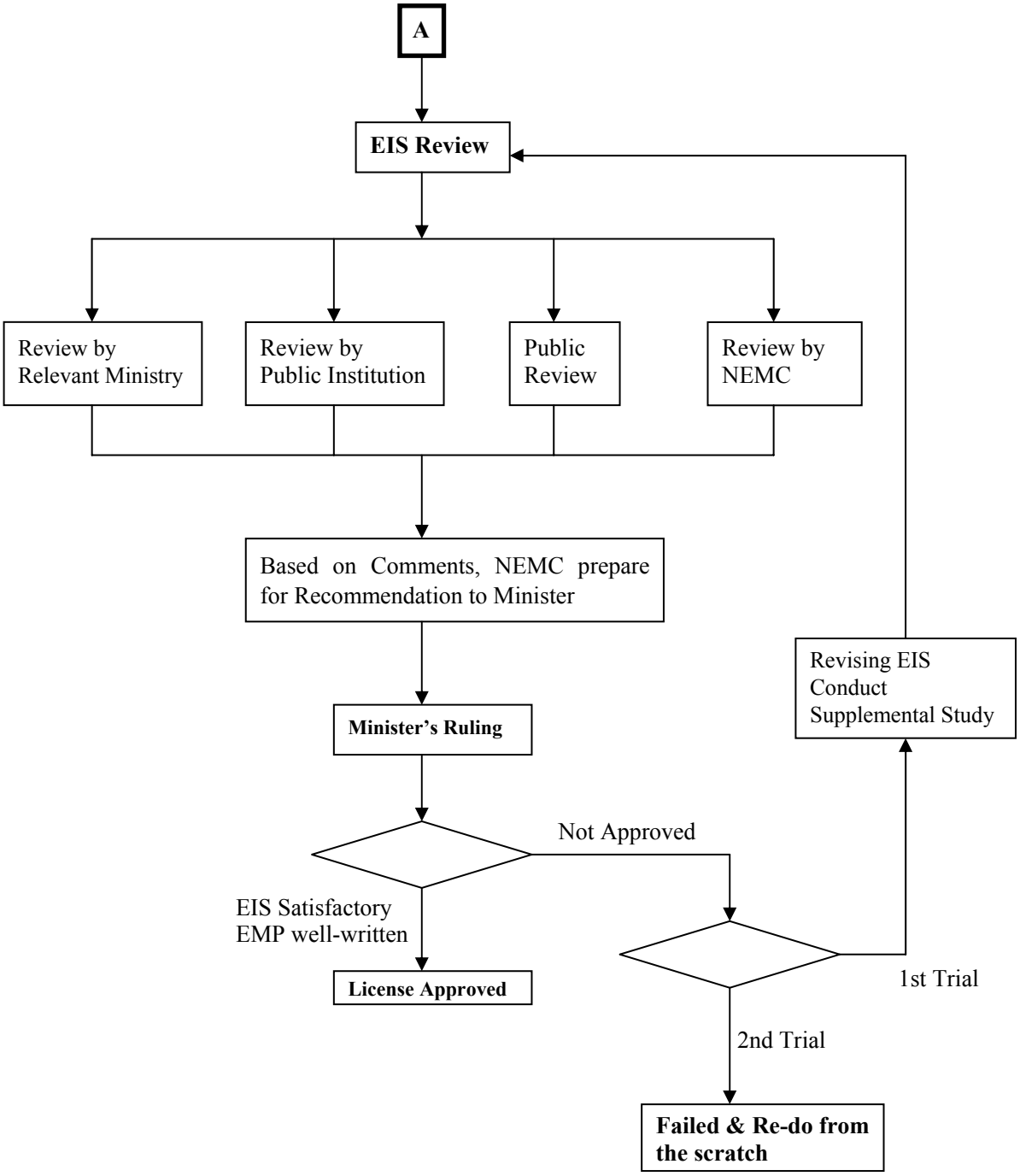


Figure 2.2.1 Environmental License Approval Process in Tanzania (Continued)

2.3 Environmental Scoping and Screening

2.3.1 Introduction

Preliminary environmental field inspection was carried out during July, October and November of 2007. Based on reviews of currently available reports and findings obtained from this technical site inspection, the initial environmental examination of each project site was carried out separately, and

potential environmental issues associated with the implementation of selected pre-feasibility projects are summarized. Basically, the examination is carried out for following two scenarios: i.e., (i) Do - Nothing scenario, and (ii) Do - scenario. Under Do - scenario, possible negative environmental impacts to be caused during and/after improvement works are of concern. Upon reviewing the engineering feature of Gerezani Area Transport Enhancement project, this project can be separated into following two sub-components; i.e., (i) road improvement and widening of existing Bandari-Gerezani-Sokoine road network (Options A, B, C and D), and (ii) construction of the harbor crossing bridge (Option D) for the evaluation purpose. Based on this categorization, three separate IEEs are conducted within this study.

2.3.2 Initial Environmental Examination

(1) Bandari - Gerezani – Sokoine Road Improvement Project Component (Options A, B, C and D)

Entire project routes of this project component (Options A, B, C and D) are located at the coastal lowland terrain along Krasini Creek. Existing roads are always congested, and, in particular, road congestions around morning and evening peaks are worse. Depending the current land use of the surrounding environment, this project site can be categorized into following two sections further; i.e., (i) mixed industrial/commercial area along two-lane Bandari Road, and (ii) mixed commercial/residential area along Gerezani and Sokoine Roads. Current road spaces are not wide enough for the implementation of the proposed road improvement project, so that it is likely that certain amounts of expropriation shall be taken.

There are several factories and/or storage facilities along two-lane Bandari Roads. There is one port entrance gate, connecting Tanzania Port facilities, along the adjacent Nelson Mandela Road. This port entrance is easily accessible to and from both Kilwa and Bandari Roads. In fact, many heavy trucks such as tank lorries and/or trailers are circulating around this port entrance (see Figure 2.3.1). Currently, road improvement work is on-going at the adjacent Kilwa Road, while the adjacent 2-lane Nelson Mandela Road may also be improved to a 4-lane road in the long term (not confirmed yet, as of November 2007). The engineering design of each road improvement project should be compatible with both on-going Kilwa road improvement project and future Nelson Mandela road improvement plan.

There are several roadside vegetations, one railway crossing point and towers of transmission power line along Bandari Road. Several street vendors are doing their business along this road.

Most of surrounding area along Gerezani Road is used as the residential complex for railway company's employees (see Figure 2.3.2). Also, there is several railway company related facilities such as Railway Resort Club. Several street vendors are doing their business along this road, too.

A flyover will run through a four-legged, signaled intersection of Nyerere and Gerezani Roads (see Figure 2.3.5, Options A, B and C). The current land use of surrounding environment is classified into

a mixed commercial/residential area (see Figure 2.3.6) and there are several buildings around this intersection. There is a bus station near the future Kariakoo BRT station site, where many daladala buses are circulating and parking around this area. There is a railway crossing point adjacent to this intersection, and a proposed flyover will have to have an enough vertical clearance not to disturb future railway cargo transport at this point.

There is a Gerezani floodplain lowland, bounded by Bandari, Gerezani Roads and Tanzania Port (see Figure 2.3.3). The maximum vertical difference between the current road shoulder of Gerezani Road and the lowland ground surface is approximately 8 meters. Southern half of this lowland area is used as the railway yard, connecting to the port facilities while local people cultivate remaining half and use as vegetation fields. There are many natural springs (confined and un-confined ones, see Figure 2.3.4), where water for the irrigation is always available to vegetation fields. Small wetland bush exists and several birds occur therein. Water, pouring from those springs seems to be clean and occurrences of several aquatic faunal species such as small fishes are observed at the nearby creeks. There are several irrigation channels across this lowland vegetation area. In the past, neither regional flooding nor inundation occurred around this lowland area during the every rainy season [Njawoka, personal communication, 2007]. Within the interviews with local people, it was also found that there was a groundwater pumping station used for a local beer company in the past. Currently, this pumping station is not used any more, mainly due to a recent regional groundwater contamination problem.

Between a railroad crossing point located near to BP office and Bandari-Gerezani roundabout, there is an embankment with a bridge crossing the railway yard. Several drainage facilities for the road surface run-off water are attached at both road shoulders along this embankment. Its slope protection does not seem to be appropriate and several traces of on-going minor erosion are recognized. Small creek, named Gerezani River, used to run through this lowland, is crossing this embankment via a buried channel (partially observable at the lowland floodplain), and its flow seems to connect somewhere in the adjacent downstream side (i.e., Tanzania Port).

Sokoine Road runs through the coastal area of Dar Es Salaam CBD (see Figure 2.3.7), and both Options B and C will run through this road. Many vehicles such as daladala buses and passenger cars are circulating to and from CBD of Dar Es Salaam. Along this road, a traffic police station, a daladala bus depot, several governmental buildings such as DCC and Tanzania Railway Station exist. Several road widening will be taken in Option B along Sokoine Road while no road widening activity but one-way traffic control (toward CBD direction only) is to be imposed in Option C.

No illegal squatter areas exist around this site. No school, church and/or hospital, that would prefer calm environment exist. No historical and/or cultural sites exist. Table 2.3.1 summarizes the preliminary environmental evaluation of the Bandari – Gerezani – Sokoine Road Improvement Project. It is noted that evaluation results, "U", such as examination results for the air quality, noise and vibration during the operation phase indicate that these environmental conditions highly depend on the future traffic demand forecast results, road structure, in particular, pavement conditions, and/or entire road design system, that are unknown at this moment (as of December 2007). Those evaluations may be possible after those pending issues are solved later.

Table 2.3.1 Initial Environmental Examination (Bandari-Gerezani –Sokoine Road Improvement)

Env. Factor	Descriptions of Impact		Do nothing	Do project			
				OpA	OpB	OpC	OpD
1. Air quality	Increased roadside air pollution during; (Bandari- Gerezani)	Construction	C	A	A	A	A
		Operation	B	U	U	U	U
	Increased roadside air pollution during; (Sokoine)	Construction	C	C	A	B	C
		Operation	B	U	U	U	U
	Increased roadside air pollution during; (Kariakoo)	Construction	C	A	A	A	C
		Operation	B	U	U	U	U
2. Water Quality	Risk of pollution to major tributaries and/or aquifer.	Construction	D	B	B	B	B
		Operation	D	D	D	D	D
3. Soil and sedimentation	Potential for soil erosion (e.g., slope of road embankment).	Construction	C	B	B	B	B
		Operation	C	C	C	C	C
	Occurrence of new sedimentation at downstream side.	Construction	D	C	C	C	C
		Operation	D	D	D	D	D
4. Waste Disposal	Generation of large amounts of construction wastes.		D	B	B	B	B
5. Noise/ Vibration	Increased roadside noise and vibration during (Bandari – Gerezani)	Construction	C	B	B	B	B
		Operation	B	U	U	U	U
	Increased roadside noise and vibration during (Sokoine)	Construction	C	C	A	B	C
		Operation	B	U	U	U	U
	Increased roadside noise and vibration during (Kariakoo)	Construction	C	A	A	A	C
		Operation	B	U	U	U	U
6. Ground Subsidence	Potential of large-scale consolidation due to earthwork		D	C	C	C	C
7. Bad smell	Potential of newly creation of bad smell.		D	D	D	D	D
8. Topography and Geology	Partial road inundation due to poor drainage of road surface run-off water		C	D	D	D	D
	Disturbance of local drainage system.	Construction	C	B	B	B	B
		Operation	C	D	D	D	D
9. River bed	Disturbance to river bed condition.		D	C	C	C	C
10. Fauna/ flora	Destruction of riverside/floodplain vegetation		D	D	D	D	D
	Destruction of roadside vegetation.		D	B	B	B	B
	Disturbance to bird habitats or floodplain habitats.		D	C	C	C	C
	Disturbance to aquatic ecosystem/or habitats.		D	D	D	D	D
11. Water Resources	Water quality degradation (groundwater).		D	C	C	C	C
	Disturbance to regional groundwater flow.		D	C	D	D	D
12. Accidents	Potential of increased traffic accidents.		C	U	U	U	U
	Temporal Traffic Jam during Construction (Bandari & Gerezani).		D	A	A	A	A
	Increased risk of J-walk of widened road after Construction (Bandari-Gerezani).		C	B	B	B	B
	Temporal Traffic Jam during Construction (Sokoine).		D	C	A	B	C
	Temporal Traffic Jam during Construction (Kariakoo)		D	A	A	A	D
13. Global warming	Increased CO_2 emission.		U	U	U	U	U

Note: A: significant, B: major, C: minor, D: less significant, U: unknown

Table 2.3.1 Initial Environmental Examination (Bandari-Gerezani – Sokoine Road Improvement: continued)

Env. Factor	Descriptions of Impact		Do Nothing	Do project			
				OpA	OpB	OpC	OpD
14. Involuntary Resettlement	Land (agricultural lands) expropriation due to construction (Bandari & Gerezani)		D	A	A	A	A
	Land expropriation due to construction (Sokoine)		D	D	A	D	D
	Land expropriation due to construction (Kariakoo)		D	B	B	B	D
	Demolition of roadside houses (Bandari & Gerezani)		D	A	A	A	A
	Demolition of roadside houses (Sokoine)		D	D	A	D	C
	Demolition of roadside houses (Kariakoo)		D	B	B	B	D
	Demolition of illegal squatters' lots.		D	D	D	D	D
15. Local Economy	Possible impact on local employment and livelihood (Bandari & Gerezani)		D	C	C	C	C
	Possible impact on local employment and livelihood (Sokoine)		D	D	B	C	C
	Possible impact on local employment and livelihood (Kariakoo)		D	B	B	B	D
16. Land use and Utilization of local Resources	Conflict with current local land use plan (TPA and/or Railway Authority)		D	B	B	B	B
	Conflict with local development plans (TPA and/or Railway Authority)		D	B	B	B	B
	Establish engineering integrity with on-going Kilwa Road Improvement Project.		A	A	A	A	A
	Establish engineering integrity with future possible Nelson Mandela Road Improvement Project.		A	A	A	A	A
17. Social Institutions	Possible impact on social infrastructure & local decision-making system.		D	D	D	D	D
	Community separation due to the widened road and increased future traffic volume after Construction (Bandari-Gerezani).		D	B	B	B	B
18. Existing social infrastructures and services	Possible Impact on public transport system (Bandari & Gerezani)	Construction	D	B	B	B	B
		Operation	D	U	U	U	U
	Possible Impact on public transport system (Sokoine)	Construction	D	D	A	B	C
		Operation	D	U	U	U	U
	Possible Impact on local transport system (Kariakoo)	Construction	D	A	A	A	D
		Operation	D	U	U	U	U
	Conflict with current local energy/communication/water supply system (e.g., power line cable and towers)		D	B	B	B	B
19. The poor, indigenous of ethnic group	Existence of ethnic minority around the site.		D	D	D	D	D
20. Mis-distribution of benefit & damage	Risk of possible damages/or negative impacts concentration/or localization.		D	D	D	D	D
21. Local Conflict of interests	Conflicts between regional environmental conservation and development.		D	D	D	D	D
22. Gender	Risk of WID-related issues		D	D	D	D	D
23. Children's right	Risk of illegal child labors (e.g., street vender)		D	D	D	D	D
24. Cultural Heritage	Conflict with the setting of historical, cultural or monumental sites.		D	D	D	D	D
25. Infectious Disease	Risk of Dengue, Malaria and other Insect-borne diseases for construction workers.		D	B	B	B	B
	Risk of HIV/AIDS		D	C	C	C	C

Note: A: significant, B: major, C: minor, D: less significant, U: unknown

Figure 2.3.1 Daily Traffic Condition along Bandari Road

Figure 2.3.2 Daily Traffic Condition along Gerezani Road

Figure 2.3.3 Overview of Gerezani Floodplain Lowland Area

Figure 2.3.4 Well (unconfined) at Gerezani Lowland Area

Figure 2.3.5 Intersection of Neyerere and Gerezani Roads

Figure 2.3.6 Current Roadside Condition around Future Kariakoo BRT Station Site

Figure 2.3.7 Current traffic condition of Sokoine Road

(2) Harbor Crossing Bridge Construction Project Component– Option D

Tanzania Port is located around the ex-estuary of Gerezani River, and most of this harbor crossing route (Option D) will run through the inside of this Tanzania Port Facilities on where a busy port operation is on-going and many trucks are circulating (see Figure 2.3.8). Beside those heavy vehicles, several passenger cars are running to and/from entrance gates (note: there are three gates to get into this port) for the short-cut purpose. Many port facilities such as storages, control centers and railroad lines exist (see Figure 2.3.9), and TPA is planning to have a multi-story parking facility, to be located near the project route (TPA, personal communication, 2007). Basically, the port-wide security of Tanzania Port is very strict and entire port facilities are off-limit.

Two-lane approach road at the CBD-side will run in parallel along the existing 2-lane road along that several office buildings such as the police station exist (see Figure 2.3.10). So, it is likely that expropriation would be required for the construction of this approach road.

Similarly, approach road at Kilwa-side will directly hit some of port facilities (see Figure 2.3.11) and will connect to the proposed harbor crossing. It is highly likely that the demolition of existing port facilities is necessary for this approach road construction. As mentioned in previous section, a road improvement work is on-going at adjacent Kilwa Road, so that the engineering design of this selected project shall be compatible with this Kilwa road improvement project.

No major tributary is running through and/or nearby the project route, but it is likely that there is a buried channel/or pipe that receives upstream Gerezani River within the current port facility. No important flora/fauna occurs. No illegal squatter areas exist around this site. No school, church and/or hospital, that would prefer calm environment exist. No historical and/or cultural sites exist. Table 2.3 summarizes the preliminary environmental evaluation of the Harbor Crossing Bridge Construction Project. It is noted that evaluation results, “U”, such as examination results for the air quality, noise and vibration during the operation phase indicate that these environmental conditions highly depend on future traffic demand forecast results, road structure, in particular, pavement conditions, and/or entire road design system, that are unknown at this moment (as of December 2007). Those evaluations may be possible after those pending issues are solved later.

Table 2.3.2 Initial Environmental Examination (Harbor Crossing – Option D)

Environmental Factor	Descriptions of Impact		Do nothing	Do project
1. Air quality	Increased roadside air pollution during;	Construction	C	B
		Operation	C	U
2. Water Quality	Risk of pollution to nearest coastline during;	Construction	D	C
		Operation	D	D
3. Soil and sedimentation	Potential for soil erosion (e.g., slope of road embankment).		D	C
	Occurrence of new sedimentation at downstream side.		D	D
4. Waste Disposal	Generation of large amounts of construction wastes.		D	B
5. Noise/Vibration	Increased roadside noise and vibration during;	Construction	C	B
		Operation	C	U
6. Ground Subsidence	Potential of large-scale consolidation due to earthwork		D	B
7. Bad smell	Potential of newly creation of bad smell.		D	D
8. Topography and Geology	Partial road inundation due to poor drainage of road surface run-off water		C	D
	Enhanced coastline erosion/scouring .		D	D
	Disturbance of local drainage system	Construction	C	B
		Operation	C	D
9. River bed	Disturbance to river bed condition.		D	D
10. Fauna/flora	Destruction of floodplain vegetation		D	D
	Destruction of roadside vegetation.		D	D
	Disturbance to bird habitats or floodplain habitats.		D	D
	Disturbance to aquatic ecosystem/or habitats.		D	D
11. Water Resources	Water quality degradation.		D	D
	Disturbance to regional groundwater flow.		D	D
12. Accidents	Potential of increased traffic accidents.		C	U
	Temporal Traffic Jam during Construction.		D	B
13. Global warming	Increased CO_2 emission.		U	U
14. Involuntary Resettlement	Temporal use of port land during construction (e.g., set-up of construction yard)		D	B
	Land Expropriation due to construction		D	B
	Demolition of roadside houses (approach road).		D	B
	Demolition of illegal squatters' lots.		D	D
15. Local Economy	Possible impact on local employment and livelihood		D	D
16. Land use and Utilization of local Resources	Conflict with current local land use plan (TPA)		D	A
	Establish engineering integrity with on-going Kilwa Road Improvement Project.		D	A
	Establish engineering integrity with future possible Nelson Mandela Road Improvement Project.		D	A
17. Social Institutions	Temporal interference with port security during construction		D	B
	Other possible Impact on social infrastructure and local decision-making institutions.		D	D
18. Existing social infrastructures and services	Conflict with current local transport system during	Construction	D	B
		Operation	D	D
	Conflict with current local energy/ communication/water supply system (e.g., port operation).		D	A
19. The poor, indigenous of ethnic group	Existence of ethnic minority around the site.		D	D
20. Misdistribution of benefit and damage	Risk of possible damages/or negative impacts concentration/or localization (e.g., TPA's loss of profit due to the temporal disturbance to be caused by construction activity).		D	B
21. Local Conflict of interests	Conflicts between regional environmental conservation and development.		D	D
22. Gender	Risk of WID-related issues		D	D
23. Children's right	Risk of illegal child labors (e.g., street vender).		D	D
24. Cultural Heritage	Conflict with the setting of historical, cultural or monumental sites.		D	D
25. Infectious Disease	Risk of Dengue, Malaria and other Insect-borne diseases for construction workers.		D	B
	Risk of HIV/AIDS		D	C

Note A: significant, B: major, C: minor, D: less significant, U: unknown

Note: Trailer is climbing southern approach slope connecting to Gate #3.

Figure 2.3.8 Inside of Tanzania Port

Note: Several railway lines exist inside of this port.

Figure 2.3.9 Inside of Tanzania Port

Note: Proposed northern (i.e., CBD-side) approach road may run in parallel to this road.

Figure 2.3.10 Existing Port access Road connecting to Gate #1

Note: Proposed southern (i.e., Kilwa-side) approach road will hit this port building directly.

Figure 2.3.11 Tanzania Port Facilities on the Project Route

(3) Tazara Intersection Improvement Project

Tazara Intersection exists over an arid, flat costal lowland terrain, and Tazara Railway Station is located at nearby south-west corner of this intersection. This intersection is 4-legged, signalized one, and both Nelson Mandela and Nyerere Roads, crossing each other at this point, have a wide RoW of 60 meters, respectively. Land use of surrounding environment is classified as mixed commercial/industrial area. Current traffic volume passing through this intersection is huge and severe traffic congestions sometimes occur around morning and evening peak hours (see Figure 2.3.12). Around this intersection, there are several bus stops (see Figure 2.3.13), and many bus passengers as well as street vendors are gathering around this intersection. There are roadside vegetation along both Nelson Mandela and Nyerere Roads. Within this improvement project, a flyover with the total length of 600 meters is to be constructed along Nelson Mandela Road. Its construction is to be carried out within the current road space of Nelson Mandela Road, so no expropriation or demolition of roadside house will be carried out. However, a temporal use of a wide land space for the set-up of the construction yard will be necessary, depending on the construction plan. Currently, partial road improvement work is on-going along Nelson-Mandela Road and it is highly likely that this improvement work will be extended to this Tazara intersection in the future. The engineering design of this intersection improvement project shall be compatible with this long-term Nelson- Mandela Road improvement project.

No major tributary is running through and/or nearby the project route. No important flora/fauna occurs. No illegal squatter areas exist around this site. No school, church but one hospital (see Figure 2.3.14) that would prefer calm environment exists. No historical and/or cultural sites exist. Table 2.3.3 summarizes the preliminary environmental evaluation of the Tazara Intersection Improvement Project. It is noted that evaluation results, "U", such as examination results for the air quality, noise and vibration during the operation phase indicate that these environmental conditions highly depend on future traffic demand forecast results, road structure, in particular, pavement conditions, and/or entire road design system, that are unknown at this moment (as of December 2007). Those evaluations may be possible after those pending issues are solved later.

Table 2.3.3 Initial Environmental Examination (Tazara Intersection Improvement)

Environmental Factor	Descriptions of Impact		Do nothing	Do project
1. Air quality	Increased roadside air pollution during;	Construction	B	B
		Operation	B	U
2. Water Quality	Risk of pollution to major tributaries.		D	D
3. Soil and sedimentation	Potential for soil erosion.		D	D
	Occurrence of new sedimentation at downstream side.		D	D
4. Waste Disposal	Generation of large amounts of construction wastes.		D	B
5. Noise/Vibration	Increased roadside noise and vibration during;	Construction	B	B
		Operation	B	U
6. Ground Subsidence	Potential of large-scale consolidation due to earthwork		D	D
7. Bad smell	Potential of newly creation of bad smell.		D	D
8. Topography and Geology	Partial road inundation due to poor drainage of road surface run-off water		C	D
	Disturbance of local drainage system	Construction	C	B
		Operation	C	D
9. River bed	Disturbance to river bed condition.		D	D
10. Fauna/flora	Destruction of roadside vegetation.		D	D
	Disturbance to surrounding habitats.		D	D
11. Water Resources	Disturbance to regional groundwater flow.		D	D
12. Accidents	Potential of increased traffic accidents.		C	D
	Temporal Traffic Jam during Construction.		B	A
13. Global warming	Increased CO_2 emission.		U	U
14. Involuntary Resettlement	Temporal use of land space during construction (e.g., set-up of construction yard)		D	B
	Land expropriation due to construction		D	D
	Demolition of roadside houses.		D	D
	Demolition of illegal squatters' lots.		D	D
15. Local Economy	Possible impact on local employment and livelihood (e.g., street vendors)	Construction	D	B
		Operation	D	D
16. Land use and Utilization of local Resources	Conflict with current local land use plan		D	D
	Conflict with local development plans		D	D
	Establish engineering integrity with on-going Nelson-Mandela Road improvement work.		D	A
17. Social Institutions	Possible Impact on social infrastructure and local decision-making institutions		D	D
18. Existing social infrastructures and services	Conflict with current local transport (e.g., daladala bus) system	Construction	D	B
		Operation	D	D
	Conflict with current local energy/ communication/water supply system.		D	D
19. The poor, indigenous of ethnic group	Existence of ethnic minority around the site.		D	D
20. Misdistribution of benefit and damage	Risk of possible damages/or negative impacts concentration/or localization.		D	D
21. Local Conflict of interests	Conflicts between regional environmental conservation and development.		D	D
22. Gender	Risk of WID-related issues		D	D
23. Children's right	Risk of illegal child labors (e.g., street vender).		D	D
24. Cultural Heritage	Conflict with the setting of historical, cultural or monumental sites.		D	D
25. Infectious Disease	Risk of Dengue, Malaria and other Insect-borne diseases for construction workers.		D	B
	Risk of HIV/AIDS		D	C

Note A: significant, B: major, C: minor, D: less significant, U: unknown

Note: Photo taken from CBD-side along Nyerere Road

Figure 2.3.12 Tazara Intersection

Note: Daladala bus heading for airport.

Figure 2.3.13 Bus stop around Tazara Intersection

Figure 2.3.14 Hospital located at Tazara Intersection

2.3.3 Summary of IEE

Here, based on IEE results of the selected pre-feasibility projects, possible environmental impacts, commonly identified for three project components, are summarized in Table 2.3.4. It is noted that most of identified negative impacts to be caused by the proposed pilot projects are evaluated as either of B or C. Also, most of B evaluations are related with construction activities, so it can be said those negative impacts are temporal ones. Tables 2.3.5 – 2.3.7 summarize more detailed descriptions of each potential negative impacts for both "Do – Nothing" and "Do – Project" scenarios, identified for three project components, respectively.

Table 2.3.4 Summary of Potential Negative Impacts

	Project Name		Potential Negative Impacts					
			Do Nothing			Do Project		
			A	B	C	A	B	C
1	Bandari – Gerezani – Sokoine	**Op. A**	2	6	12	10	16	12
		Op. B				16	17	8
		Op. C				10	20	9
		Op. D				6	13	16
2	Harbor Crossing (**Op. D**)		0	0	8	4	13	3
2'	**Option D** (total)		2	6	20	10	26	19
3	Tazara Intersection		0	5	4	2	9	1

Note: The evaluation summary of **Option D** (total) = Bandari-Gerezani-Sokoine (**Op. D**) + Harbor Crossing (**Op. D**)

Table 2.3.5 Breakdown of Each Potential Impacts (Bandari – Gerezani - Sokoine)

	Environmental Factors	Remarks of Possible Impacts
1	Air Quality	1. Increased roadside air quality degradation during construction 2. Future roadside air quality degradation after construction.
2	Water Quality	1. Risk of pollution to major tributaries and/or aquifer.
3	Soil and Sedimentation	1. Potential for soil erosion during construction. 2. Occurrence of new sedimentation at downstream side during construction.
4	Waste Disposal	1. Preparation of excavated soil dump site. 2. Proper treatment of industrial wastes to be generated during construction period.
5	Noise/Vibration	1. Noise and vibration during construction period. 2. Future roadside noise and vibration after construction.
6	Subsidence	Less significant
7	Bad Smell	Less significant
8	Topography/ Geology	1. Disturbance of local drainage system during construction.
9	River Bed	Less significant
10	Flora/Fauna	1. Destruction/or relocation of roadside vegetation.
11	Water Resources	1. Water quality degradation (groundwater). 2. Disturbance to regional groundwater flow.
12	Accidents	1. Potential of increased traffic accidents during construction period. 2. Increased risk of J-walk of widened road after Construction.
13	Global Warming	Unknown, CO_2 emission loading may be reduced.

Table 2.3.5 Summary of Possible Impacts (Bandari – Gerezani - Sokoine, continued)

	Environmental Factor	Remarks of Possible Impact
14	Involuntary Resettlement	1. Land (office/housing/agricultural lands) expropriation due to construction 2. Demolition of roadside houses
15	Local Economy	Less significant
16	Land use and Utilization of local Resources	1. Conflict with current local land use and development plans (TPA and/or Railway Authority) 2. Establish engineering integrity with both on-going Kilwa Road Improvement Project and future Nelson Mandela Road Improvement One.
17	Social Institutions	1. Community separation due to the widened road and increased future traffic volume after Construction.
18	Existing social infrastructures and services	1. Conflict with current local transport system during construction. 2. Conflict with current local energy/communication/water supply system (power line cable and towers).
19	Poor, indigenous of ethnic group	Less significant
20	Misdistribution of benefit and damage	Less significant
21	Local Conflict of interests	Less significant
22	Gender	Less significant
23	Children's right	Less significant
24	Cultural Heritage	Less significant
25	Infectious Disease	1. Risk of Dengue, Malaria and other Insect-borne diseases for construction workers.

Table 2.3.6 Breakdown of Each Potential Impacts (Harbor Crossing – Option D)

	Environmental Factors	Remarks of Possible Impacts
1	Air Quality	1. Increased roadside air quality degradation during construction 2. Future roadside air quality degradation after construction.
2	Water Quality	Less significant.
3	Soil and Sedimentation	Less Significant.
4	Waste Disposal	1. Preparation of excavated soil dump site. 2. Proper treatment of industrial wastes to be generated during construction period.
5	Noise/Vibration	1. Noise and vibration during construction period. 2. Future roadside noise and vibration after construction.
6	Subsidence	1. Consolidation due to the approach road construction.
7	Bad Smell	Less significant
8	Topography/ Geology	Less significant.
9	River Bed	Less significant
10	Flora/Fauna	Less significant
11	Water Resources	Less significant
12	Accidents	1. Potential of increased traffic accidents during construction period.
13	Global Warming	Unknown, CO_2 emission loading may be reduced.

Table 2.3.6 Summary of Possible Impacts (Harbor Crossing – Option D, continued)

	Environmental Factor	Remarks of Possible Impact
14	Involuntary Resettlement	1. Temporal use of port land during construction (e.g., set-up of construction yard). 2. Demolition of roadside houses (approach road).
15	Local Economy	Less significant
16	Land use and Utilization of local Resources	1. Conflict with current local land use plan (TPA). 2. Establish engineering integrity with both on-going Kilwa Road Improvement Project and future Nelson Mandela Road Improvement One.
17	Social Institutions	1. Temporal interference with port security during construction
18	Existing social infrastructures and services	1. Conflict with current local transport system during construction. 2. Conflict with current local energy/communication/water supply system (e.g., port operation).
19	Poor, indigenous of ethnic group	Less significant
20	Misdistribution of benefit and damage	1. Loss of profit due to the temporal construction-related disturbance.
21	Local Conflict of interests	Less significant
22	Gender	Less significant
23	Children's right	Less significant
24	Cultural Heritage	Less significant
25	Infectious Disease	1. Risk of Dengue, Malaria and other Insect-borne diseases for construction workers.

Table 2.3.7 Breakdown of Each Potential Impacts (Tazara Intersection)

	Environmental Factors	Remarks of Possible Impacts
1	Air Quality	1. Increased roadside air quality degradation before and/or during construction 2. Future roadside air quality degradation after construction.
2	Water Quality	Less significant
3	Soil and Sedimentation	Less significant
4	Waste Disposal	1. Preparation of excavated soil dump site. 2. Proper treatment of industrial wastes to be generated during construction period.
5	Noise/Vibration	1. Noise and vibration before and/or during construction period. 2. Future roadside noise and vibration after construction.
6	Subsidence	Less significant
7	Bad Smell	Less significant
8	Topography/ Geology	1. Disturbance of local drainage system.
9	River Bed	Less significant
10	Flora/Fauna	Less significant
11	Water Resources	Less significant
12	Accidents	1 Potential of increased traffic accidents before and/or during construction period.
13	Global Warming	Unknown, CO_2 emission loading may be reduced.

Table 2.3.7 Summary of Possible Impacts (Tazara Intersection, continued)

	Environmental Factor	Remarks of Possible Impact
14	Involuntary Resettlement	1. Temporal use of land space during construction (e.g., set-up of construction yard).
15	Local Economy	1. Possible impact on local employment and livelihood (e.g., street vendors)
16	Land use and Utilization of local Resources	1. Establish engineering integrity with on-going Nelson-Mandela Road improvement work.
17	Social Institutions	Less significant
18	Existing social infrastructures and services	1. Conflict with current local transport (e.g., daladala bus) system during construction.
19	Poor, indigenous of ethnic group	Less significant
20	Misdistribution of benefit and damage	Less significant
21	Local Conflict of interests	Less significant
22	Gender	Less significant
23	Children's right	Less significant
24	Cultural Heritage	Less significant
25	Infectious Disease	1. Risk of Dengue, Malaria and other Insect-borne diseases for construction workers.

2.4 Preliminary Environmental Impact Assessment

2.4.1 Scoping for Pre-EIA Study

Pre-EIA is concerned with potential natural and social environmental impacts to be caused by the proposed pre-feasibility projects. Those potential negative impacts are identified throughout the environmental screening/scoping of this report, summarized in previous section. Based on those screening/scoping results, pre-EIA study is carried out in accordance with the Tanzanian EIA law, JICA Guideline and relevant international EIA standards/guidelines. Main purpose of this pre-EIA study is to evaluate the potential impacts of the proposed projects at three different phases (i.e., pre-construction, construction, and operation phases), establish appropriate environmental mitigation and management programs, and provide fundamental environmental study results that support environmental license application processes that may be carried out by Tanzanian C/P. It shall be noted that actual environmental license application processes for selected pre-feasibility studies are not carried out within this environmental study.

ToR for this pre-EIA-related environmental field study is developed, based on Tanzanian EIA law and JICA Guideline as well as relevant international environmental guideline for the large-scale infrastructure development projects. Also, several remarks, suggestions/or comments obtained through a series of discussion/or consultation processes with NEMC and other relevant agencies/or organizations are incorporated within this ToR development.

2.4.2 Impact Assessment

(1) Introduction

Possible environmental impacts regarding environmental factors, listed in Tables 2.6 – 2.8, are summarized for each selected pre-feasibility projects, separately. Basically, more detailed studies shall be carried out for some of identified "Category-A" and "Category-B" environmental factors whereas simple analysis is for "Category-C" and "Category-D" ones within this pre-EIA study. More specific ToR descriptions for each "Category-A" and "Category-B" factors-related studies are to be delineated in following section.

(2) Descriptions of Impact Assessment: I. Bandari - Gerezani – Sokoine Road improvement project component.

1) Air Quality

i) Dust during the construction period

It is likely to have temporal dust problem for all Options A, B, C and D projects during the construction period. In general, construction activities of the proposed project would comprise of large-scale earthworks but are scheduled to be done within relatively short period. So, the magnitude of the dust level will not be major during this period. It is recommended that stock piles of sand and soil are well screened from residential areas. Frequent usage of sprinklers would be appropriate in Dar Es Salaam due to the fine soil characteristics (note that this water sprinkling is observed at on-going Kilwa road construction site). Multi-directional fall-out buckets should be used to monitor dust levels during the construction period.

ii) Local Air quality degradation after the operation starts.

Some local feeder roads connecting to the project sites run through residential area on where current traffic volumes are not so large. The future roadside air quality of some local feeder roads may be deteriorated due to the increased traffic volume after the construction. It would be better to carry out air quality-related study in order to evaluate the future air quality impacts on some residential areas.

2) Water Quality

Most of the existing Bandari and Gerezani Roads are to be widened within all Options A, B, C and D , and it is likely that some portion of Gerezani floodplain lowland area on where several creeks and natural springs exist will be disturbed temporally. So, there may be temporal water quality-related impact during the construction period. It would be essential to carry out the water quality analysis in order to obtain the baseline water quality data of those natural springs and creeks.

3) Soils and sedimentation

Current RoW of Bandari and Gerezani Roads is not wide enough for the road widening activity, proposed within Options A, B C and D, so it is highly likely that some portions of current roadside spaces would be disturbed. It is noted that there is an embankment section along Bandari Road. Minor traces of on-going erosion are observed at the slope of road shoulders along this section. There are several channels across this lowland area, and minor sedimentation may occur during the construction period. So, it is essential to prepare appropriate anti-erosion measures such as slope vegetation for newly constructed embankment.

4) Waste Disposal

i) Preparation of excavated soil dump site.

All excavated soils and other construction wastes will not be re-used and have to be dumped at proper waste disposal sites. Appropriate industrial waste treatment sites should be prepared and be large enough for the treatment of this excavated soil and construction wastes for all four options. More specific information such as total amounts and/or types of construction wastes will be available after the construction plan of the proposed project is delineated.

5) Noise/vibration

i) Noise and vibration during the construction period

Since construction activities, proposed within all options, will result in almost continuous noise from a mobile mechanical plant and others, the order of the magnitude of the noise and the vibration level will be significant during this period temporally. Entire construction activities maybe planned to be initiated during the night time, and applications of special mitigation measures such as noise barriers or silent construction machinery may be considered to alleviate the noise and the vibration impacts around the school or residential areas.

ii) Noise and vibration transmitted from the new transport system.

Due to the increased future traffic volume, predicted under both “Do-Nothing” and “Do-project” scenarios, the roadside noise environment of several points would become worse. However, if the proposed project will be implemented, entire future traffic circulation will be smooth due to the implementation of both more organized regional transport network system and the comprehensive traffic management program. So, the future roadside noise/vibration environment at some points may be improved to some extents, compared with “Do-Nothing” scenario.

Currently, several residential communities exist along those routes. So, it may be wise to prepare for the noise and/or vibration mitigation measures such as the noise barrier installment in order to lessen the potential noise and/or vibration impacts on surrounding residential areas.

6) Subsidence

Exiting embankment section of Bandari Road, road component contained within all four options, runs through parts Gerezani floodplain area, and its geological condition does not seem to be good. If a large-scale earthwork is to be done at this embankment section, minor subsidence may occur around the foot of this newly constructed embankment. It may be essential to prepare for appropriate anti-subsidence measures.

7) Bad Smell

Several slight obnoxious smells, presumably mixture of the vehicular emission, household compost and others, are sensed along the current roadside of the project route. It is likely that these points will be renovated and/or removed within the construction of the proposed project. So, it is expected that entire amenity of the road space will be improved as well as no major negative smell-related impact will be arisen.

8) Topography and Geology

Most of the road improvement works, proposed within all four options, will be conducted within the current plain RoW space and certain scale of sub-terrain construction activity is to be implemented within this proposed project. Several channels and drainage systems exist along these project routes, and minor impacts such as partial disturbance to those systems may be triggered during the construction period. It is essential to carry out a detailed hydrological study and prepare appropriate regional drainage program that would avoid the accidental occurrence of temporal inundation that may cause outbreak of mosquito.

9) River Bed

As mentioned earlier, several small creeks run through the Gerezani floodplain lowland area. So, it is essential to prepare appropriate anti-sedimentation mitigation measure as well as creek-bed monitoring system during the construction period.

10) Flora/Fauna

There are neither important environmental reserves nor ecologically sensitive area around study areas of all four options. So, no major impact on the overall flora/fauna will be expected. Several roadside vegetations exist along this entire project route of all four options. In Tanzania, the disposal of the roadside vegetation removed due to the construction work shall be consulted with the waste management section of DCC, and the project owner shall submit DCC both an inventory and total amount of roadside vegetation to be removed [DCC, 2007].

11) Water Resources

Most of the drinking water for entire residential areas along project routes of all four options is delivered through the piped water-supply system, not from groundwater pumping. Besides, no

important groundwater recharge areas exist around the project site either. So, it can be said that the impact on the regional water use is small.

There are several natural springs across the lowland area, mentioned earlier, and some of them are located within 100 meters from the current road centerline. No large-scale earthwork that would encroach the current regional aquifer system is to be carried out. So, no major impact on the regional water resources will be expected. However, it is essential to carry out baseline environmental surveys such as water quality survey for those spring water as precaution.

12) Accidents

i) Increased traffic levels during the construction for the road material transport.

Due to the delivery of a large amount of road construction materials and/or wastes, temporal traffic increase and/or resultant traffic jams are expected to occur at several sites for all four options. Several material sources such as asphalt, concrete, and aggregate plants and quarries are available around Dar Es Salaam. If those deliveries are spread throughout the entire project period, this may not result in significant increases in the road traffic.

ii) Increased risk of J-walking of widened road during the operation phase.

Project routes along Bandari and Gerezani Roads will be widened to 6-lane (Options A, B and C) and /or 4-lane (Option D), and traffic circulation is expected to be improved compared with current condition with frequent J-walk road crossing observed. It is essential to prepare an appropriate pedestrian protection program in order to avoid and/or lessen car-pedestrian crossing collision.

13) Global Warming

i) Possible CO_2 emission reduction after bus system operation starts.

The future traffic volume of project routes of all options will be increased for both "Do" and "Do-Nothing" scenarios, provided that no significant change in a city-wide traffic condition will occur. Total amount of the regional vehicular emission (e.g., CO_2) under "Do-Scenario" may be reduced due to the implementation of more organized transport system, compared with that of "Do-Nothing Scenario".

Beside these proposed projects, there are several on-going urban transport system improvement projects around the study area. It is quite essential to carry out quantitative evaluation of a cumulated amount of entire vehicular emission loading to be generated under each option. More detailed discussions of CO_2 emission will be presented in the vehicular emission study section of this technical report.

14) Involuntary Resettlement

i) Land Acquisition

There are small agricultural lands and private company's properties (e.g., storages facilities) at the

foot of the current road embankment section of Bandari Road. Several minor land acquisitions may be required for the road improvement work of all proposed options. It is essential to prepare an appropriate compensation program for possible land expropriation.

ii) Demolition of roadside houses

Current RoW of Bandari and Gerezani is not wide enough for the proposed road widening activity, so it is highly likely that some portions of roadside houses and/or buildings have to be expropriated. Preliminary expropriation estimation is to be conducted within the expropriation study section of his technical report.

iii) Illegal Squatters

No illegal squatters' community exits around the project site. So, no major illegal squatters-related impact will be expected.

15) Local Economy

Several street vendors are doing their business along this road. Besides, several shops are set up inside of current RoW. It is likely that those small-scale businesses would be affected to some extents during the construction period. Amenity of the current road space of the project route and relevant public transport system will be improved, and then positive indirect impacts on the local economy will be expected.

16) Land use and Utilization of local Resources

All Options A, B, C and D directly connect to Kilwa Road at where a road improvement work is on-going. Besides, the existing 2-lane Nelson Mandela Road, connecting to Bandari Road, may be improved to 4-lane road in the future. It is essential to establish engineering integrity among this on-going Kilwa Road Improvement project, a future Nelson Mandela road improvement plan and selected pre-feasibility study.

Several power line towers are set-up along Bandari Road, crossing Bandari Road around the BP office, and there is a railroad yard across the Gerezani floodplain lowland area. Besides, there is one railway crossing point and one short-spanned two-lane road bridge crossing the rail road, that is to be rehabilitated within all proposed options. There is one more rail road crossing in Options A, B and C. It is essential to establish engineering integrity between the proposed road improvement projects and those facilities.

17) Social Institutions

Project routes along existing Bandari and Gerezani Roads run through several communities, and those two roads will be widened to 6-lane (Options A, B and C) and /or 4-lane (Option D), having future increased traffic volume. As a result, some communities may be separated due to this widened road. It is essential to carry out more detailed social study in order to analyze the social structure of community of concerns and evaluate those social impacts.

18) Existing social infrastructures and services

Several commuter bus routes are running through the current existing road network system. Those bus operations would be hampered (e.g., temporal traffic diversion) to some extents during the construction period.

19) The poor, indigenous of ethnic group

No properties of poor/or indigenous people exist around project routes of all options. So, no major impact with this issue such as expropriation of sacred land for indigenous tribes will be expected.

20) Misdistribution of benefit and damage

Main purpose of this proposed project is to improve the local traffic condition along Bandari, Gerezani and Sokoine Roads and maximize the regional transport network system without avoiding misdistribution of benefit and damage. So, no major direct impact on this issue will be expected.

21) Local Conflict of interests

As mentioned earlier, the main purpose of this proposed project is to improve the regional transport network system, and entire amenity of the public transportation system will be improved without causing local conflicts of interests. So, no major impact on this issue will be expected.

22) Gender

No serious gender-related issue is reported around project sites of all options. So, no major gender-related impact will be expected. On the contrary, the access to major market places or relevant facilities along the project route will be improved. So, certain indirect and/or second positive impacts will be expected (e.g., increase of household income).

23) Children's right

No serious children's right-related issue is reported around the project site. So, no major negative impact with this issue will be expected. On the contrary, the access to schools or relevant facilities will be improved. So, certain indirect and/or second positive impacts will be expected.

24) Cultural Heritage

No important archeological/historical/cultural and/or monumental properties exist around project sites of all options. So, no major cultural-heritage-related impact will be expected.

25) Infectious Disease

Malaria and other waterborne diseases are rampant across the entire city. So, there may be major infectious diseases-related impact for construction workers.

(3) Descriptions of Impact Assessment: Harbor Crossing Bridge Construction Project component – Option D

1) Air Quality

i) Dust during the construction period

It is likely to have temporal dust problem during the construction period. In general, construction activities of the proposed crossing project are scheduled to be done within relatively short period. So, the magnitude of the dust level will not be major during this period. It is recommended that stock piles of sand and soil are well screened from residential areas. Frequent usage of sprinklers would be appropriate in Dar Es Salaam due to the fine soil characteristics. Multi-directional fall-out buckets should be used to monitor dust levels during the construction period.

ii) Local Air quality degradation after the operation starts

The route connecting the city center and Kilwa Road via the proposed harbor crossing would be one of important future main corridors (see Transport Planning Section of this main report for more detailed information) in Dar Es Salaam. So, it is expected to have a huge traffic volume along this corridor after its operation will start. Eventually, the future roadside air quality of this corridor may be deteriorated due to the increased traffic volume.

2) Water Quality

There is no major tributary around the study area, so, no major water quality-related impact will be expected. Some portion of the proposed alignment would run through the coastal area, so minor water quality degradation due to the accidental spillage of construction materials and/or wastes may occur during the construction period.

3) Soils and sedimentation

The approach road at Kilwa Road side would run through the hill at where minor traces of on-going erosion are observed. So, if several earthworks (e.g., cutting and/or earthwork) are to be carried out around this area, minor soil erosion may be triggered during the construction period. It is essential to prepare appropriate anti-erosion measures such as slope vegetation for newly constructed embankment of the proposed approach road.

4) Waste Disposal

i) Preparation of excavated soil dump site

All excavated soils and other construction wastes will not be re-used and have to be dumped at proper waste disposal sites. Appropriate industrial waste treatment sites should be prepared and be large enough for the treatment of this excavated soil and construction wastes. More specific amount and/or type of construction wastes will be available after the construction schedule of the proposed project is delineated.

5) Noise/vibration

i) Noise and vibration during the construction period

Since construction activities will result in almost continuous noise from a mobile mechanical plant and others, the order of the magnitude of the noise and the vibration level will be significant during this period. Entire construction activities maybe planned to be initiated during the night time, and applications of special mitigation measures such as noise barriers or silent construction machinery may be considered to alleviate the noise and the vibration impacts.

ii) Noise and vibration transmitted from the new transport system.

Due to the increased future traffic volume, predicted under both "Do-Nothing" and "Do-project" scenarios, the future roadside noise environment of several major routes connecting this proposed alignment would become worse. However, if the proposed project will be implemented, entire future traffic circulation will be smooth due to both the introduction of more organized regional transport system and the implementation of the comprehensive traffic management program. So, the future roadside noise/vibration environment at some points may be improved to some extents, compared with "Do-Nothing" scenario.

6) Subsidence

The project alignment cuts through Gerezani floodplain lowland area, and as mentioned earlier, the geological condition of this floodplain area is not good. If a large-scale earthwork is to be done at the approach road embankment section, a minor subsidence may occur around the foot of this newly constructed embankment. It may be essential to prepare for appropriate anti-subsidence measures.

7) Bad Smell

There are several slight smelly points along the project route. It is likely that these points will be renovated and/or removed within the construction of the proposed project. So, no major negative smell-related impact will be arisen.

8) Topography and Geology

Construction of new approach roads at both Kilwa and CBD sides may disturb regional drainage system. Also, it is likely that there is several buried drainage system inside of port. It is essential to carry out a detailed hydrological study and prepare appropriate regional drainage program that would avoid the accidental occurrence of temporal inundation that may cause outbreak of mosquito.

9) River Bed

As mentioned earlier, there is no major tributary, so, no major river bed-related impact will be expected.

10) Flora/Fauna

There are neither important environmental reserves nor ecologically sensitive area around the study area. So, no major flora/fauna-related impact will be expected.

11) Water Resources

No groundwater recharge areas exist around the study area. So, no major impact on the regional water resources will be expected.

12) Accidents

i) Increased traffic levels during the construction for the road material transport

Due to the delivery of a large amount of construction materials and/or wastes, temporal traffic increase and/or resultant traffic jams are expected to be occurred at several sites. Several material sources such as asphalt, concrete, and aggregate plants and quarries are available around Dar Es Salaam. If those deliveries are spread throughout the entire project period, this may not result in significant increases in the road traffic.

13) Global Warming

i) Possible CO_2 emission reduction after bus system operation starts

As mentioned previously, the future traffic volume of the project route will be increased for both "Do" and "Do-Nothing" scenarios, provided that no significant change in a city-wide traffic condition will occur. Total amount of the regional vehicular emission (e.g., CO_2) under "Do-Scenario" may be reduced due to the implementation of more organized transport system, compared with that of "Do-Nothing Scenario".

Beside this proposed project, there are several on-going urban transport system improvement projects around the study area. It is quite essential to carry out quantitative evaluation of a cumulated amount of entire vehicular emission loading to be generated from each project. More detailed discussions of CO_2 emission will be presented in the vehicular emission study section of this main report.

14) Involuntary Resettlement

i) Acquisition TPA properties

No private property exists along the project route. Most of the proposed alignment would run through the current port facility, so some portions of that facility would be expropriated (e.g., construction of several bridge piers and abutments). The construction of new approach road at CBD side will require certain amounts of land acquisitions.

ii) Demolition of roadside houses

Kilwa-side approach road will hit several TPA facilities directly, so it is highly likely that several

demolitions would be unavoidable due to the construction of this approach road at this side. As mentioned earlier, the land acquisition to be required for the construction of new approach road at CBD side will cause certain amounts of house/or building demolitions. Preliminary expropriation estimation is to be conducted within the expropriation study section of his technical report.

iii) Illegal Squatters

No illegal squatters' community exits around the project site. So, no major illegal squatters-related impact will be expected.

15) Local Economy

Amenity of future regional road network and relevant public transport system will be improved, and then positive indirect impacts on the local economy will be expected.

16) Land use and Utilization of local Resources

Most of the alignment will run through the current Tanzania Port facility. Currently, TPA has several port rehabilitation plans such as the construction of a multi-story car parking facilities that would be located very close to the proposed crossing alignment. Also, several rail road line and storage facilities exist across the current port yard. It is essential to establish engineering integrity between the proposed road improvement project and those facilities.

Approach road of this harbor crossing at Kilwa side directly connects to Kilwa Road at where a road improvement work is on-going. Besides, the existing 2-lane Nelson Mandela Road, to be connected to Kilwa side approach road, may be improved to 4-lane road in the future. It is essential to establish engineering integrity among this on-going Kilwa Road improvement project, a future Nelson Mandela road improvement plan and this proposed harbor crossing project.

17) Social Institutions

As mentioned earlier, most part of the alignment will run through within the current busy Tanzania Port facility that has a strict port-wide security system. Frequent deliveries of construction materials and/or wastes and mass movement of construction workers may disturb the port security system to some extents during the construction period.

18) Existing social infrastructures and services

As mentioned earlier, many trailers are circulating inside of current Tanzania Port. Besides, several railway lines exist across this port yard. Frequent deliveries of construction materials and/or wastes and mass movement of construction workers may disturb this port activity to some extents during the construction period.

19) The poor, indigenous of ethnic group

No properties of poor/or indigenous people exist around the project route. So, no major impact with this issue such as expropriation of sacred land for indigenous tribes will be expected.

20) Misdistribution of benefit and damage

As described earlier, there is a possibility that the construction activities of this harbor crossing will hamper the port operation and may cause some temporal damages and/or loss of profits to TPA. It is essential to feedback TPA's opinions/or comments into this harbor crossing project and minimize those damage as small as possible, without causing any misdistribution of benefit and damages.

21) Local Conflict of interests

As mentioned earlier, main purpose of this proposed project is to improve the regional transport network system, and entire amenity of the public transportation system will be improved without causing local conflicts of interests. So, no major impact on this issue will be expected.

22) Gender

No serious gender-related issue is reported around the project site. So, no major gender-related impact will be expected. On the contrary, the access to major market places or relevant facilities along the project route will be improved. So, certain indirect and/or second positive impacts will be expected (e.g., increase of household income).

23) Children's right

No serious children's right-related issue is reported around the project site. So, no major negative impact with this issue will be expected. On the contrary, the access to schools or relevant facilities will be improved. So, certain indirect and/or second positive impacts will be expected.

24) Cultural Heritage

No important archeological/historical/cultural and/or monumental properties exist around the project site. So, no major cultural-heritage-related impact will be expected.

25) Infectious Disease

Malaria and other waterborne diseases are rampant across the entire city. So, there may be major infectious diseases-related impact for construction workers.

(4) Descriptions of Impact Assessment: Tazara Intersection Improvement Project

1) Air Quality

i) Dust during the construction period

It is likely to have temporal dust problem during the construction period. It is recommended that stock piles of sand and soil are well screened from residential areas. Frequent usage of sprinklers would be appropriate in Dar Es Salaam due to the fine soil characteristics. Multi-directional fall-out buckets should be used to monitor dust levels during the construction period.

ii) Local Air quality degradation after the operation starts

The future traffic volume of the project route will be increased for both "Do" and "Do-Nothing" scenarios, provided that no significant change in city-wide traffic condition will occur. Future roadside air quality issue around this intersection would highly depend on the future traffic demand circulating around this intersection. Current traffic congestion problem at this intersection seems to be chronic, and may be solved after the operation of this graded flyover will start. Eventually, the future roadside air quality around this intersection may be improved due to the smoothing of entire traffic flows.

2) Water Quality

There is no major tributary around the study area, so, no major water quality-related impact will be expected.

3) Soils and sedimentation

The existence of contaminated soil sites around the project site is not reported yet. So, no major soil and sedimentation-related impact will be expected.

4) Waste Disposal

i) Preparation of excavated soil dump site

All excavated soils and other construction wastes will not be re-used and have to be dumped at proper waste disposal sites. Appropriate industrial waste treatment sites should be prepared and be large enough for the treatment of this excavated soil and construction wastes. More specific amount and/or type of construction wastes will be available after the construction plan of the proposed project is delineated.

5) Noise/vibration

i) Noise and vibration during the construction period

Since construction activities will result in almost continuous noise from a mobile mechanical plant and others, the order of the magnitude of the noise and the vibration level will be significant during this period. Entire construction activities maybe planned to be initiated during the night time, and applications of special mitigation measures such as noise barriers or silent construction machinery may be considered to alleviate the noise and the vibration impacts around the school or residential areas.

ii) Noise and vibration transmitted from the new transport system

Due to the increased future traffic volume, predicted under both "Do-Nothing" and "Do-project" scenarios, the future roadside noise environment of several points along major roads would become worse. As mentioned earlier, the future roadside noise and vibration issue around this intersection would highly depend on the future traffic demand circulating around this intersection.

However, if the proposed project will be implemented, entire future traffic circulation will be smooth due to both the construction of graded intersection and the implementation of the comprehensive traffic management program. So, the future roadside noise/vibration environment at some points may be improved to some extents, compared with "Do-Nothing" scenario.

Currently, there is one hospital at the roadside of Nyerere Road, approximately 100 meter away from this intersection. So, it may be wise to prepare for the noise and/or vibration mitigation measures such as the noise barrier installment in order to lessen the noise and/or vibration impacts on this hospital.

6) Subsidence

The existence of geologically unstable area around the project site is not reported yet. So, no major subsidence-related impact will be expected.

7) Bad Smell

Several slight obnoxious smells, presumably mixture of vehicular emission, roadside litters and others, are sensed around this intersection. It is likely that these points will be renovated and/or removed within the construction of the proposed project. So, it is expected that entire amenity of the road space around this intersection will be improved as well as no major negative smell-related impact will be arisen.

8) Topography and Geology

Most of the intersection improvement works will be conducted within the current plain RoW space and certain amounts of sub-terrain construction activity is to be implemented within this project. The capacity of existing drainage facility around Tazara intersection may be good enough to handle additional road surface run-off rainfall water,, to be caused by the construction of the flyover (L=600 m). It is essential to carry out appropriate hydrological study for future regional drainage system.

9) River Bed

As mentioned earlier, there is no major tributary, so, no major river bed-related impact will be expected.

10) Flora/Fauna

There are neither important environmental reserves nor ecologically sensitive area around the study area. So, no major flora/fauna-related impact will be expected.

11) Water Resources

No important groundwater recharge areas exist around the study area. So, no major impact on the regional water resources will be expected.

12) Accidents

i) Increased traffic levels during the construction for the road material transport

Due to the delivery of a large amount of construction materials and/or wastes, temporal traffic increase and/or resultant traffic jams are expected to be occurred at several sites. Several material sources such as asphalt, concrete, and aggregate plants and quarries are available around Dar Es Salaam. If those deliveries are spread throughout the entire project period, this may not result in significant increases in the road traffic.

13) Global Warming

i) Possible CO_2 emission reduction after bus system operation starts

As mentioned previously, the future traffic volume of the project route will be increased for both "Do" and "Do-Nothing" scenarios, provided that no significant change in a city-wide traffic condition will occur. Total amount of the regional vehicular emission (e.g., CO_2) under "Do-Scenario" may be reduced due to the implementation of more organized transport system, compared with that of "Do-Nothing Scenario".

Beside this proposed project, there are several on-going urban transport system improvement projects around the study area. It is quite essential to carry out quantitative evaluation of a cumulated amount of entire vehicular emission loading to be generated from each project. More detailed discussions of CO_2 emission will be presented in the vehicular emission study section of this main report.

14) Involuntary Resettlement

i) Private land Acquisition

Most of the intersection improvement works will be conducted within the current plain RoW space. So, no major expropriation-related impact will be expected.

ii) Illegal Squatters

No illegal squatters' community exits around the project site. So, no major illegal squatters-related impact will be expected.

15) Local Economy

There are many street vendors and several small shops around this intersection. It is likely that those small-scale businesses would be affected to some extents during the construction period. Amenity of the current road space of the intersection and relevant public transport system will be improved, and then positive indirect impacts on the local economy will be expected.

16) Land use and Utilization of local Resources

The land use around this intersection is classified as the industrial/commercial mixed one. There are

many factories and/or offices along around this intersection. Currently, road improvement works of Nelson Mandela Road, funded by EU, are on-going. It is essential to establish engineering integrity between the proposed intersection improvement project and those on-going ones.

17) Social Institutions

The proposed intersection improvement project is an infrastructure development one, so no major direct impact on the social institutions of surrounding environment will be expected.

18) Existing social infrastructures and services

Several community bus routes are running and there are several bus stops around this intersection. So, it is very likely that these facilities will be affected (i.e., demolished and/or relocated) and local bus operations circulating this intersection would be hampered, mainly due to the, temporal traffic diversion to some extents during the construction period. Tazara Railway Station is located at the southeast corner of existing intersection. It is essential to establish good and safe access to this railway station facility from the proposed flyover structure. It is reported that several channels and drainage systems are buried around this intersection, and minor impacts such as partial disturbance to those systems may be triggered during the construction period.

19) The poor, indigenous of ethnic group

No properties of poor/or indigenous people exist around the project route. So, no major impact with this issue such as expropriation of sacred land for indigenous tribes will be expected.

20) Misdistribution of benefit and damage

Main purpose of this proposed project is to improve Tazara intersection, and, then, maximize total benefits of the regional transport system without avoiding misdistribution of benefit and damage. So, no major direct impact on this issue will be expected.

21) Local Conflict of interests

As mentioned earlier, main purpose of this proposed project is to improve the urban transport network system, and entire amenity around the Tazara intersection will be improved without causing local conflicts of interests. So, no major impact on this issue will be expected.

22) Gender

No serious gender-related issue is reported around the project site. So, no major gender-related impact will be expected. On the contrary, the access to major market places or relevant facilities along the project route will be improved. So, certain indirect and/or second positive impacts will be expected (e.g., increase of household income).

23) Children's right

No serious children’s right-related issue is reported around the project site. So, no major negative

impact with this issue will be expected. On the contrary, the access to schools or relevant facilities will be improved. So, certain indirect and/or second positive impacts will be expected.

24) Cultural Heritage

No important archeological/historical/cultural and/or monumental properties exist around the project site. So, no major cultural-heritage-related impact will be expected.

25) Infectious Disease

Malaria and other waterborne diseases are rampant across the entire city. So, there may be major infectious diseases-related impact for construction workers.

2.4.3 ToR of Pre-EIA-related field Survey

Based on the potential impacts that may be induced during both construction and operation phases of selected pre-feasibility projects, described above, further environmental studies/or surveys, regarding several environmental issues, are carried out. Tables 2.4.1 and 2.4.2 summarize the ToR of field surveys, conducted within this environmental study.

Table 2.4.1 Field Environmental Survey (Bio-Physical)

1. Roadside Air Quality
Carry out 24-hours continuous survey at five (5) points across the entire study area. Parameter: PM10 and NOX Traffic volume by vehicle type Survey Campaign: Once in November.
2. Roadside Noise
Carry out 24-hours continuous survey at five (5) points across the entire study area. Parameter: Leq, Traffic volume by vehicle type Survey Campaign: Once in November.
3. Water Quality Survey
Ten sampling points in total shall be designated in/around for whole study area. During the field study, conducted by JICA Study Team, several natural spring sites are identified around the lowland area of Bandari – Gerezani Roads. Those ten sites shall be incorporated as water sampling sites for this study. Ten parameters such as pH, turbidity, DO, BOD, COD, conductivity, temperature, SS, E-Coli form and Total Coli form are of concern.
4. Soil Survey
Soil survey is to be carried out at five points in order to obtain the baseline soil characteristics data that would support the identification of potential soil contaminated sites. Four heavy metal and other contaminant parameters such as iron, lead, zinc and mercury are of concern.
5. Regional Drainage Study
The preliminary drainage study is to be carried out in order to summarize current inventory of drainage facilities (e.g., box culvert, ditch, pipe and others), analyze the current regional drainage system, study regional hydrological features, and to feedback those information to a suitable design of the drainage system that might be associated with selected pilot projects.

Table 2.4.2 Field Environmental Survey (Socio-Cultural)

1. Questionnaire-based public opinion survey
Community participation plays an important role for proper infrastructure project planning and management. It is essential to examine variety of aspects of the proposed project based on the current community's needs or priority. A socio-cultural survey is to be carried out in order to grasp the public opinion about this proposed project from nearby community properly.
2. Roadside Housing/Facility Survey
The main objective of this survey is to grasp the precise condition of current roadside housing/major facilities including roadside electric poll and vegetation, located along each project routes. This survey shall be conducted within 100 meters both sides of road centerlines.
3. Roadside Health Survey
In order to grasp the current health conditions of people working at heavy traffic congestion areas of Dar Es Salaam City and to study the health damage to be caused by the vehicular emission, the questionnaire-based health damage survey shall be carried out. (1) Traffic police officers in charge of traffic control and patrol (50 officers) (2) Street vendors (50 persons) (3) Office worker (50 persons)

2.5 Environmental Field Survey

2.5.1 Introduction

Based on the ToR developed in previous section, following eight EIA-related environmental field studies were carried out for the selected two project sites:

(1) Roadside Air Quality Survey
(2) Roadside Noise Survey
(3) Water Quality Survey
(4) Soil Survey
(5) Regional Drainage Survey
(6) Roadside House/Facilities Survey
(7) Questionnaire-based public opinion survey
(8) Questionnaire-based roadside heath damage survey

Study results of each survey are described in following sections, separately. It should be noted that major outputs of regional drainage and roadside house/facilities surveys such as inventories of existing drainage facilities and roadside house/facilities are summarized in separate documentations.

2.5.2 Roadside Air Quality Survey

(1) Outline of the Field Survey.

In order to analyze the current roadside air quality condition of the two sites, the roadside air quality field measurements were carried out. Two parameters: PM-10 and NOX are of concern in this field survey. Beside these two parameters, the hourly traffic volume count survey at four roadside points

(i.e., Points 1 – 4) was also conducted at the same time. Based on the current traffic condition of the study area, five survey sites along the project route representing dominant characteristics of the current public transport system, land use, and topographical conditions were chosen for the roadside air quality measurements. Basically, 24-hours continuous roadside air quality surveys were conducted. Among of 5 points, two points are located around Gerezani Area while other two around Tazara Intersection, and remaining one at TIRDO. Tables 2.5.1 and 2.5.2 summarize the basic measure of the air quality measurements. It is noted that Point 5 (TIRDO) is used for the background air quality survey to study relatively less polluted environment that does not receive any severe impacts from the traffic.

Table 2.5.1 Instruments Used for Air Quality Measurements

Pollutant	Instrument Used for Measurement
Dust (PM-10)	Airmetrics (Minivol. Portable Air Sampler), USA
Nox	Same as above

Notes: Total number of sampling points = 5, Measuring period: November 2007 and January 2008.

Table 2.5.2 Measurement Point Location (Air Quality)

Point #	Location (approx)
1	Gerezani Road (between Sokoine and the roundabout)
2	Gerezani Road (between Nyerere Road and the roundabout)
3	TOHS, Hospital near to Tazara Intersection
4	Buguruni (Nelson Mandela)
5	Inside of TIRDO, Bagamoyo

Note: Roadside noise measurement is carried out, using same 5 survey points.

(2) Results and Discussions

1) PM-10

Figures 2.5.1 – 2.5.5 show the time variation of three hour-averaged PM-10 concentration values and hourly traffic counting results, measured at all five sampling points. As shown in these figures, all measured values except Point 5 are varied between 350μg/m3 and 10μg/m3 (maximum and minimum measured PM-10 value are of 344μg/m3 and 11μg/m3, respectively). As shown in these figures, measured PM 10 values at all roadside points seem to have diurnal variation patterns that have correlation with nearby traffic conditions. Most of them tend to have relatively higher values around morning, noon and evening peaks whereas get subdued after the midnight.

Table 2.5.3 summarizes the daily-averaged PM-10 values of all survey results. As of December 2007, no air quality-related environmental standard exists in Tanzania. In general, a daily averaged PM10 environmental standard, implemented in other developing and/or developed countries, is of roughly 150μg/m3 . Using this fact, it can be said that current roadside air quality (i.e., dust) conditions of Tazara Intersection and Nelson Mandela Road are not in good condition, in particular, PM10 value of Tazara exceeds that PM10-related environmental standard, commonly implemented in other countries.

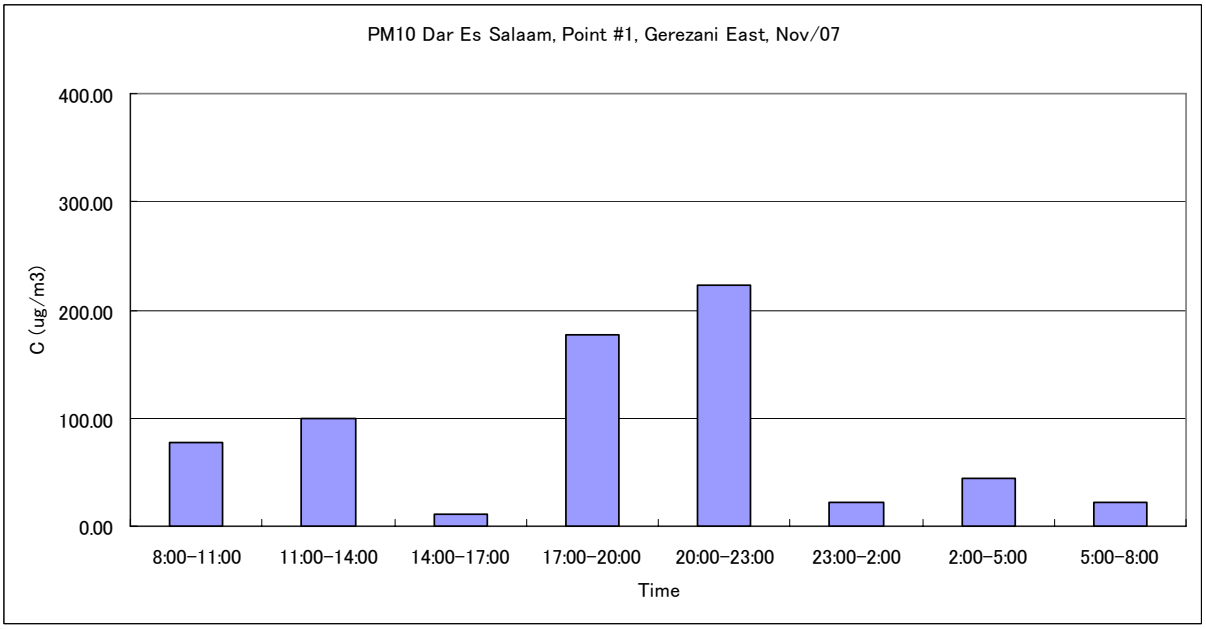


Figure 2.5.1(a) Roadside A/Q Survey (PM 10, Point #1, Gerezani East, November 2007)

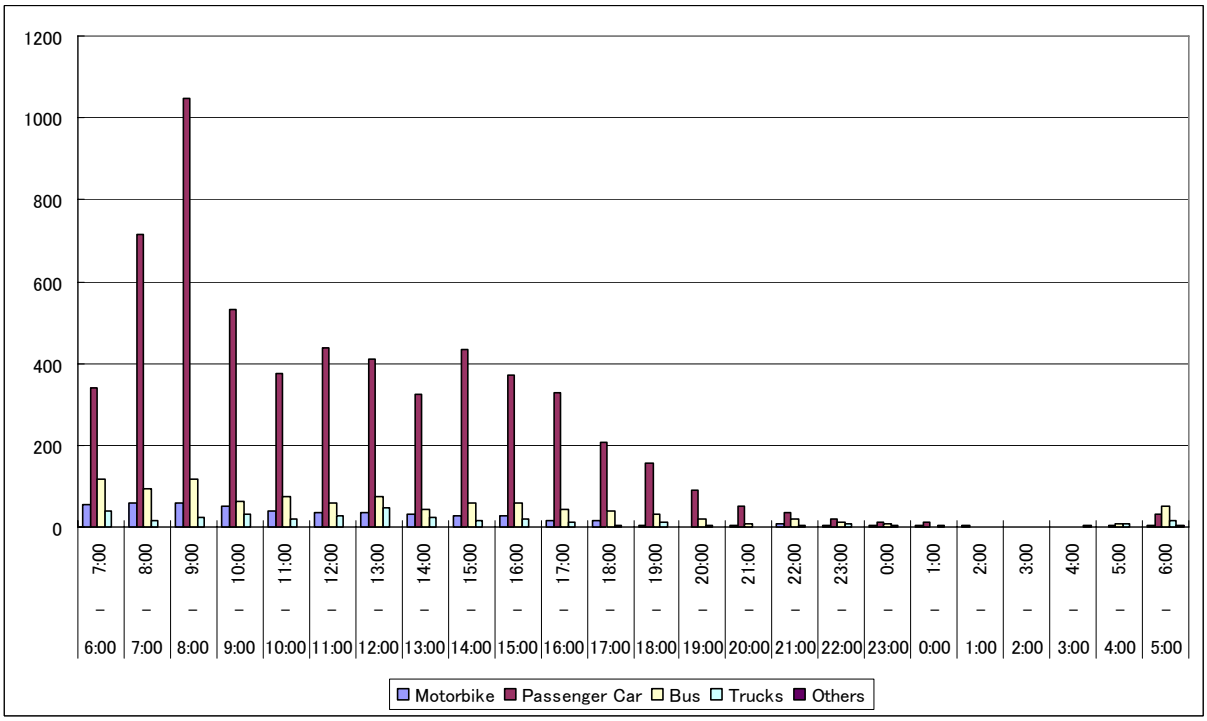


Figure 2.5.1 (b) Hourly Traffic Counting Result (Point #1, Gerezani East, November 2007)

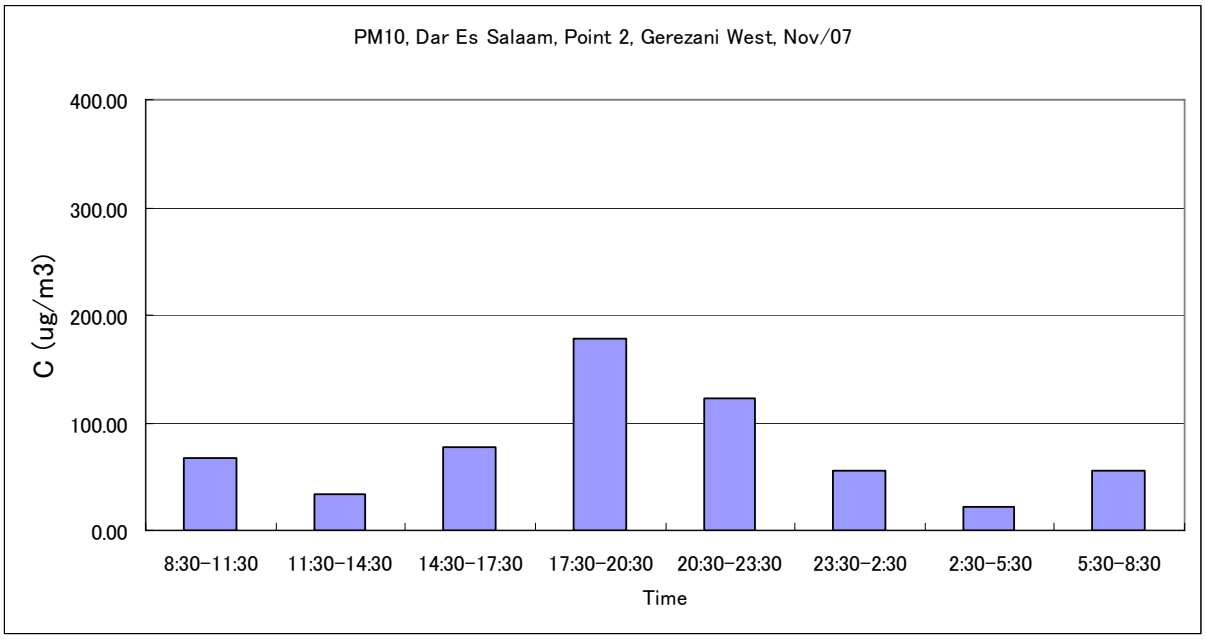


Figure 2.5.2 (a) Roadside A/Q Survey (PM 10, Point #2, Gerezani West, November 2007)

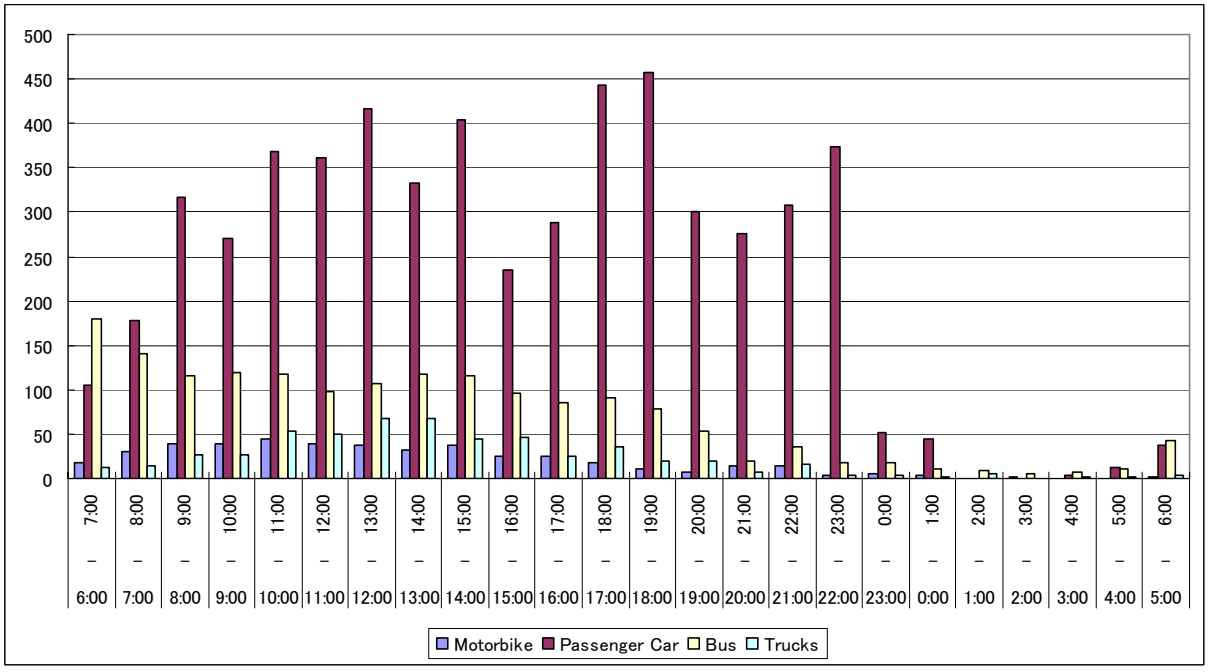


Figure 2.5.2 (b) Hourly Traffic Counting Result (Point #2, Gerezani West, November 2007)

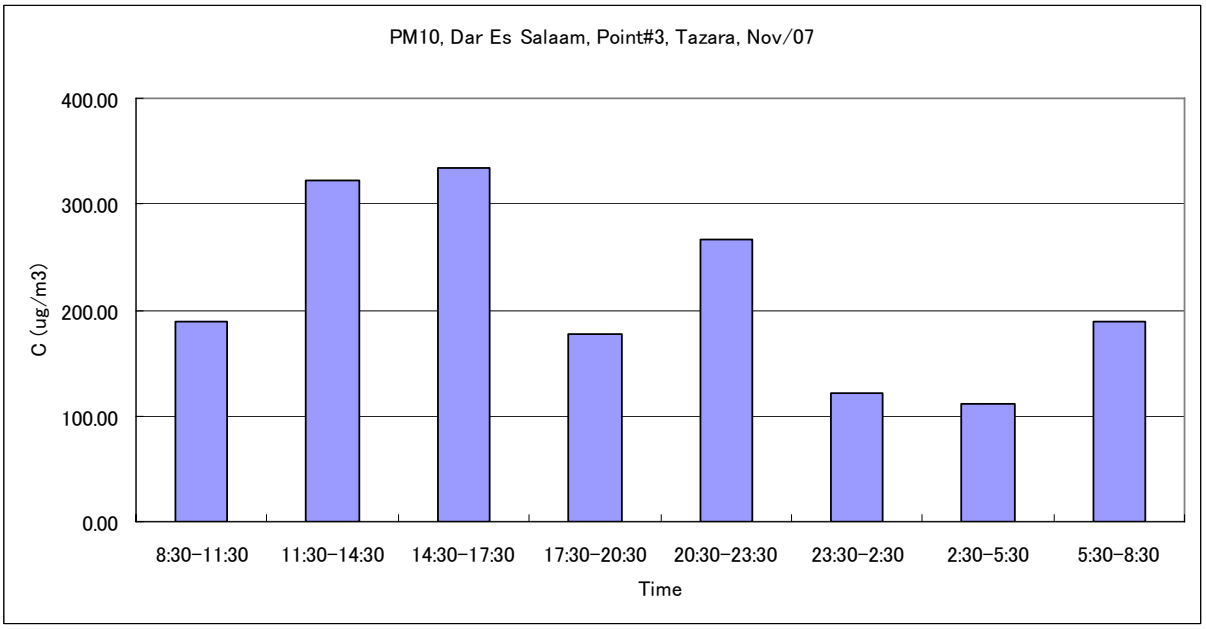


Figure 2.5.3 (a) Roadside A/Q Survey (PM 10, Point #3, Tazara, November 2007)

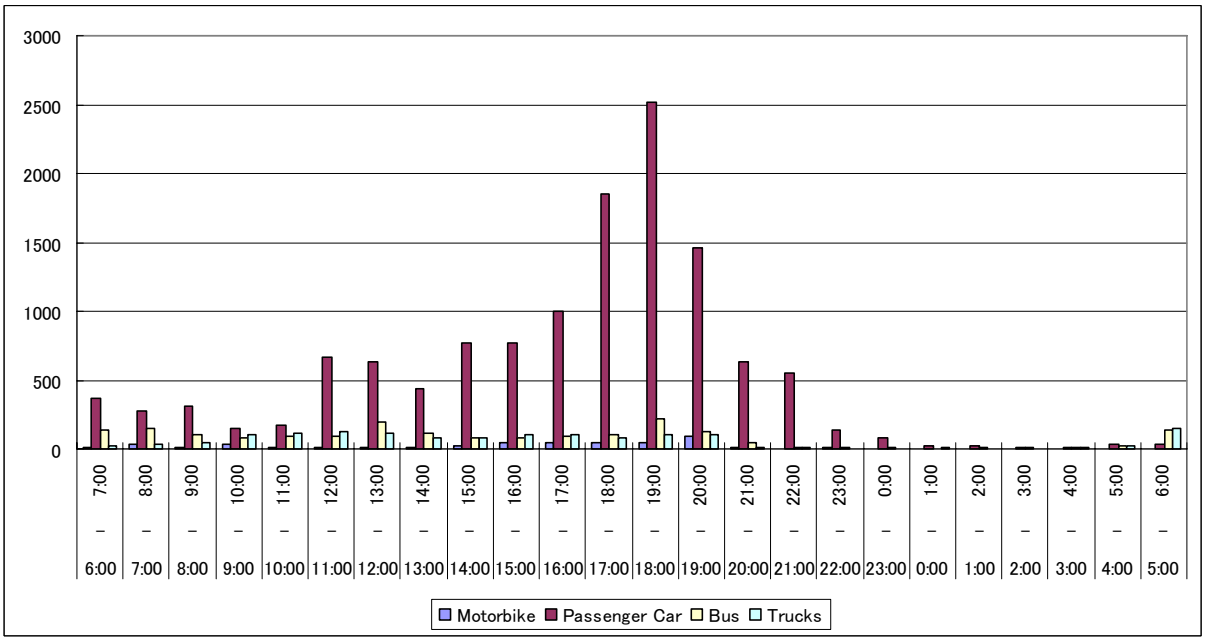


Figure 2.5.3 (b) Hourly Traffic Counting Result (Point #3, Tazara, November 2007)

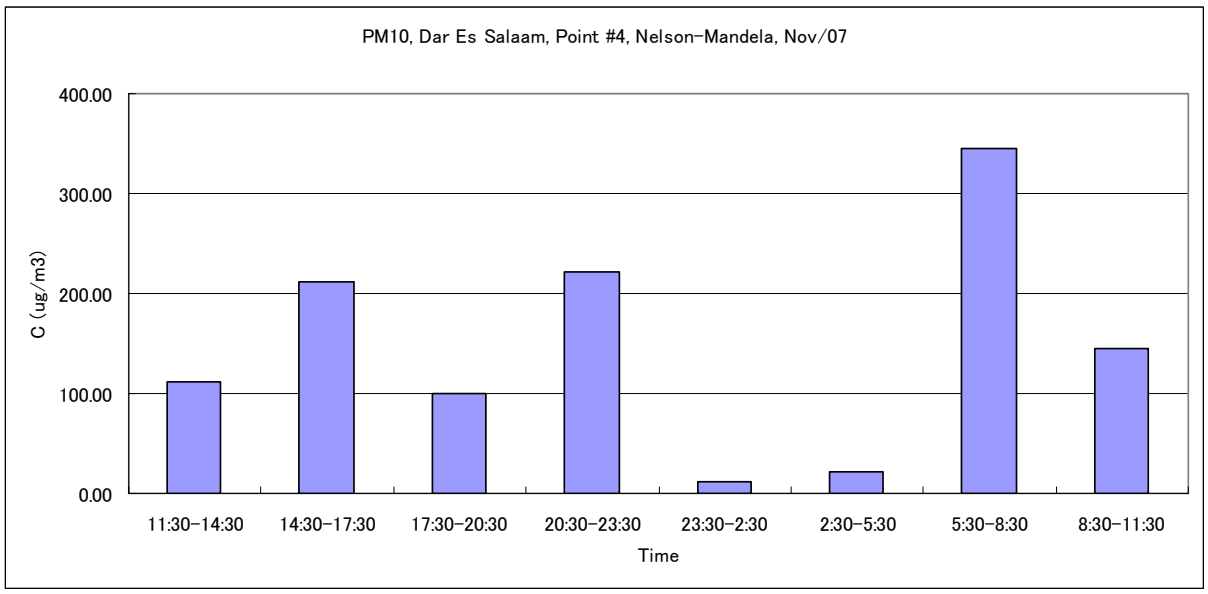


Figure 2.5.4 (a) Roadside A/Q Survey (PM 10, Point #4, Buguruni Nelson Mandela, November 2007)

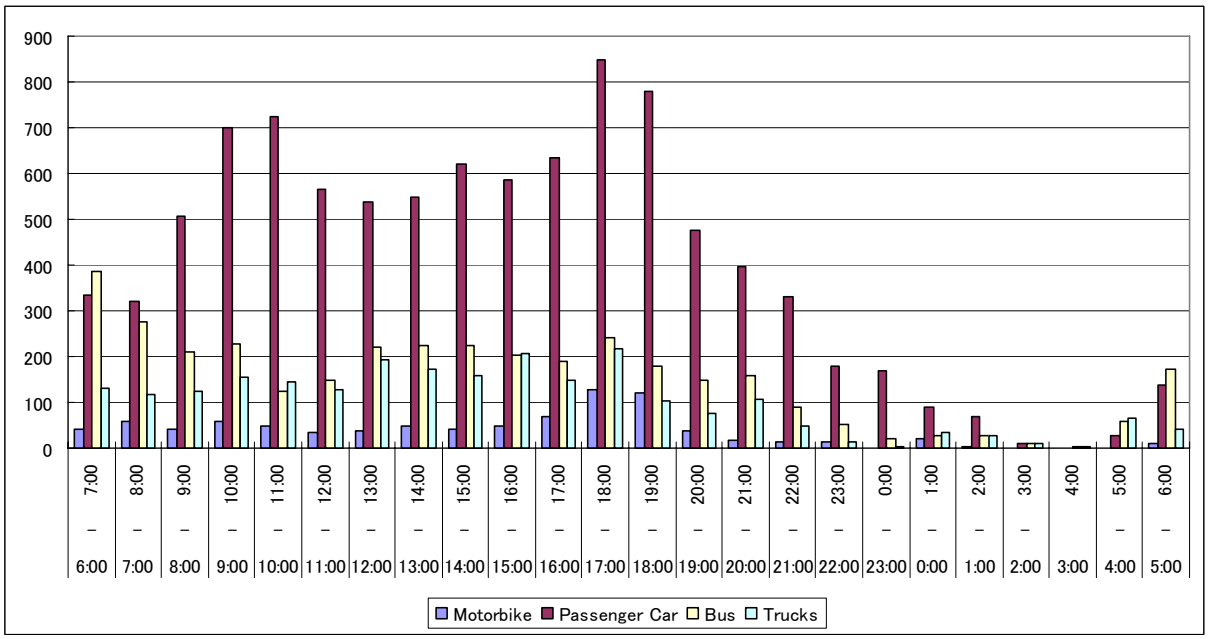


Figure 2.5.4 (b) Hourly Traffic Counting Result (Point #4, Buguruni Nelson Mandela, November 2007)

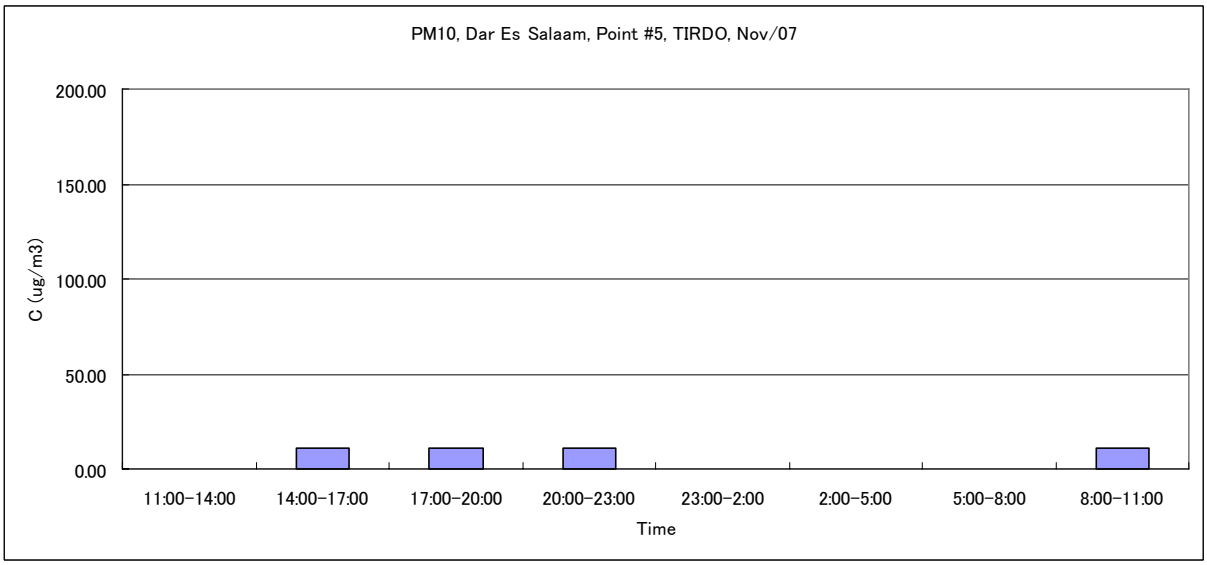


Figure 2.5.5 Roadside A/Q Survey (PM 10, Point #5, TIRDO, November 2007)

Table 2.5.3 Daily Averaged Survey Values (PM10)

	PM10 (ug/m^3)
1	85
2	76
3	214
4	146
5	6

2) NOx

Figures 2.5.6 – 2.5.10 show the time variation of three hour-averaged NO_X concentration values, measured at all five sampling points. As shown in these figures, all measured values except Point 5 are varied between 150 ppb and 1 ppb (maximum and minimum measured NO_X value are of 143 ppb and 1 ppb, respectively). Similar diurnal variation pattern, discussed in previously, exist, and most of roadside NO_X values tend to have relatively higher values during day-time and early evening whereas get subdued after the midnight.

Table 2.5.4 summarizes the daily-averaged NO and NO_2 values of all survey results. As mentioned earlier, no air quality-related environmental standard exists in Tanzania, yet. 1-hour averaged NO_2 environmental standard, implemented in other countries, is of roughly 300μg/m3 (roughly 100 ppb). In general, the order of the magnitude of 1 hour-averaged value is several times higher than 3 hours-averaged one (Note that only 3-hour averaged NO_2 value was surveyed due to the technical limitations of equipments used within this field study). From these facts, it can be said that the current roadside NO_2 conditions are not in good condition.

(3) Conclusions

The air quality survey suggest that the current roadside air quality conditions along major roads such as Gerezani, Nyerere and Nelson Mandela are not good for human health. Daily air quality fluctuation pattern at each survey site is parallel to the traffic volume at each site respectively. It is safe to sat that the current roadside air quality degradation is caused mainly by vehicular emissions, and which can be mitigated by alleviating chronic traffic congestions (by the proposed projects). It should be noted that most of the vehicular emissions are originated from ill-conditioned vehicles such as old daladala. In addition to the proposed physical improvement, establishment of a proper vehicle inspection could be effective to improve the air quality along the roadside.

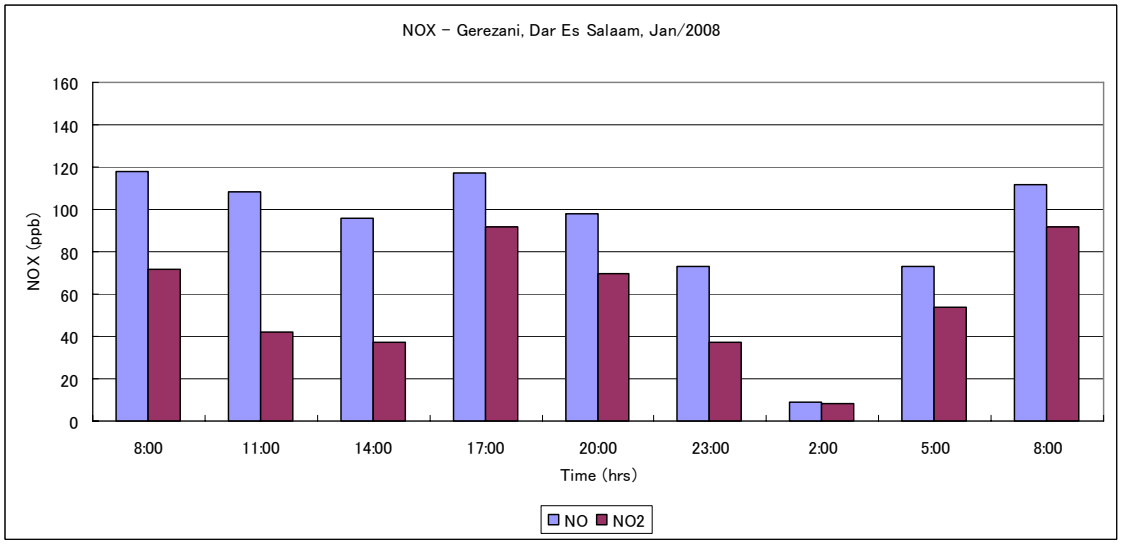


Figure 2.5.6 Roadside A/Q Survey (NOX, Point #1, Gerezani East, January 2008)

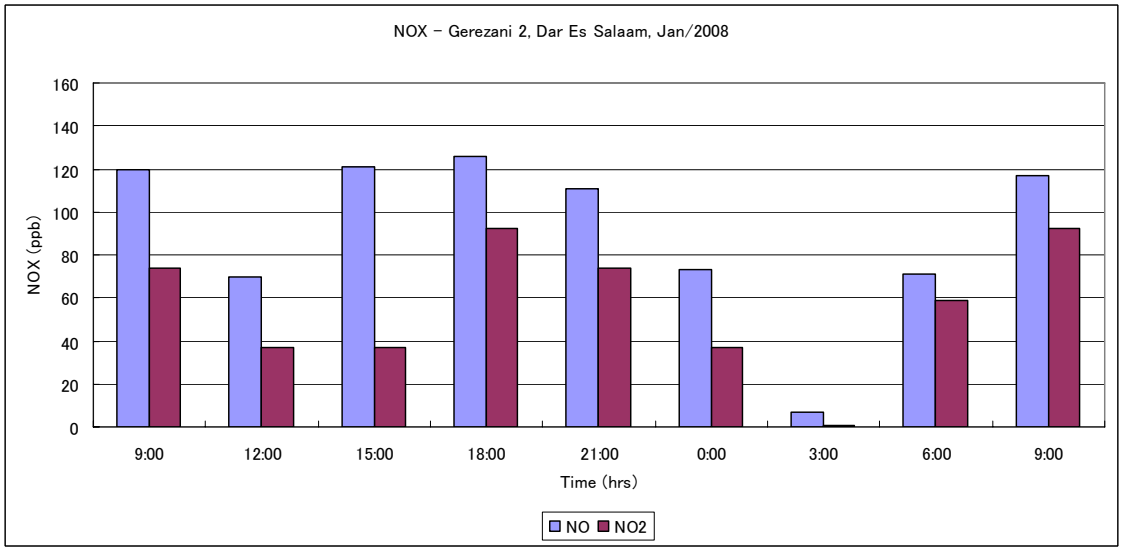


Figure 2.5.7 Roadside A/Q Survey (NOX, Point #2, Gerezani West, January 2008)

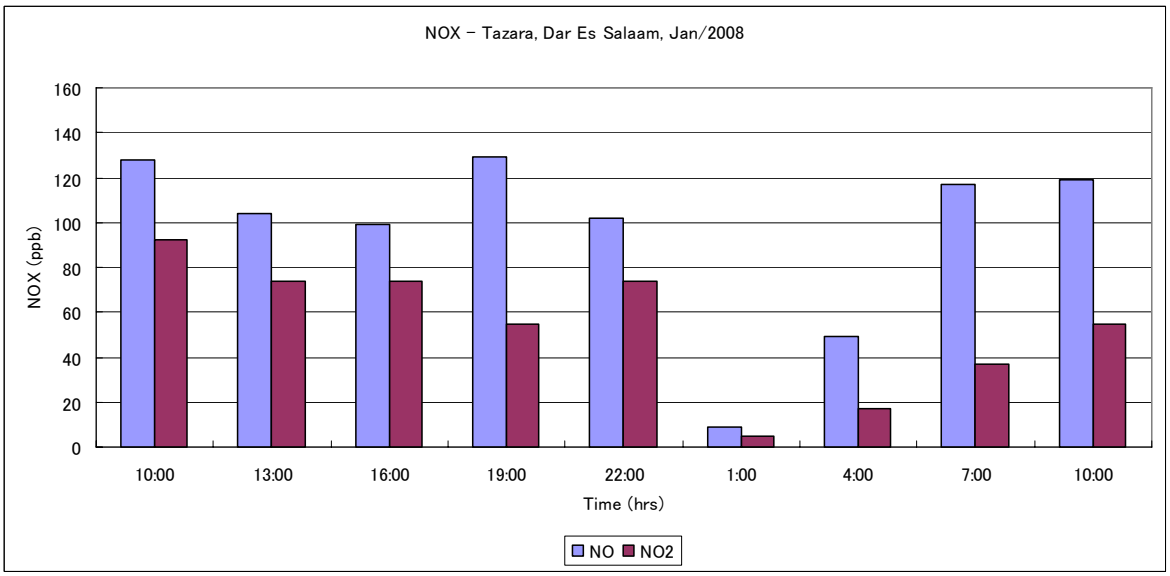


Figure 2.5.8 Roadside A/Q Survey (NOX, Point #3, Tazara, January 2008)

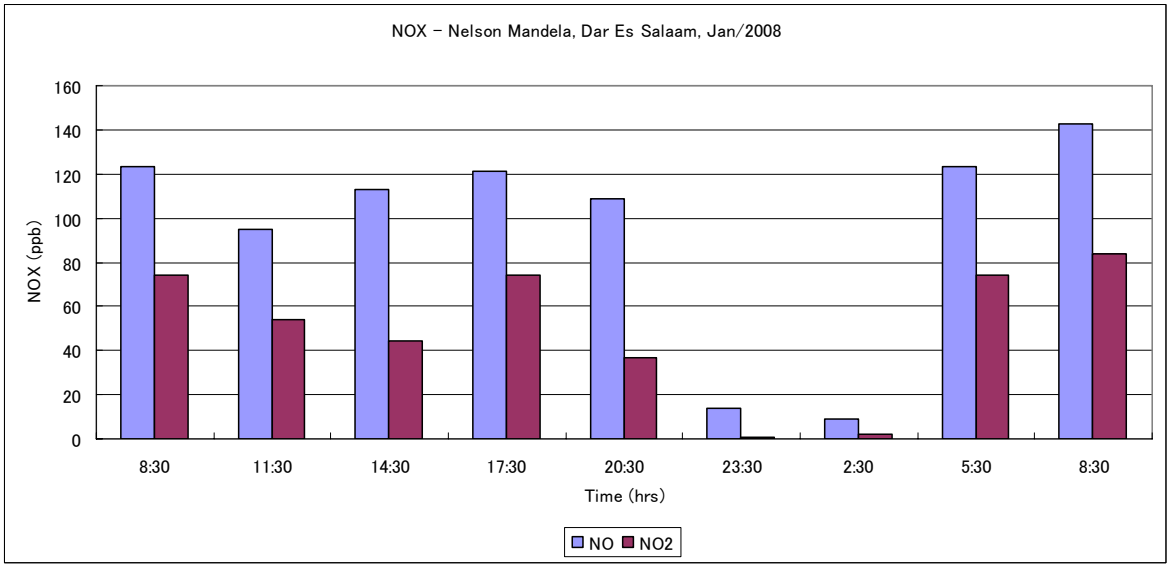


Figure 2.5.9 Roadside A/Q Survey (NOX, Point #4, Nelson Mandela, January 2008)

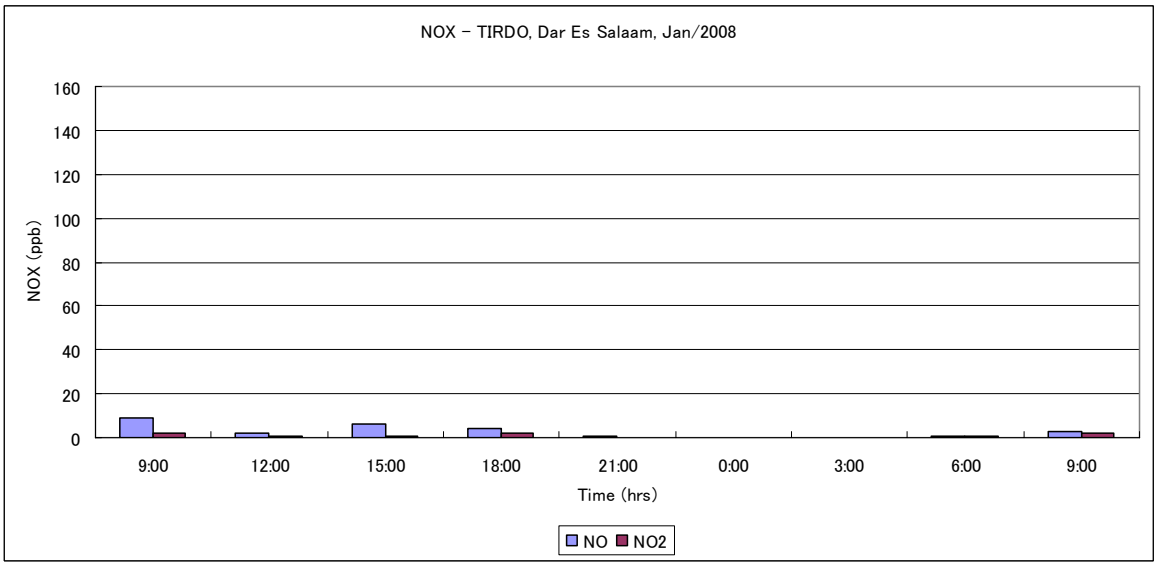


Figure 2.5.10 Roadside A/Q Survey (NOX, Point #5, TIRDO, January 2008)

Table 2.5.4 Daily Averaged Survey Values (NOX)

	NO (ppb)	NO2 (ppb)
1	89.3	56.0
2	90.7	44.9
3	95.1	53.7
4	94.4	49.3
5	2.9	1.0

2.5.3 Roadside Noise Survey

(1) Outline of Field Survey

In order to investigate the current roadside noise condition, the roadside noise survey was conducted. In this field survey, the noise parameter, Leq, is of concern. As described in previous roadside air quality survey section, the hourly traffic volume at four roadside points (i.e., Points 1 – 4) was also counted. Basically, this noise survey was conducted, using same survey sites, selected for the roadside air quality survey. Tables 2.5.5 and 2.5.6 summarize the outline of this noise measurement.

Table 2.5.5 Noise Measurement.

Total number of survey points = 5. Measuring period: November of 2007	
Parameter	Instrument
Leq	Sper Scientific 840028 (serial # 3003537), CHINA

Table 2.5.6 Measurement Point Location (Noise)

Point #	Location (approx)
1	Gerezani Road (between Sokoine and the roundabout)
2	Gerezani Road (between Nyerere Road and the roundabout)
3	TOHS, Hospital near to Tazara Intersection
4	Buguruni (Nelson Mandela)
5	Inside of TIRDO, Bagamoyo

Note: Roadside air quality and vibration measurements are carried out, using same 5 survey points.

(2) Results and Discussions

Figures 2.5.11 – 2.5.15 show the hourly fluctuation of the averaged Leq values and traffic volume measured at all five points. From these figures, it can be seen that Leq values measured at all roadside points varies between 40 and 80 dBA.

Similarity in terms of daily fluctuation pattern between the noise level and traffic volumes is recognized at all four roadside survey sites. It can be seen that there are three peaks in a day in the noise level, which corresponds to the traffic volumes (i.e., morning, noon and evening). During the nighttime it tends to be subdued below 60 dBA.

Table 2.5.7 summarizes the Day-Night Average Sound Level, Ldn, computed at all points. From this table, it can be seen that most of roadside Ldn values are higher than 70 dBA. Using the noise zone classification criteria summarized in Table 2.5.8 (no noise-related environmental standard exits in Tanzania, yet), the current roadside noise condition of the project routes can be classified as "severe exposure"-level (i.e., Categories C-1 and C-2). Note that Ldn values along Gerezani Road are worse than that of Nelson Mandela according to this survey. To summarize this discussion, it can be said that the current roadside noise environment of the project sites is noisy and are harmful to the human health. Figure 2.5.16 visualizes major survey results summarized in Table 2.5.8.

(3) Conclusions

Based on this noise survey, it was found that current roadside noise conditions at major roads such as Gerezani, Nyerere and Nelson Mandela are harmful for human health. Daily noise fluctuation pattern has a strong correlation with nearby traffic volume as recognized in the roadside air quality pattern. There are several possible mitigation measures such as the improvement of road structure (e.g., road surface improvement), the road design as well as the installation of the noise barriers. Also, the establishment of appropriate vehicle I/M program would lessen the order of the magnitude of the mechanical vibration and/or noise. It is essential to establish compounded noise mitigation measures in order to keep future comfortable roadside noise environment.

Table 2.5.7 Roadside Noise Survey Results

Site #	Location (approx)	Ld (dBA)	Ln (dBA)	Ldn (dBA)
1	Gerezani Road East	73.20	67.90	75.59
2	Gerezani Road West	74.54	68.64	76.55
3	TOHS Hospital at Tazara	66.45	61.77	69.24
4	Buguruni (Nelson Mandela)	70.99	65.61	73.33
5	TIRDO	40.84	38.81	45.57

Table 2.5.8 Noise Zone Classifications

	Noise Exposure Class	DNL (dBA)	Leq (hour)	HUD Noise Standard
A	Minimal Exposure	< 55	< 55	Acceptable
B	Moderate Exposure	55 – 65	55 – 65	
C-1	Significant Exposure	65 – 70	65- 70	Normally Acceptable
C-2		70 – 75	70 – 75	
D-1	Severe Exposure	75 – 80	40 – 80	Unacceptable
D-2		80 – 85	80 – 85	
D-3		> 85	. 85	

(Source: Larry W. Canter, 1996)

DNL: Day-Night average sound level, Ldn, defined by following formula;

$Ldn = 10 \log (0.625 (10^{(Ld/10)}) + 0.375 (10^{(Ln+10)/10})$

where Ld is the Leq for the daytime (0700 - 2200) and Ln is the Leq for the nighttime (2200 - 0700).

HUD: Department of Housing and Urban Development, USA.

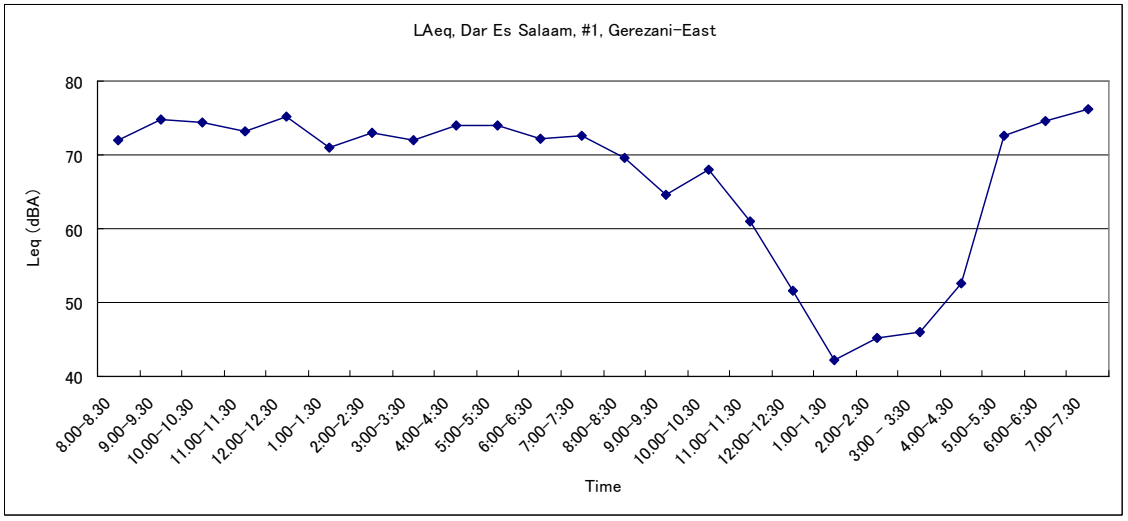


Figure 2.5.11 (a) Noise Measurement Results (Point #1, Gerezani East, November 2007)

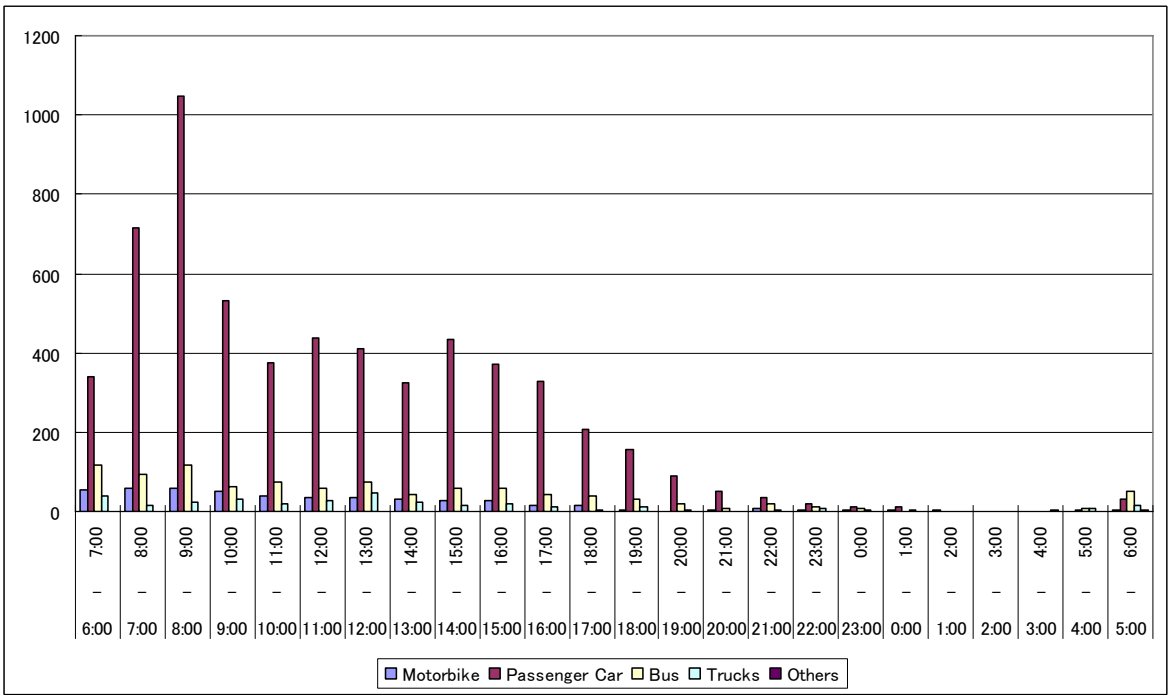


Figure 2.5.11 (b) Hourly Traffic Counting Result (Point #1, Gerezani East, November 2007)

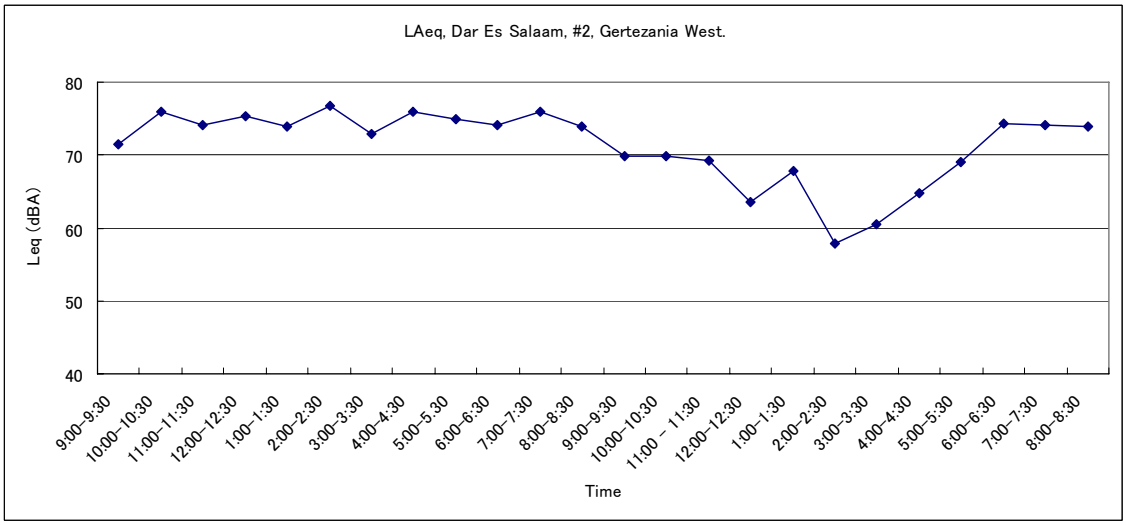


Figure 2.5.12 (a) Noise Measurement Results (Point#2, Gerezani West, November, 2007)

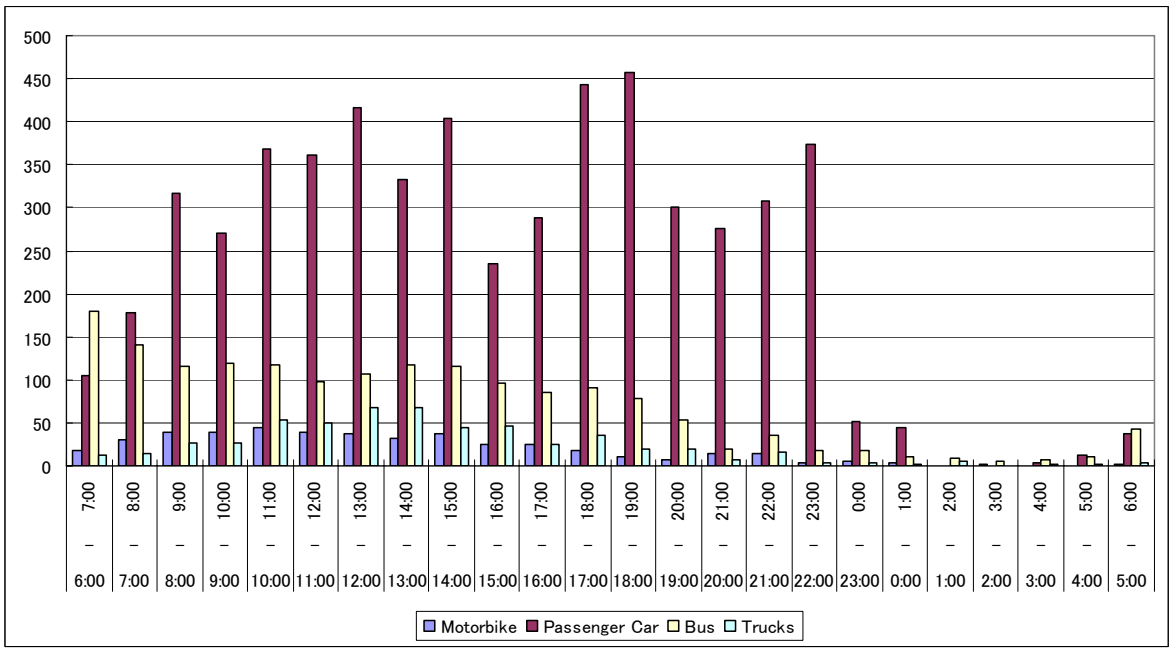


Figure 2.5.12 (b) Hourly Traffic Counting Result (Point #2, Gerezani West, November 2007)

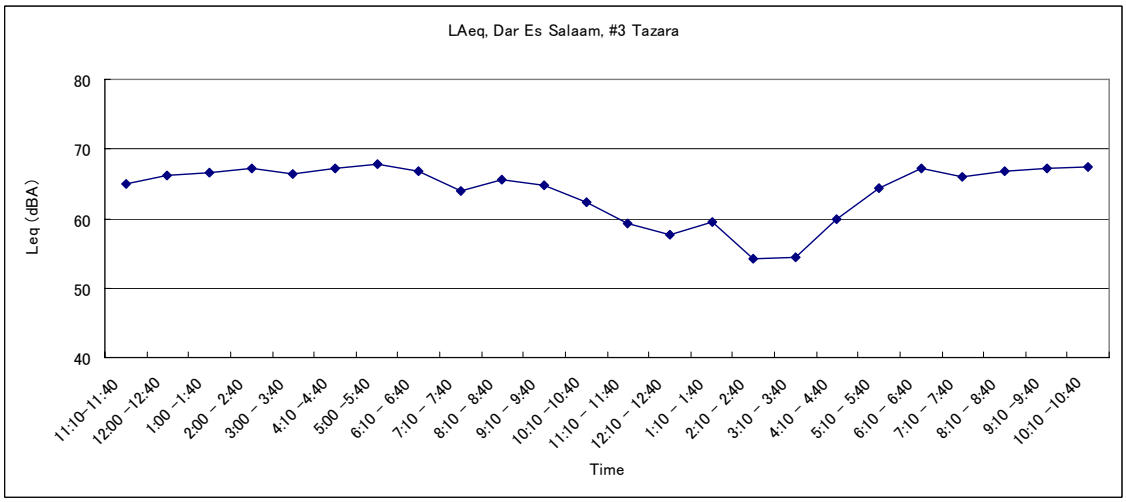


Figure 2.5.13 (a) Noise Measurement Results (Point #3, Tazara, November 2007)

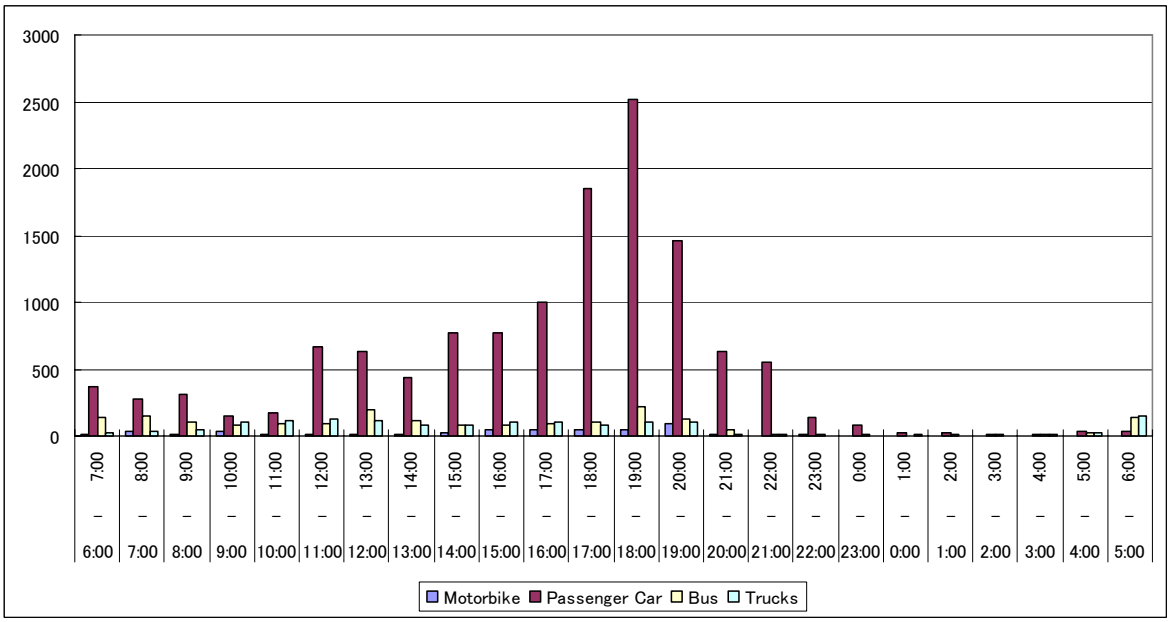


Figure 2.5.13 (b) Hourly Traffic Counting Result (Point #3, Tazara, November 2007)

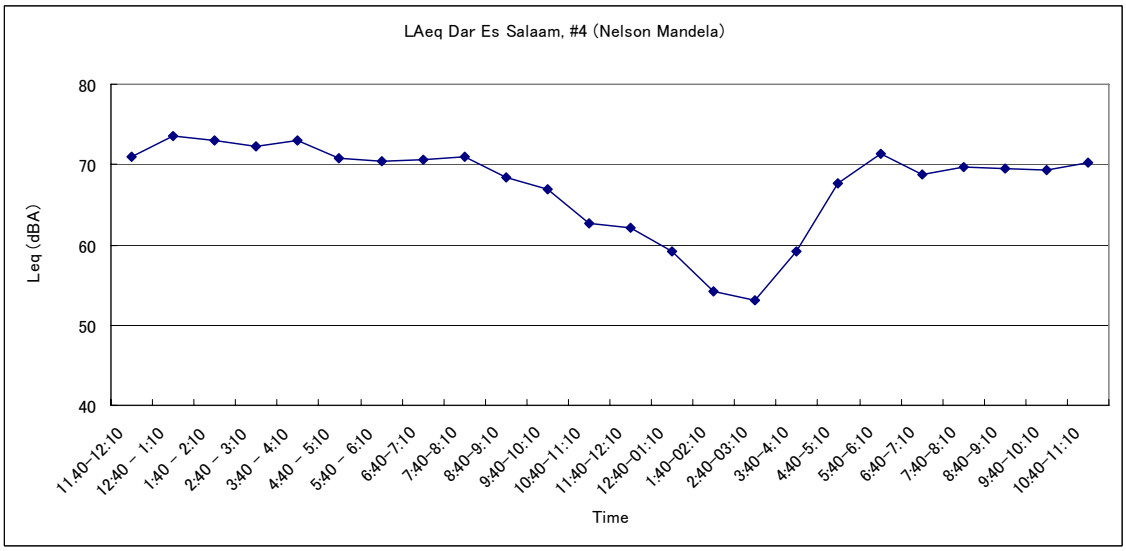


Figure 2.5.14 (a) Noise Measurement Results (Point #4, Nelson Mandela, November 2007)

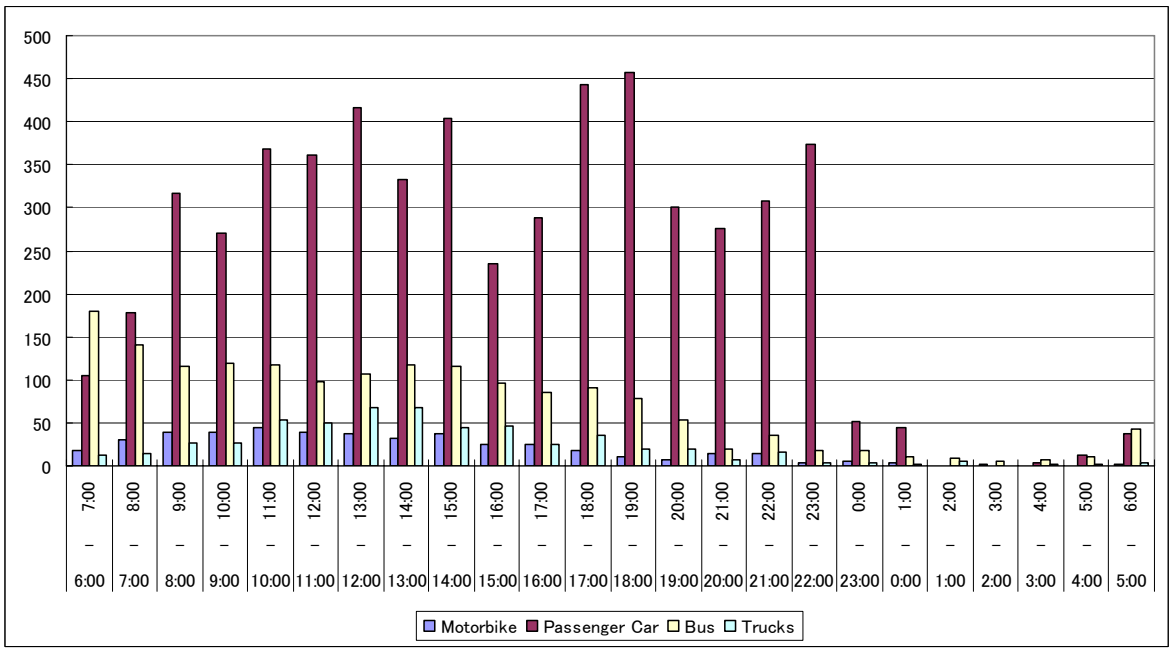


Figure 2.5.14 (b) Hourly Traffic Counting Result (Point #4, Buguruni Nelson Mandela, November 2007)

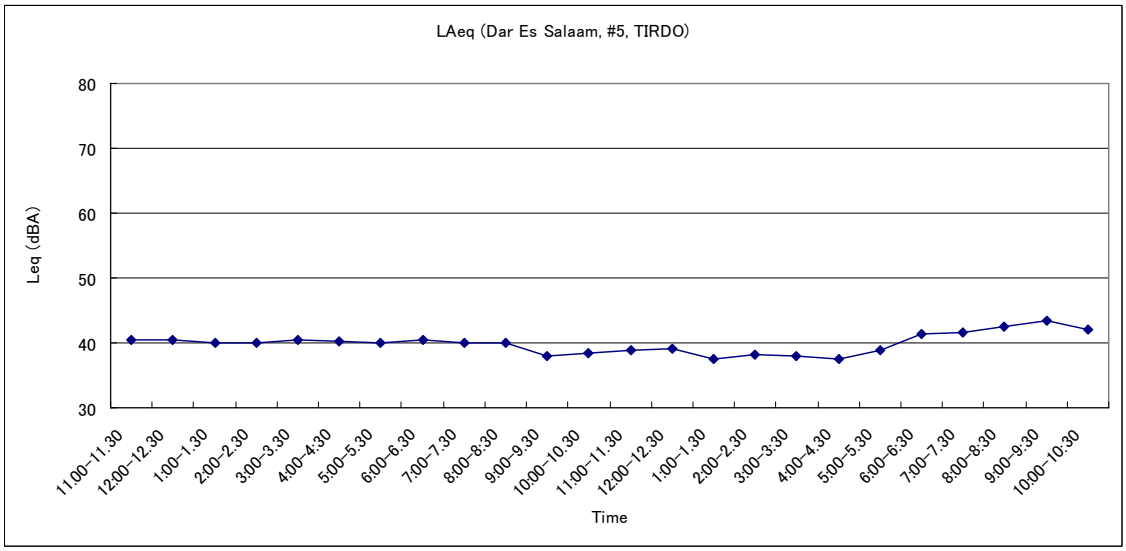


Figure 2.5.15 Noise Measurement Results (Point #5, TIRDO, November 2007)

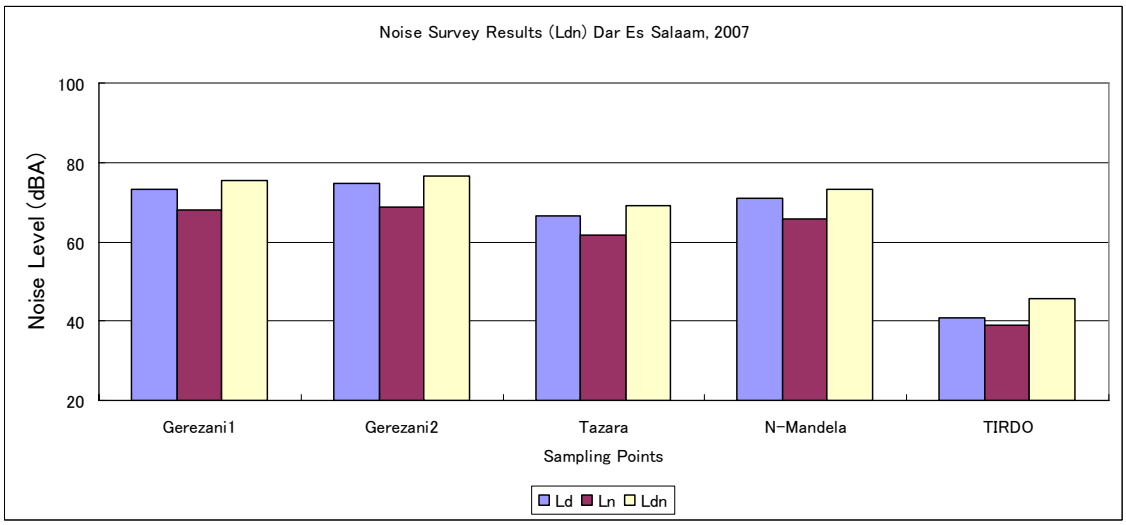


Figure 2.5.16 Roadside Noise Level (dBA) Ld, Ln and Ldn of Dar Es Salaam, November 2007

2.5.4 Water Quality Survey

(1) Outline of Field Survey

In order to grasp the current water quality condition around selected pre-feasibility study sites, the field measurement of the water quality was carried out. Within this measurement, ten parameters, listed in Table 2.19, are of concern. Upon considering the topographic features of study sites, ten points are chosen as sampling points for this measurement, mainly located around the Gerezani floodplain area (see Appendix A for more detailed site information).

Table 2.5.9 Water Quality Measurement.

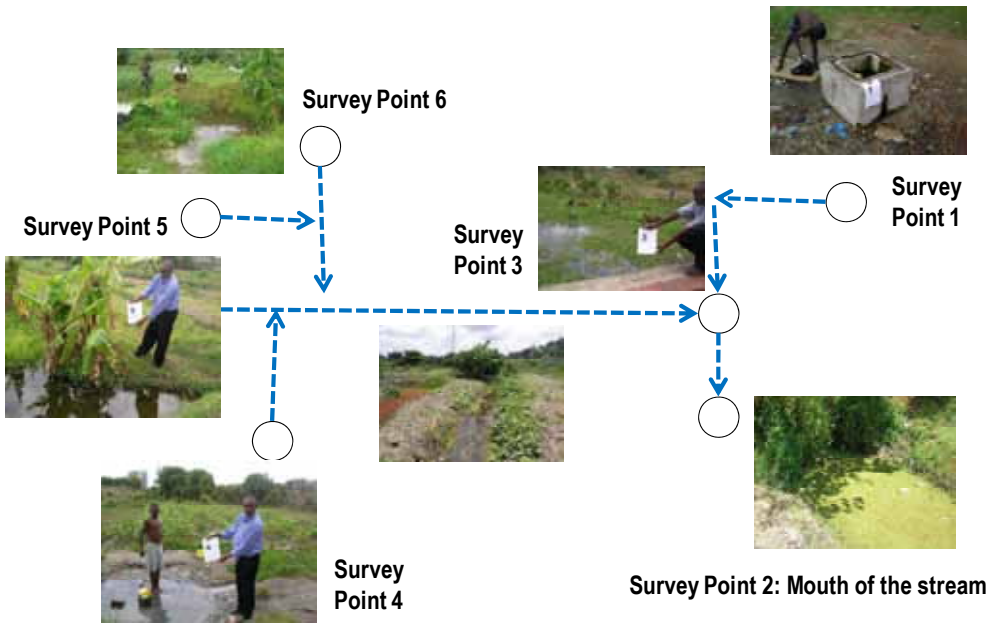
Total number of sampling points = 10. Measuring period: November 2007	
Parameter	Temperature, pH, Turbidity, Conductivity, TSS, DO, BOD, COD, E-Coli-form, Total Coli-form
Lab	Analyzed at University of Dar Es Salaam Water Quality Laboratory

(2) Results and Discussions

Figures 2.5.18 – 2.5.22 show water quality laboratory results of all the collected samples. Point 3 is located at approximately 10 meters downstream side from Point 1(see Figure 2.5.17), and most of its pooled water is coming from Point 1 (confined groundwater). The differences in water quality parameters between Points 1 and 3 probably due to human activities such as farming and/or live husbandry conducted around Point 3. Stagnant creek (Point 2) is located at the most downstream side of this Gerezani floodplain area and all waters are running down to this point via several branch channels and/or paths. Accordingly, it can be seen that several water quality parameters such as turbidity (see Figure 2.5.20), BOD, COD (see Figure 2.5.21) and SS (see Figure 2.5.22) tend to be higher than those of other well and/or spring points due to the accumulation effect.

No water quality-related environmental standard exists in Tanzania (as of December 2007). Using conventional water quality standards and/or guidelines, it can be said that the water qualities of all natural springs, in particular, qualities of Points 1, 4 (confined groundwater)- 9, are relatively in good condition and good enough for the irrigation purpose.

Point 10 is located downstream side of the Gerezani River, running through undeveloped residential areas at the upstream side. This point is located from other Gerezani drainage system such as Points 1 - 6. Most of the household wastes and/or effluents are discharged into this river without proper treatment. Accordingly some parameters such as turbidity (see Figure 2.5.17), BOD, COD (see Figure 2.5.21) and SS (see Figure 2.5.22) tend to be higher than others. It is noted that E-Coli and T-Coli values at Point 10 (the Gerezani River) are the highest within this water quality survey. This also can be explained by the reasoning mentioned above.



Note that all spring water poured from Points 1, 4, 5 and 6 are flowing to Point 2.

Point 3 is a small pool located at the downstream side of Point 1.

Figure 2.5.17 Local Drainage Schematic Diagram

(3) Conclusion

There are several wells across the Gerezani floodplain, and all these wells are used for local agriculture purpose across this floodplain. Based on this water quality survey, the current water quality conditions of these wells are good enough for irrigation purpose. Some of them are located around bottom of the current road embankment of Gerezani Road, and temporal water quality degradation may occur during the construction period of proposed Gerezani Area Transport enhancement Project.

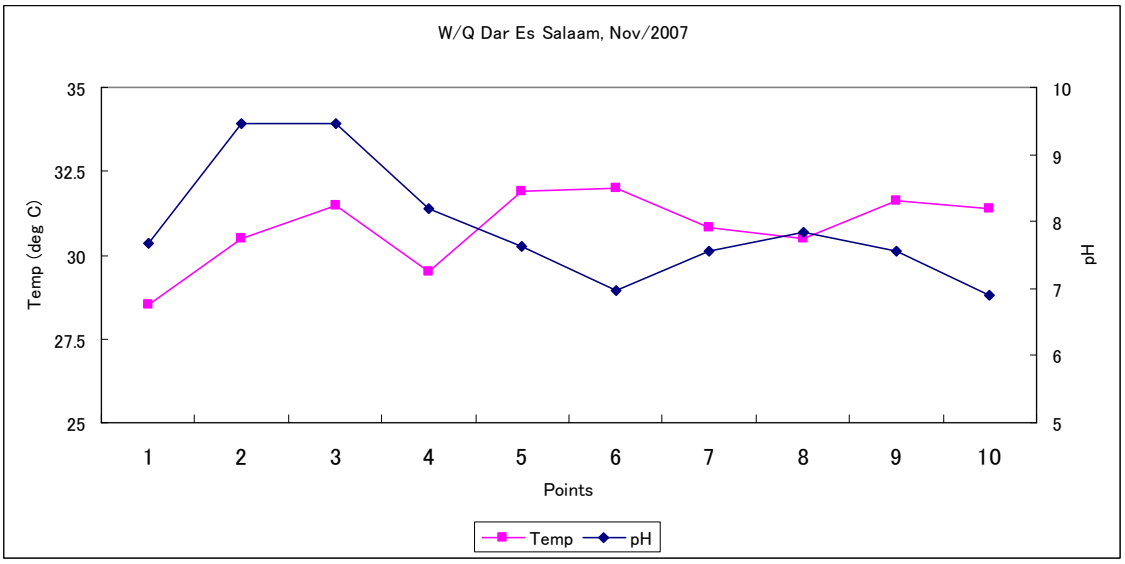


Figure 2.5.18 Water Quality Results, Gerezani Floodplain (Temperature and pH, November 2007)

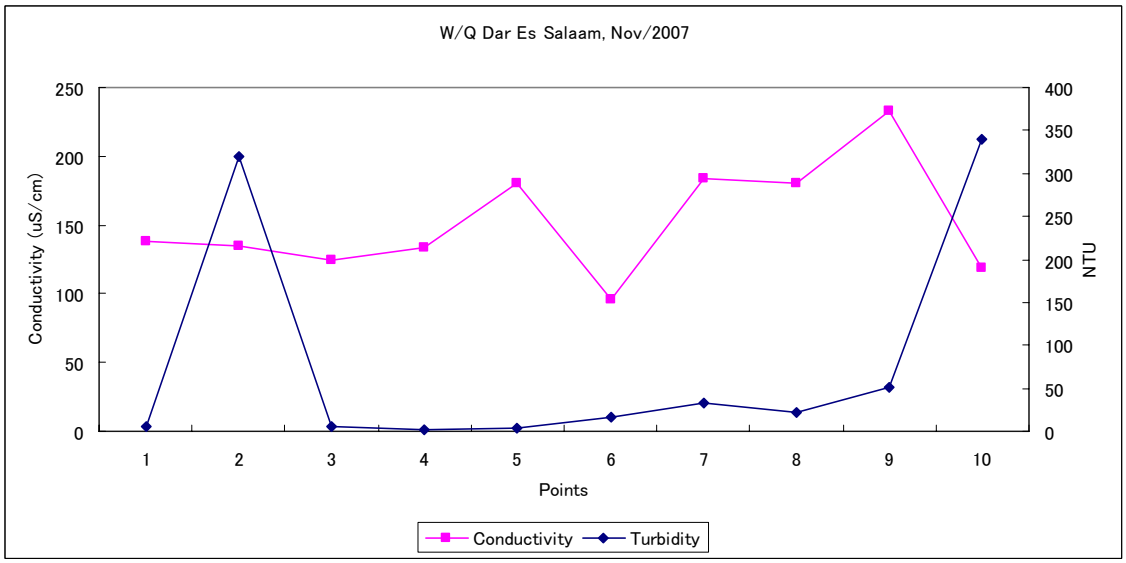


Figure 2.5.19 Water Quality Results, Gerezani Floodplain (Conductivity and Turbidity, November 2007)

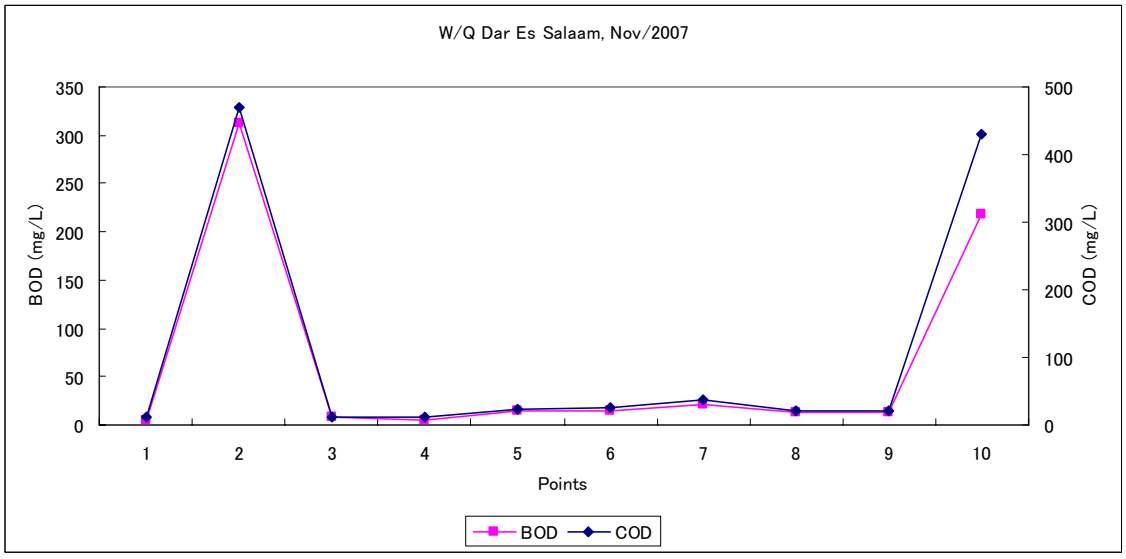


Figure 2.5.20 Water Quality Results, Gerezani Floodplain (BOD and COD, November 2007)

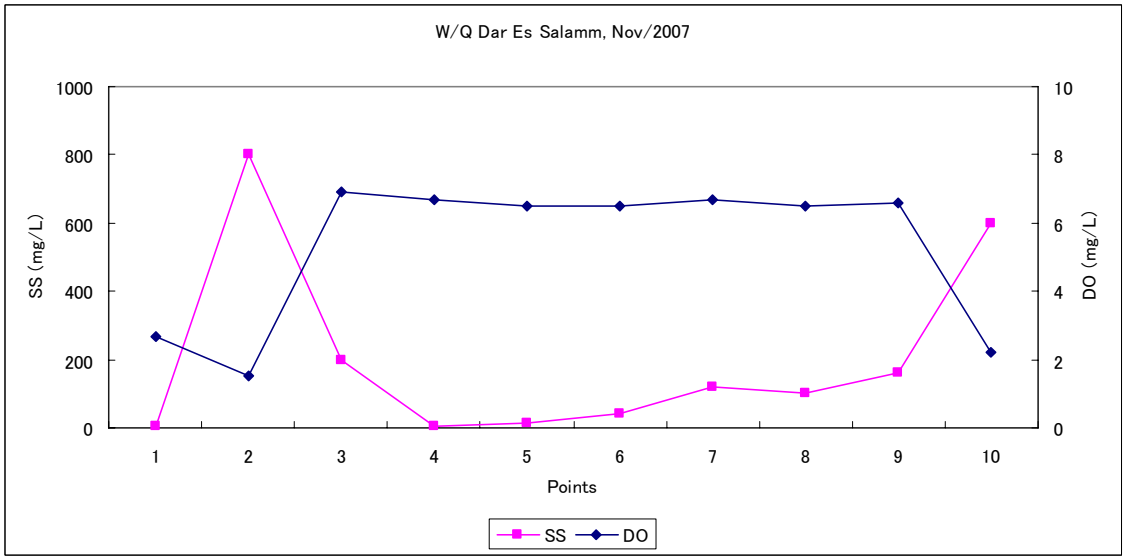


Figure 2.5.21 Water Quality Results, Gerezani Floodplain (SS and DO, November 2007)

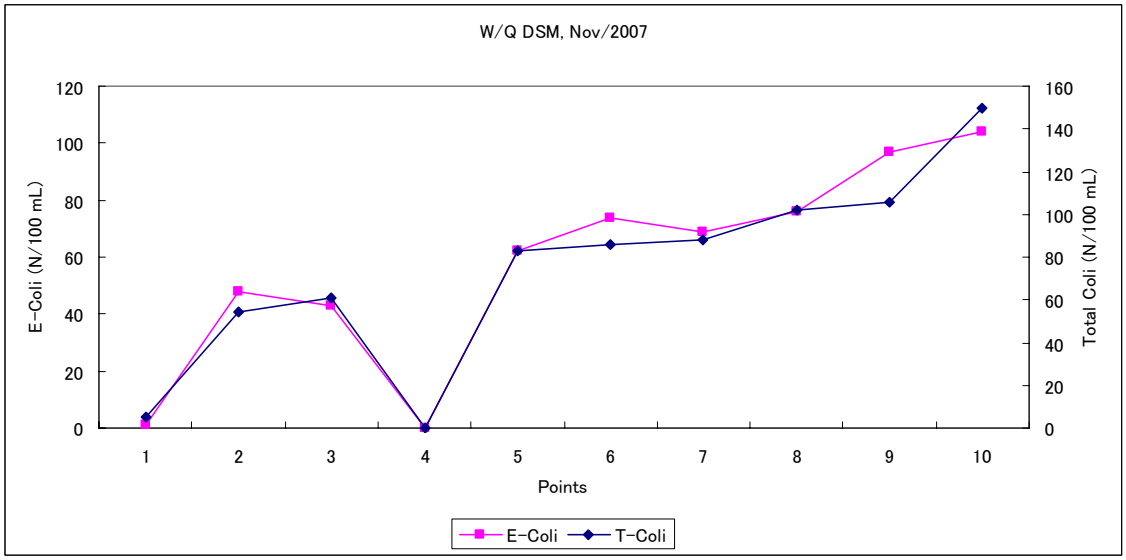


Figure 2.5.22 Water Quality Results, Gerezani Floodplain (E-Coli and T-Coli, November 2007)

2.5.5 Soil Quality Survey

(1) Outline of the Field Survey.

In order to analyze the current soil quality conditions around selected pre-feasibility study sites, the soil quality field measurement was carried out by the Study Team. Four parameters, summarized in Table 2.5.10, are of concern. Among of them, Iron (Fe) and Zinc (Zn) are chosen for the comparison with current literature values. Based on the outline of selected pre-feasibility projects, five sampling points are chosen for this measurement. Tables 2.5.10 and 2.5.11 summarize the outline of this soil quality measurement (see Appendix B for more detailed site information).

Table 2.5.10 Soil Quality Measurement.

Total number of survey points = 5. Measuring period: November - December 2007	
Parameter	Instrument
Iron (Fe) Lead (Pb) Zink (Zn) Mercury (Hg)	AAS Perkin Elmer 5000 (Flame AAS)

Table 2.5.11 Soil Sampling Point Location (Soil Quality)

Site #	Location (approx) and local land use
1	Site close to water quality sampling point #1. Agricultural land.
2	Site close to W/Q sampling point #9. Agricultural land.
3	Site close to W/Q sampling point #10. Agricultural land.
4	Road shoulder of Bandari Road, close to BP Office.
5	Road shoulder of Nyerere Road, close to TOHS.

(2) Conclusion

Table 2.5.12 summarizes results of the two soil contaminants analysis, Pb and Hg of the two selected project sites (note that Fe and Zn are commonly found in non-polluted soil, so that a detailed discussion of these two parameters is not made here). As shown in this table, analytical results of these two contaminant parameters obtained at all five points are below the current environmental standards, implemented in other countries (no soil-related environmental standard exits in Tanzania, yet). So, it can be said that the likelihood of the soil contamination at all survey points by heavy metals would be small.

Table 2.5.12 Soil Quality Survey Results

	1	2	3	4	5	Environmental Standard
Pb (mg/kg)	6.00	11.2	3.4	3.8	5.19	600 mg/kg dry soil[*1]
Hg (ppb)[*2]	5.96	11.2	3.4	3.8	5.19	3 mg/kg dry soil[*1]

(Source. *1: Soil Contamination by Heavy Metal, Japan Association of Soil and Fertilizer, 1998)
Note[*2]: ppb = ug/kg

2.5.6 Socio-Cultural Community Survey

(1) Introduction

Community participation is important for proper infrastructure project planning and management. It is essential to examine every aspects of the project based on the current community's needs and priority. A preliminary socio-cultural survey has to be done in order to grasp the opinion about this new transport development project from the communities of Dar es Salaam properly. Detailed descriptions of methodology of the interview conducted in this survey is presented in the following section.

(2) Study Design

A preliminary socio-cultural opinion survey, carried out by the JICA Study Team in November 2007, recorded 100 residents around CBD area of Dar Es Salaam. This survey addressed following major five study concerns:

i. General concern in the current traffic condition.

ii. General concern in the current pedestrian environment.

iii. General opinion on the current public transport system.

iv. General concerns about transport improvement projects.

v. General environmental concerns regarding the current road and traffic condition.

The results should be used for identification of potential environmental impacts to be assessed. The questionnaire sheet is attached in Appendix C.

(3) Discussions.

1) Attributes of interviewees

The study team selected 100 interviewees at random. The age of the interviewees varies from under 20 to over 60. 72% of the interviewees belong to the range of 20 to 39 years old. The gender balance is evenly taken: 49 % of male and 51 % of female, and 80 % of the interviewees have regular jobs. 72 % of interviewees commute by daladala, and 54 percent of them spend 1 – 2 hours for their commuting every day.

2) Opinion on current traffic and pedestrian conditions

Most of the interviewees stated that the current urban transport system is problematic, in particular, traffic jam, driving condition and traffic accident are very serious. For example, 62 % of them stated that the current road pavement condition is not good enough for safe and comfortable driving. While regarding parking space capacity in CBD Area, 80 % of interviewees regard this issue as minor and/or not so urgent problems for them.

Most of them do not have severe complaints about the current sidewalk condition. However, they have concerns on unsafe road crossing and road environment issues (69 % and 84 %, respectively).

3) Opinion on public transport system.

75 % of interviewees use the current public transport services (i.e., daladala) every weekday, so that they tend to show considerable concerns about the public transport-related issues such as bus fare (80 %), bus stop location (69 %), bus driver's manner (71 %), driving safety (74 %) and vehicle condition (77 %).

4) Opinion on transport improvement project

91% of interviewees perceive the necessity of the urban transport improvement projects although 70 % of interviewees think resultant environmental degradation may occur to a certain extent. This result is consistent with the current traffic condition-related survey results, mentioned earlier. 48 % of interviewees expect their employment opportunities will be improved by implementation of some forms of urban transport improvement.

5) Opinion on environment

Since most of interviewees use the current public transport system (i.e., daladala) quite often in their daily lives, they show great concerns for public transport-related environmental issues such as the roadside noise (61 %), the vehicular emission (85 %), and the roadside air quality (88 %) as well as general urban environmental concerns such as the water quality (91 %), the vegetation (72 %) and the safety (66 %). Compared with these environmental issues, percentages related with "fauna" and "historical and cultural" issues are somewhat lower but each scores more than 50 %, respectively.

As an environmental mitigation measures, most of them think various hard and soft mitigation measures, listed in the questionnaire sheets, as effective such as the vehicle inspection (54 %), the law

enforcement (80 %), the traffic control (74 %) and the driver's education (80%). Within this survey, most of them do not seem to regard the construction of new bike path (63 %) and/or walk way (62 %) as effective in order to improve current urban environment.

6) Opinion on road crossing of a broad ways such as Nyerere, Nelson Mandela and Morogoro Roads

62 % of interviewees claim that current crossing points/or facilities along existing broad ways such as Nyerere, Nelson Mandela and Morogoro Road are not safe enough, but only 32 % perceive the necessity of new construction of pedestrian bridges. Also, 75 % of them do not feel a strong community separation due to the construction of either Nyerere, Nelson Mandela Roads or Morogoro. It shall be noted that some of interviewees, selected within this survey, do not live around nearby communities adjacent to either roads. So, it is recommended to conduct a similar survey around those communities in order to evaluate the community separation-related impact precisely.

(4) Conclusions

Most of interviewees use daladala quite often in their daily activities. Through their daily observation, daladal is regarded a cause of current transport-related pollution, and they think that any necessity actions should be taken in a proper manner. They primarily expect to achieve a solution by improving constructing new urban road facilities, while recognizing importance of several non-physical measures such as enhancement of vehicle inspection and maintenance program, tightening of traffic law enforcement and others.

2.5.7 Roadside Health Survey

(1) Objectives

In order to grasp the current health conditions of people working at heavy traffic congestion areas around selected pre-feasibility study sites and to study the health damage to be caused by the vehicular emission, the questionnaire-based health damage survey is carried out. In this preliminary study, following three social groups are of concern; i.e., (i) traffic police officers, (ii) street vendors, and (iii) office workers. It is assumed that most of office workers are working inside the buildings, so chances to have a direct exposure to the vehicular emissions are less than those of traffic police officers and street vendors. Throughout the comparison of those three groups, the impacts of vehicular emission and/or noise on the human health is analyzed qualitatively.

(2) Outline

Table 2.5.13 summarizes the outline of this health damage survey.

Table 2.5.13 Study Design of Health Survey

	Traffic Police Officers	Street Vendors	Office Worker
Total number of interviewees	50	50	50
Survey Periods	November 2007		

Pollutants to be generated by the vehicular emission have many adverse effects on human health. Inhalation is the main route of the exposure to the air pollutants originating from the vehicular emission. Exposure by inhalation directly affects respiratory, nervous and cardiovascular system of human body, resulting in impaired pulmonary functions, sickness, and even death.

This survey addressed following major three study items:

i. General descriptions of working environment (e.g., working hours, daily income (only for street vendors)), and other fundamental information).
ii. Current health conditions (respiratory, nervous, cardiovascular and otolaryngological system).
iii. Medical history (current/or past medical treatment of respiratory, nervous, cardiovascular and otolaryngological system).

Based on background differences of three targeted groups, two different survey sheets (one is rewritten, using simpler expressions in order to avoid the usage of complicated terminology and/or phrase) were prepared (see Appendix D).

(3) Results and Discussions

1) Traffic Police Officer

a) Personal attributes

Most of the traffic police officers interviewed within this survey, are aged between 30 and 49 years old (94 % of total). The ratio of female officers to male ones is of about 1 to 3. 32 % of the traffic police officers work less than 6 years whereas 68 % of them work more than 6 years. All of them work for 13 – 18 hours per day. So it can be said that they are highly vulnerable to the direct vehicular emission.

b) Current Health Condition

Most of the interviewees do not claim any popular symptoms caused by the direct, long-term exposure to the vehicle emission. Among of them, only 16 % of interviewees claim chronic bronchitis although 44 % of all interviewees said they go to hospitals/or clinics in order to treat sicknesses. From this survey, it can be said that there are several health damages, caused by the direct exposure to the vehicular emissions and/or noise.

2) Street Vendor

a) Personal attributes

Ages of street vendors interviewed are varied between 20 – 39 years old (84 %). The ratio of female street vendors to male ones is of about 1 to 2. 82 % of them work outside for 7 to 12 hours per day.

This means they are highly prone to the direct exposure to the vehicular emissions. Their daily incomes (or sales) varies from Tsh 5,000 to Tsh 30,000 per day. 52 % of them started their current business within last one year.

b) Current Health Condition

40 % of the interviewed street vendors claim several health problems, presumably triggered by a long-term direct exposure to the vehicle emission. Especially, the percentage of the nasal congestion (30 %) and the sore throat (18 %) are relatively higher than other symptoms to be caused by the vehicular emission and/or noise. 56 % of interviewees do not go to clinic/hospital for the treatment but 54 % of same group bought medicine for the treatment.

3) Office Worker

a) Personal attributes

Ages of office workers interviewed are varied between 20 – 43 years old (80 %). The ratio of female office workers to male ones is of about 1 to 1. Most of them work at their office for 40 to 50 hours per week (an exact figure for these working hour/or career issues are not calculated due to the lack of enough replies).

b) Current Health Condition

Within this study, most of interviewees do not claim any vehicular emission-related health problems. Compared with other two target groups, it can be said that the total number of health claims seems to be quite less in this group.

(4) Conclusions

It is found that most of the interviewees working outside have several health problems such as sore throat and nasal congestion. In particular, heath damage of the street vendors seems to be much more serious than that of traffic police officers. Presumably, those symptoms are caused by the direct, long-term exposure to the vehicular emission/or noise.

More detailed study such as epidemiological one is recommended in order to grasp the mechanism of human health deterioration to be caused by the vehicular emission and/or noise and evaluate the health impacts on human body.

2.6 Expropriation Estimation Study

2.6.1 Introduction

When resettlement or relocation issues are arisen within a large-scale infrastructure development project, a full compensation program must be prepared prior to any construction activities. Throughout selected two pre-F/S projects, no major expropriation is to be carried out within Tazara intersection improvement work but is within Gerezani Area Transport Enhancement one. So, necessary expropriation negotiation processes with all persons to be affected by the project (PAPs) shall be settled down peacefully, and appropriate RoW, required for the implementation of the proposed road improvement project, shall be established before the initiation of any construction work.

2.6.2 Estimation Method

Based on the preliminary design works of selected four options (Options A, B, C and D) for Gerezani Area Transport Enhancement Project, the expropriation cost are estimated. Based on the technical site visit and aerial photo map around each project site, it is assumed that all properties and/or facilities to be affected are commerce and industry-related ones. So, the unit building compensation price of Tsh 600/m^2 is used [DCC, 2007]. Other compensation items such as accommodation, transport, disturbance and loss of profits are estimated, using the resettlement action plan of BRT project [DCC, 2007]. All four design options need the relocation of three electric towers, currently located along Bandari Road. Relocation cost of these three transmission power line towers is estimated, based on the quotation data of the current report [JICA, 2007]. Table 2.6.1 summarizes the inventory of building/house to be affected by each design option. Based on this information, preliminary expropriation estimation is carried out.

Table 2.6.1 Properties to be affected by each Gerezani Area Transport Enhancement Project Options (m^2)

	Bandari	Gerezani	Sokoine	Harbor Crossing	Total	Others
Option A	78	3,032	***	***	3,110	3 electric towers
Option B	78	4,043	778	***	4,899	3 electric towers
Option C	78	3,032	***	***	3,110	3 electric towers
Option D	78	817	***	842	1,737	3 electric towers

Note: Possible affected areas for each design option, summarized in this table, are obtained from preliminary design work of this study, using regional aerial photo map.

Source: This Study

2.6.3 Results and Discussions

The total areas to be expropriated for each design option are of 3,110 m^2, 4,899 m2, 3,110 m^2 and 1,737 m^2, respectively (see Table 2.6.1). Based on the estimation methods, mentioned earlier, preliminary compensation estimation is carried out. Table 2.6.2 summarizes the estimated total compensation cost for each design option. From this table, it can be seen that the total compensation

cost of Option B is the highest whereas that of Option D is the lowest. This is due to the fact that total affected area by the road widening activity is the largest in option B whereas the smallest in Option D.

Table 2.6.2 Summary of Estimated Compensation Costs

	Compensation Cost (Million Tsh)
Option A	4,530
Option B	6,583
Option C	4,530
Option D	2,334

2.7 Impact Mitigation

It is essential to establish a comprehensive impact mitigation program that should be effective (i.e., avoidance, reduction, and elimination) against the negative impacts caused by the pre-construction and construction phases of selected pre-feasibility projects. The mitigation plan should address to the potential negative environment impacts caused by the construction works and its operation. The impacts to be caused during the construction period are mostly of a temporary nature, lasting only for the construction period but not for the operation period. Key environmental issues to be addressed within the mitigation program for each pre-feasibility study are summarized below.

2.7.1 Gerezani Area Transport Enhancement Project

① Maintenance of comfortable roadside environment throughout the project.

② Alleviation of impacts of roadside air quality, noise/vibration.

③ Harmonization of new transport facilities with surrounding communities.

④ Preparation for the comprehensive expropriation program.

⑤ Set-up of integrated regional drainage system.

⑥ Set-up of appropriate construction waste treatment program.

⑦ Minimization of traffic diversion-related disturbance during construction phase.

⑧ Relocation of electric grid towers.

⑨ Engineering integrity with railway crossing points.

⑩ Smooth access to the Kariako BRT Bus Terminal.

⑪ Engineering integrity with relevant on-going projects (e.g., Kilwa Road Improvement Project, TPA port facility rehabilitation plan).

⑫ Suitable road configuration to improve the traffic safety.

2.7.2 Tazara Intersection Improvement Project

① Maintenance of comfortable roadside environment throughout the project.

② Alleviation of impacts of roadside noise/vibration.

③ Harmonization of new transport facilities with surrounding communities.

④ Smooth access to Tazara Railway Station from flyover.

⑤ Set-up of appropriate construction waste treatment program.

⑥ Minimization of traffic diversion-related disturbance during construction phase.

⑦ Engineering integrity with relevant on-going projects (e.g., Nelson Mandela Road Improvement Project)

⑧ Suitable intersection configuration to improve the traffic safety.

It should be noted that since the engineering designs prepared for the selected pre-feasibility projects are very preliminary ones, it is likely that further engineering options (overall and/or partially modified options) will be developed later. Accordingly, a more concrete and specific environmental mitigation plan as well as an environmental management program that would cover every critical environmental issue should be prepared.

Such comprehensive mitigation program must be incorporated into tender documents in order to ensure that contractors are obliged to comply with measures in the environmental management plan (EMP). Also, it is essential to incorporate probable working practices into the mitigation program. By doing this, those potential environmental issues can be anticipated and relevant knowledge of potential environmental impacts can be shared among various stakeholders, and a comprehensive environmental management program can be established smoothly prior to the construction work.

2.8 Environmental Management

2.8.1 Introduction

Effective environmental management during pre-construction and construction requires establishment of effective institutional arrangements for implementation of the Environmental Management Program (EMP). In general, EMP is developed as an integral part of the overall project planning and its execution, making a significant and continuous contribution to successful implementation of the project. EMP should not be regarded merely as an activity limited to monitoring and regulating activities using a pre-determined checklist. EMP must interact dynamically with other elements of the project in the course of the project implementation, dealing flexibly with environmental impacts – both expected and unexpected as they arise. In order to do effective EMP, a periodic audit which evaluates compliance of on-site environmental management practices with the EMP requirements is necessary.

2.8.2 Scopes and Objectives

The main purpose of EMP is to ensure that the various environmental protection measures employed through the project-planning phase are to be implemented during the construction phase. By effective EMP the environmental degradation and pollution resulting from construction activities will be minimized. Specific objectives of EMP are:

i. To define organizational and administrative arrangement for the environmental monitoring including the definition of role of staff, coordination, liaison, and reporting procedures.

ii. To discuss procedures for pro-active environmental management, so that potential problems can be identified and mitigation measures to be adopted prior to the construction commencement.

2.8.3 Methodology

Basic approaches towards EMP development include following activities:

i. To review the prepared mitigation plan,

ii. To have interviews / discussions with engineers engaged in design phase of the project, and

iii. To collect past practices through similar / relevant environmental monitoring activities.

2.8.4 Environmental Management Plan (EMP)

Basically, there are three elements to be considered in order to have a well-organized and efficient EMP: (1) Contractor organization, (2) Resident engineer organization, and (3) Liaison, Coordination and Reporting between project elements.

(1) Contractor Organization.

Tender documents should require declaration of contractor's clear statement regarding its environmental policy. Clear specification of the responsibility for the environmental protection within the contractors' organization is critical and important for the achievement of good environmental control. The proposal should include an environmental management plan which basically includes following items:

i. Clear statement of their environmental policy,

ii. Organizational framework, in particular, assignment of a chief engineer to take overall responsibility, to manage environmental control facilities on daily basis and to liaise with the Resident Engineer monitoring team,

iii. Principal pollution control facilities, including procedures of the construction wastes disposal, and of contingency plans in the event of facility failures,

iv. Proposed environmental monitoring procedures in order to ensure that facilities are operating satisfactorily and problems are being dealt with promptly, and

v. Environmental awareness training program for the workforce.

(2) Resident Engineer Organization (REO)

Project Manager has full responsibility for environmental matters, while Chief Resident Engineer (CRE) is responsible for daily direction and management regarding the environmental management. It is necessary to employ an Environmental Monitor (EM) who makes occasional visits to the site, and a full-time local Assistant Environmental Monitor (Assistant EM) who is responsible for daily monitoring activities of the project. Needless to say, EM should have relevant experiences in the environmental management.

(3) Liaison, Co-ordination and Reporting

1) Liaison with the Contractors

The Assistant EM shall attend weekly site meetings inviting relevant contractor staff and discuss environmental shortcomings if any. From the contractor side, attendance of senior manager/engineers responsible for the environmental protection is preferred for this meeting. From the consultant side, EM or Assistant EM and RE/or CRE should attend. All the discussion in these meetings shall be recorded.

2) Liaison with Governmental Organization.

Assistant EM shall prepare a brief monthly environmental monitoring report. The report should be submitted with PM approval to the relevant agencies such as the DCC, NEMC, Division of Environment, TPA and local municipalities for their review. It is recommended to organize progress meetings by inviting such relevant organizations.

3) Liaison with the Local Community

Liaison with local communities will be important during the construction period in order to ensure that their views are taken into account and that problems and nuisances such as noise and dust are reduced to the required level. All types of complaints from the local communities and responses from the contractor / consultant must be recorded. The responses should include necessary actions to mitigate / avoid such possible environmental problems.

4) Consultant's Internal Co-ordination and Reporting

Environmental Monitoring Team shall prepare a monthly report, which shall not be lengthy, but will summarize issues carried over from the previous report, stating whether they have been resolved or are on-going, and new issues arising. This shall be included in a general monthly consultant progress report to be submitted to DCC, NEMC, Division of Environment, TPA and other competent relevant agencies. It is not envisaged that formal meetings will be required for the internal management of the environmental program, and that ad-hoc meeting would be adequate.

(4) Environmental Management and Audit Program

The first several months of the construction phase will be important for EMP establishment. It is anticipated that the Program shall be audited annually, but that the first audit shall be carried out after six months in order to review the establishment of the management systems and procedures. The processes of environmental management shall be continuously evolving and improving as the project proceeds.

2.9 Environmental Monitoring

2.9.1 Introduction

Main objectives of the environmental monitoring are to provide continuous feedback on project implementation to identify actual or potential successes/or problems at early stage, and to implement timely adjustments to whole project management work.

2.9.2 Objectives

The objective of the monitoring system is to assist the project management through:

i. Defining requirements and procedures for the environmental monitoring (type of equipment to be used, monitoring schedule, parameters to be monitored and so on),

ii. Identifying targets and objectives for the project implementation,

iii. Keeping environmental records for the project evaluation, and

iv. Identifying problems arising from the project, and figuring out procedures for the environmental.

2.9.3 Scope of the Monitoring Plan

The scope of the monitoring plan is:

i. To identify the monitoring tasks to be undertaken by EM during the construction phase,

ii. To identify the nature and the schedule of the monitoring, and

iii. To identify samples to be taken for analysis and parameters to be measured.

2.9.4 Methodology

The basic approach to prepare this monitoring plan is composed of following components:

i. Reviews of the mitigation plan discussed in previous section, and in particular, of the monitoring requirements identified for the construction phase of the project,

ii. Discussions with engineering staff engaged in the project design and planning, and

iii. Consideration of the environmental monitoring experience.

Coordination with on-going monitoring programs such as the monthly roadside air quality survey by NEMC is important for development of a post-EIA monitoring system. The monitoring objectives should properly address anticipated impacts. Several iterations might be necessary to achieve a workable monitoring system.

2.9.5 Environmental Monitoring

It is important to develop a cost-effective approach to monitor the contractors' performance in terms of environmental concern. Certain parameters (e.g., roadside air quality, noise and vibration around the project area) can be monitored through measurements, and others can only be monitored through visual observation (e.g., tree cut-down). Careful observations should be made through this monitoring work because this is really a key part for a successful environmental management to prevent problems (or at least to limit their effects).

Baseline data will be helpful in defining the requirements for the site restoration and in providing a

basis for the comparison of effects during the construction. Post project audit shall be carried out to examine the success of the site restoration and evaluate the effectiveness of the mitigation measures adopted.

2.9.6 Monitoring Requirements

As mentioned earlier, the monitoring activities can be divided into following two groups; (i) one which can be carried out through the measurement, and (ii) one which will be carried out through observation. Table 2.9.1 provides an example of more detailed descriptions of the activities to be undertaken for each of the monitoring requirements. It is recommended that corresponding clauses shall be developed for the inclusion in the bid documents. It should be noted that monitoring activities of the roadside air quality, noise and vibration shall be supervised by EM.

Table 2.9.1 Monitoring Activities and Indicators

Monitoring Issue	Monitoring Method	Positive Indicator
Air Quality	Observations shall be made on the level of dust generated during construction activities. Damping down shall be carried out if levels are unacceptable.	Deposition of dust on surfaces shall decrease with increased dampening.
Waste Disposal	Engineer to ensure waste dumping site for construction waste material, soil, and so on.	No illegal disposal of waste material.
Noise/ Vibration	Noise measurement shall be carried out at the boundary and the inside of the work site and at the nearest sensitive receiver. Vibration measurement shall be carried out within the residential area.	Noise levels at the nearest sensitive receiver shall not exceed the relevant environmental standards.
Accidents (road safety)	Engineer shall monitor the condition of trucks arriving at the site and keep a record of night driving.	No road accidents related with project. Night driving kept to minimum.
Complaints	Engineer shall inspect the record of complaints made by local residents, to be kept by Contractor, and shall check that action is taken quickly and that the number of complaints does not rise significantly.	Number of complaints decreases.

2.9.7 Implementation and Operation of Monitoring Program

In general, implementing a monitoring system requires considerable efforts in various aspects, for example, obtaining specific inter-agency agreement and necessary funding. Monitoring activities include data collection, analysis, and impact evaluation. To do the impact evaluation it is necessary to prepare a set of evaluation criteria with agreement of relevant organizations as well as local communities. That is, the criteria should be based on legal and institutional framework, professional judgments and public inputs (opinions). And at the same time it is important to prepare likely response plans prior to implementation of the monitoring system.

It is also requested that periodical summary reports be prepared in order to document the finding and resultant response to the post-EIA (or EIS) monitoring program.

2.9.8 Manpower and Budgeting

It is requested that engineers in the construction site will carry out the environmental monitoring

program as a part of the contract throughout the entire construction work. EM will be employed on a full-time basis. Also, the Assistant EM will be full-time, and will report to the engineer, and EM. The cost of implementing the monitoring plan will include full-time salary of EM and Assistant EM and other direct costs. It may be necessary to employ an international environmental expert for the initial training of EMs and subsequently to attend at audit time.

<References>

DCC, Technical Report of Consultancy Service for the Conceptual Design of a Long Term Integrated Dar Es Salaam BRT System and Detailed Design for the Initial Corridor, Annex Vol. 8, Impact Analysis and Mitigation, Chapter 8.5, Resettlement Action Plan – Phase 1 – Part A, Draft Final Report, 2007.

JICA, Technical Report of Basic Design of Oyster Bay Power Grid Improvement Project, 2007

Appendix 1 Photo Record of Sampling Site (Water Quality Survey, November 2007)

Point 1, Well (Confined Groundwater), Relatively clear water is continuously pouring.

Point 2, Small Creek, Stagnant Flow. Average depth is of roughly 30 cm. Many small fishes occur inside.

Point 3, Pool created at about 10 meters downstream side of Point 1. Average depth is of roughly 20 cm. Many small fished occur.

Point 4, Well (confined Groundwater), Relatively clear water is continuously pouring. Local people use for body washing around this well.

Point 5. Spring located at the bottom of the road shoulder of Gerezani Road. Sometimes, local people use for washing agricultural tools and/or products.

Point 6. Spring located at the bottom of the road shoulder of Gerezani Road. Sometimes, local people use for washing agricultural tools and/or products.

Point 7, Spring, located at the foot of the road shoulder of Gerezani Road. Sometimes, local people use for washing agricultural tools and/or products.

Point 8, Well, located at the foot of the road shoulder of Gerezani Road. Sometimes, local people use for washing agricultural tools and/or products. Remnant of floodplain bush exist.

Point 9, Spring, located close to Point 8. Sometimes, local people use for washing agricultural tools and/or products.

Point 10, Gerezani Creek, located at the foot of the road shoulder of Bandari Road. The turbidity of this creek seems to be high.

Appendix 2 Photo Record of sampling Site (Soil Survey, November 2007)

Soil Sampling Site #1, close to Water Sampling Point #1.

Soil Sampling Site #2, close to Water Sampling Point #9

Soil sampling Site #3, close to Water Sampling Point #10, located at the Railway Bank.

Soil Sampling Site #4, Road Side of Bandari Road, near BP Office.

Soil Sampling Site #5, Road Side of Nyerere Road, close to TOHS (hospital at Tazara Intersection).

Appendix 3 Questionnaire Survey Sheet for Socio-Cultural Community Survey

No.

Dar Es Salaam Urban Transport and System Development M/P Project

A. BACKGROUND INFORMATION

Survey Date: _____

Occupation (1) Worker

1.Legislator, Administrator and Manager	8. Craftsmen
2. Professionals	9. Farmers
3. Tech & Associate Professionals	10. Livestock Keepers
4. Clerks	11. Fishermen
5. Small Business Managers	12. Plant Operators, Assemblers

(2) Student

1. Elementary	3. University & Institute
2. Secondary	4. Others

(3) Non-Worker

1. Job Seekers	3. Retired
2. Housewives	4. Others

Age _____ Sex M / F

Home Address: _____

Commuting Measure

1. Walking	6. Taxi	11. Trucks
2. Bicycle	7. Bhajaj	12. Railway
3. Motorcycle	8. Dala Dala	13. Ferry/Boat
4. Car	9. Inter-City Bus	14. Others
5. Pick-Up/Van	10. School/Company Bus	

Commuting Time _____ hr _____ min.

Working Place (or school location): _____

B. CURRENT ROAD CONDITION

1. What are your road-related concerns or issues?

A. Driving Condition	Less	Fair	Major
a. Traffic jam	1------2------3------4------5		
b. Traffic accident	1------2------3------4------5		
c. Inappropriate traffic signal	1------2------3------4------5		
d. Poor pavement condition	1------2------3------4------5		
e. Inappropriate parking space.	1------2------3------4------5		
f. Others (specify)	1------2------3------4------5		

B. Pedestrian Condition	Less	Fair	Major
a. Narrow Sidewalk	1------2------3------4------5		
b. Inappropriate crosswalk	1------2------3------4------5		
c. Poor pavement condition	1------2------3------4------5		
d. Unsafe road crossing	1------2------3------4------5		
e. Dusty and/or noisy	1------2------3------4------5		
f. Others (specify)	1------2------3------4------5		

C. Public Transport System

1. How often do you use the public transport system?
   a. Every Day
   b. Every weekday
   c. Only weekday
   d. Others (please specify) /week

2. What are main public-transport-system-related concerns or issues?	Less	Fair	Major
a. Bus fare (expensive)	1------2------3------4------5		
b. Bus stop locations.	1------2------3------4------5		
c. Bus stop structure	1------2------3------4------5		
d. Bus-terminal facility	1------2------3------4------5		
e. Bus-driver's manner	1------2------3------4------5		
f. Driving Safety.	1------2------3------4------5		
g. Vehicle conditions (e.g., dirty, poor suspension, not comfortabl	1------2------3------4------5		
h. Others (specify)	1------2------3------4------5		

D. Public Concern for Transport Improvement Project

1. Do you think any public transport improvement plans and/or projects necessary?
   a. No
   b. Yes (if Yes, specify)

2. Any opinions or possibility that public transport improvement plans may l	Less	Fair	Major
a. Environmental degradation (specify)	1------2------3------4------5		
b. More market access	1------2------3------4------5		
c. Availability of more services	1------2------3------4------5		
d. More educational opportunities	1------2------3------4------5		
e. More employment opportunities	1------2------3------4------5		
f. Other impacts (specify)	1------2------3------4------5		

E. ENVIRONMENT

1. What are the current main local environmental concerns or issues (general environmental issues as well as transport-related one)?	Less	Fair	Major
a. Noise/vibration	1------2------3------4------5		
b. Vehicular emission	1------2------3------4------5		
c. Air quality	1------2------3------4------5		
d. Water quality	1------2------3------4------5		
e. Vegetation	1------2------3------4------5		
f. Fauna	1------2------3------4------5		
g. Historical/cultural and/or monumental properties.	1------2------3------4------5		
h. Safety	1------2------3------4------5		
i. Others (specify)	1------2------3------4------5		

2. If the public transport system is to be improved, what will be the most effective ways to improve local environment within this entire transport project?	Less	Fair	Major
a. Enhanced Vehicle Inspection/Maintenance	1------2------3------4------5		
b. Improve Road Structure	1------2------3------4------5		
c. Law Enforcement (e.g., speed limit/frequent pa	1------2------3------4------5		
d. Improve Traffic Control (e.g., tidal flow)	1------2------3------4------5		
e. Set-up Noise Barrier	1------2------3------4------5		
f. Integrated Regional Drainage System	1------2------3------4------5		
g. Driver's education (e.g., safety drive)	1------2------3------4------5		
h. Set-up Bike path	1------2------3------4------5		
i. Improve walking path	1------2------3------4------5		
j. Others (specify)	1------2------3------4------5		

3. How do you feel the road crossing (e.g., crossing of major roads such as Nyerere, Nelson Mandera, Morogoro and other broadways)?

	Less **Fair** **Major**
a. Crossing Point is not enough.	1------2------3------4------5
b. Need more pedestrian bridges.	1------2------3------4------5
c. Bad driver's manner (i.e., should be kind to walker).	1------2------3------4------5
d. Strong Sense of Community Separation (e.g., tend to feel difficult meet near relatives/or frie	1------2------3------4------5
e. Others (specify)	1------2------3------4------5

THANK YOU FOR YOUR CO-OPERATION !!

Chapter 3 Stakeholder Meetings

3.1 Introduction

3.1.1 Outline

For the selected two pre-feasibility studies, three (3) stakeholder meetings are held based on JICA Guideline (see Table 3.1.1). Major objectives of these stakeholder meetings are to enhance the public participation by inviting relevant stakeholders, to establish a comprehensive information disclosure mechanism, to share common knowledge and understanding about the selected pre-feasibility projects among stakeholders, and to develop consensus of the project implementation. A summary of each stakeholder meeting is described in following section separately.

Table 3.1.1 Schedule of Stakeholder Meeting

	Date	Place	Main Topics
1	October, 31, 2007 (Wed)	Karimjee Hall, Downtown, Dar Es Salaam	1. Dar es Salaam Urban Transport M/P 2. Outline of Pre-Feasibility Studies 3. JICA Guideline for Environmental and Social Considerations 4. ToR of Environmental Studies
2	November, 28, 2007 (Wed)	Same as above	1. Progress of Dar es Salaam Urban Transport M/P 2. Progress of Pre-Feasibility Study a) Gerezani Transport Enhancement Project b) Tazara Intersection Improvement Project 3. Review Summary of 1st stakeholder meeting 4. Progress of Environmental Field Study 5. Environmental Screening/scoping results
3	May 20, 2008 (Tue)	Same as above	1. Outline of the Master Plan (Draft Final Report) 2. Summary of environmental survey 3. Updates of Pre-FS (Draft Final Report) 4. Recommendations

3.1.2 Information Disclosure

The importance of information disclosure at a planning stage is stressed in the JICA Guideline. After each stakeholder meeting, following information and/or material were disclosed for the public review purpose (see Table 3.1.2). Prior to this information disclosure process, a public notice that indicates

the outline of this public review process was put on each bulletin board of Dar Es Salaam City Council, Ilala and Temeke Municipalities, respectively. Also, the hard copy of this announcement was sent to all meeting participants by mail.

Table 3.1.2 Information Disclosure

	Descriptions
1st Stakeholder Meeting	
Public Review	November 12, 2007 – November 22, 2007
List of information	1. Presentation materials used at each stakeholder meeting 2. Contents of Q/A sessions (English) 3. Lists of Attendants 4. Photo Records 5. Post-meeting survey results
2nd Stakeholder Meeting	
Public Review	N/A
List of information	1. Presentation materials used at each stakeholder meeting 2. Contents of Q/A sessions (English) 3. Lists of Attendants 4. Photo Records 5. Post-meeting survey results
3rd Stakeholder Meeting	
Public Review	N/A
List of information	1. Presentation materials used at each stakeholder meeting 2. Lists of Attendants 3. Photo Records 4. Post-meeting survey results

3.2 Summary of Stakeholder Meeting

3.2.1 1st Stakeholder Meeting

(1) Outline of 1st Stakeholder Meeting

The 1st stakeholder meeting was held on October 31, 2007 at Karimjee Hall, Dar es Salaam. Table 3.2.1 shows the adopted agenda of this meeting. Registration started at 9:30 of October 31, and the meeting at 10:20 and ended at 12:30. Entire process of this stakeholder meeting was recorded. 30 stakeholders were selected from various organizations / agencies / schools / NGOs / groups / communities and others, and then, an invitation letter was sent to each of those selected stakeholders prior to the meeting. A total of 35 people attended at the 1st stakeholder meeting.

Table 3.2.1 Adopted Agenda of 1st Stakeholder Meeting

(1) Registration
(2) Opening Remarks
(3) Dar Es Salaam Urban Transport Policy and System Development M/P
(4) Explanation of Pre-Feasibility Project Outline
(5) Q/A Session
(6) Explanation of JICA Guideline for Environmental and Social Considerations
(7) TOR of Environmental Study
(8) Q/A Session
(9) Discussions
(10) Post-meeting survey
(11) Closing Remarks

(2) Summary of Minutes of Meeting

During the Q/A session, a total of 12 questions and/or comments was raised about the proposed pre-feasibility projects (see Table 3.2.1).

Table 3.2.1 Categorization of Questions

Topics	# of Question
Engineering/Planning	
Include Ubungo, Mwenge Intersections	3
Integrity with other development projects/plans	1
Environment	
Environmental Field Survey	4
Undertaking of Future EIA	1
Others	
Too small fonts	1
Project Registration	1
Stakeholder meeting	1
Total	12

In order to evaluate overall achievement of this stakeholder meeting, a simple questionnaire survey was conducted for all participants after all presentations and Q/A sessions were completed, and there were 19 respondents for this survey.

All respondents (i.e., 19 persons) said they understand the outline of each pre-feasibility project, presented within this first stakeholder meeting fairly (see Figures 3.2.1 and 3.2.2). 16 percents (3 persons) said selected projects would cause negative environmental impacts on the surrounding environment (see Figures 3.2.3 and 3.2.4), and 84 percents (16 persons) and 89 percents (17 persons) said their situations would be improved if each selected pre-feasibility project is implemented (see Figures 3.2.5 and 3.2.6, respectively). Also, 100 percents (19 persons) and 95 percents (18 persons) said they wish the proposed projects to be implemented promptly (see Figures 3.2.7 and 3.2.8,

respectively). Lastly, 74 percents (14 persons) said they understand and/or get familiar with concepts and policy of JICA Guidelines for Social and Environmental considerations by attending this 1st stakeholder meeting (see Figure 3.2.9).

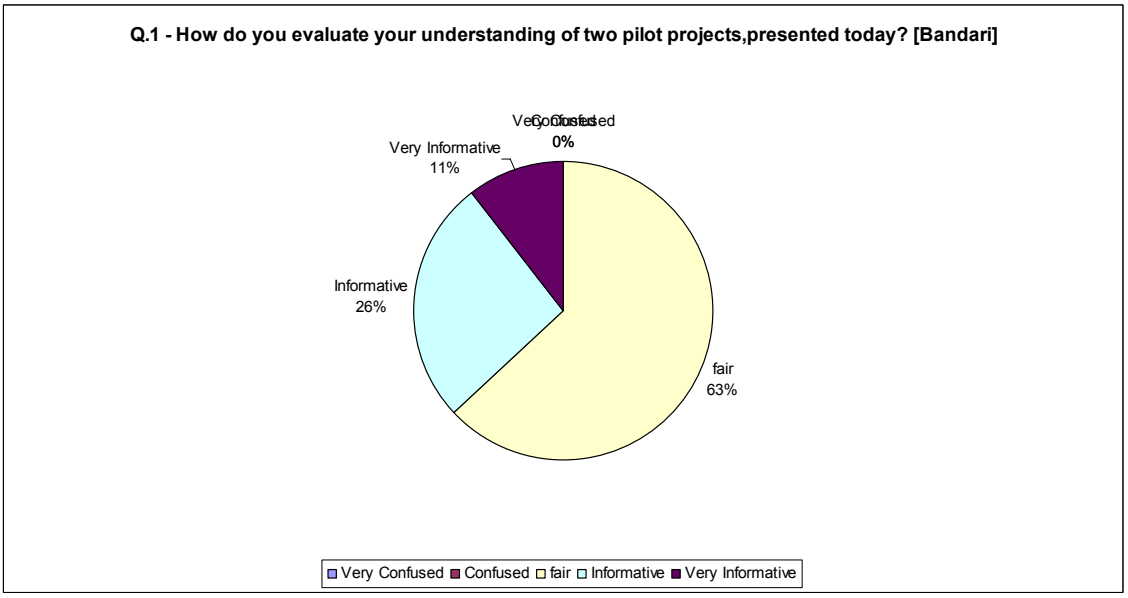


Figure 3.2.1 Post Questionnaire Survey: Understanding of Pre-Feasibility Project – Gerezani

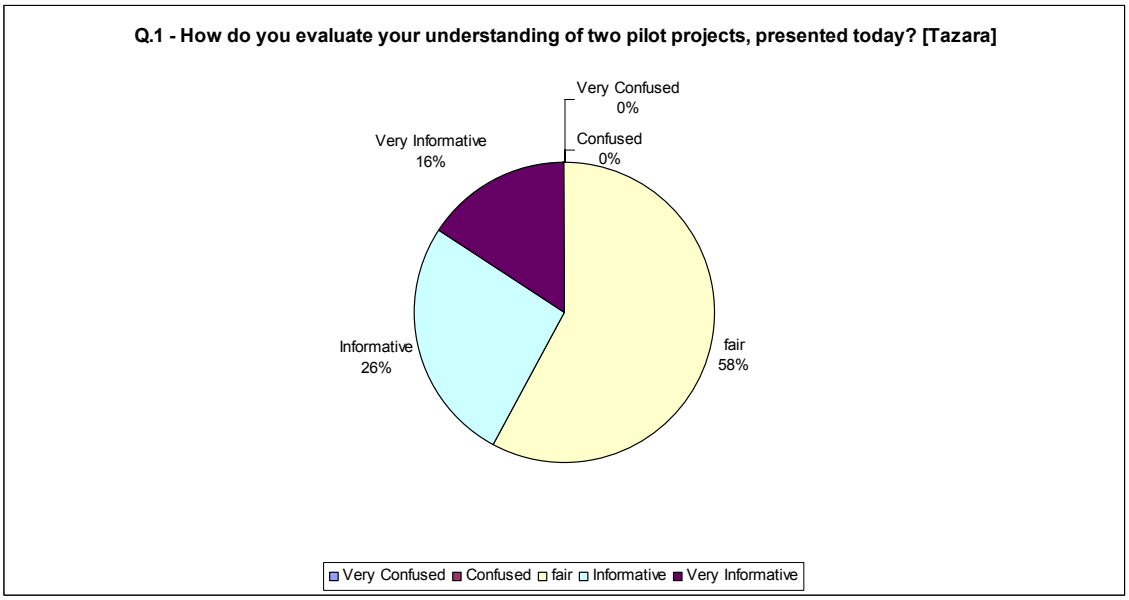


Figure 3.2.2 Post Questionnaire Survey: Understanding of Pre-Feasibility Project – Tazara

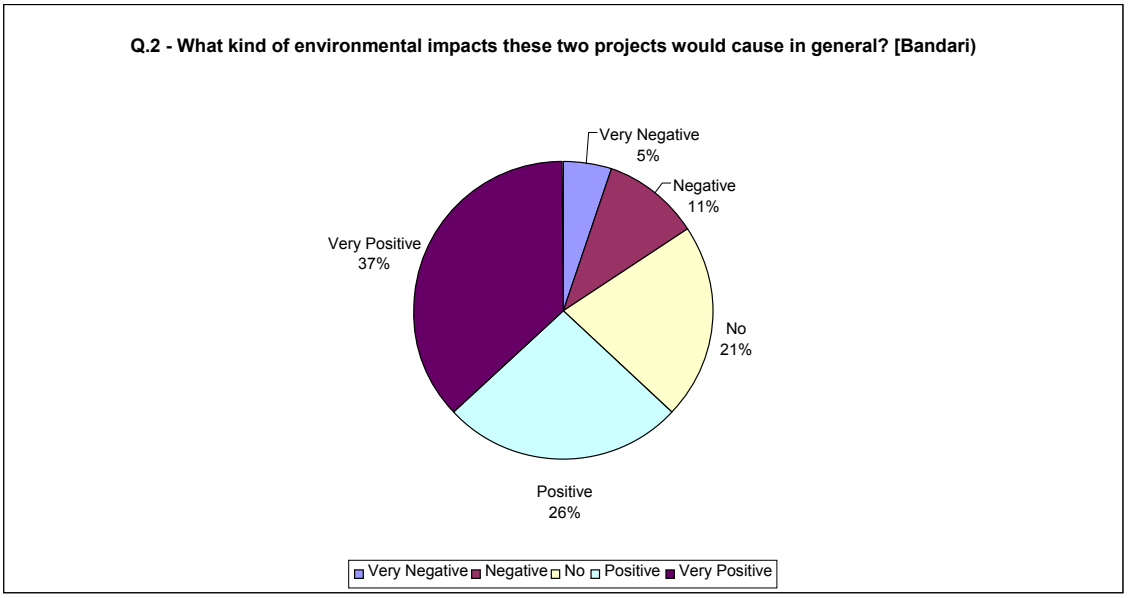


Figure 3.2.3 Post-Meeting Questionnaire Survey: Environmental Impacts - Gerezani

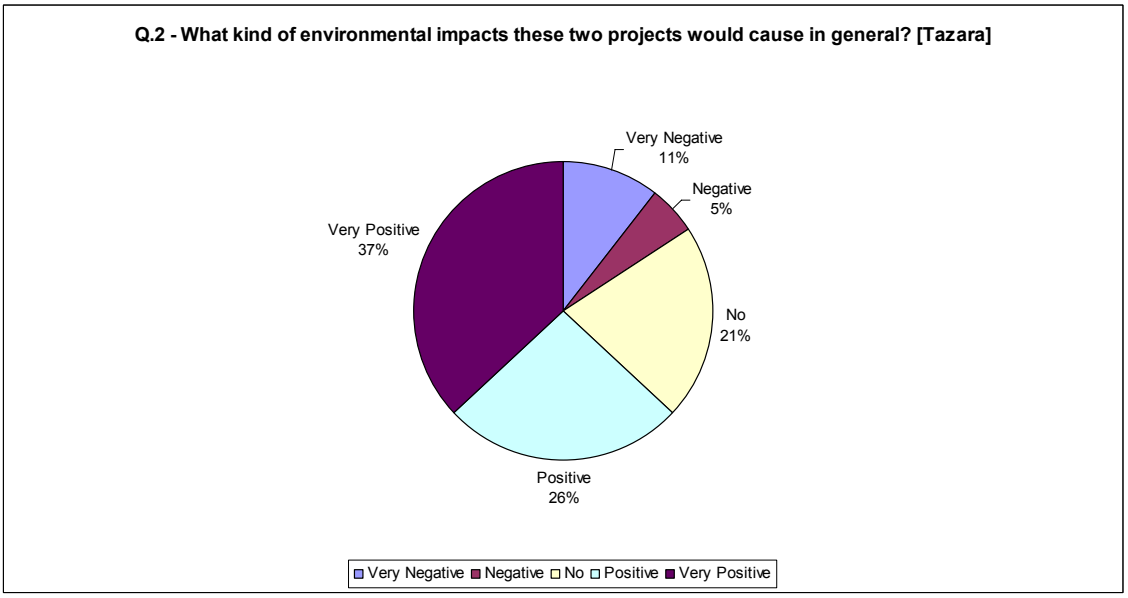


Figure 3.2.4 Post-Meeting Questionnaire Survey: Environmental Impacts - Tazara

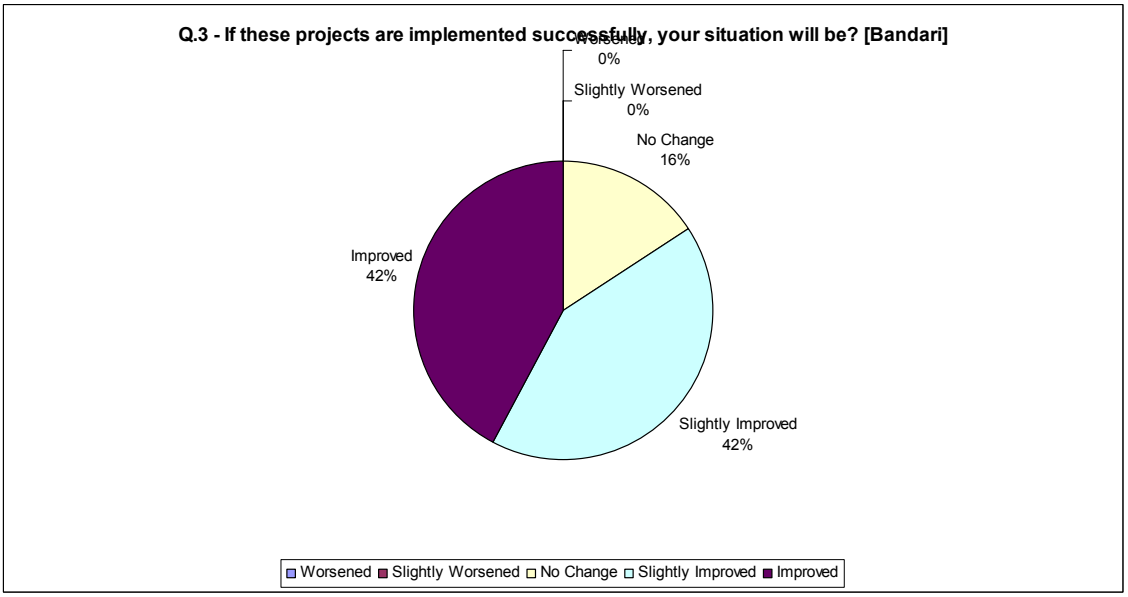


Figure 3.2.5 Post-Meeting Questionnaire Survey: Future situation - Gerezani

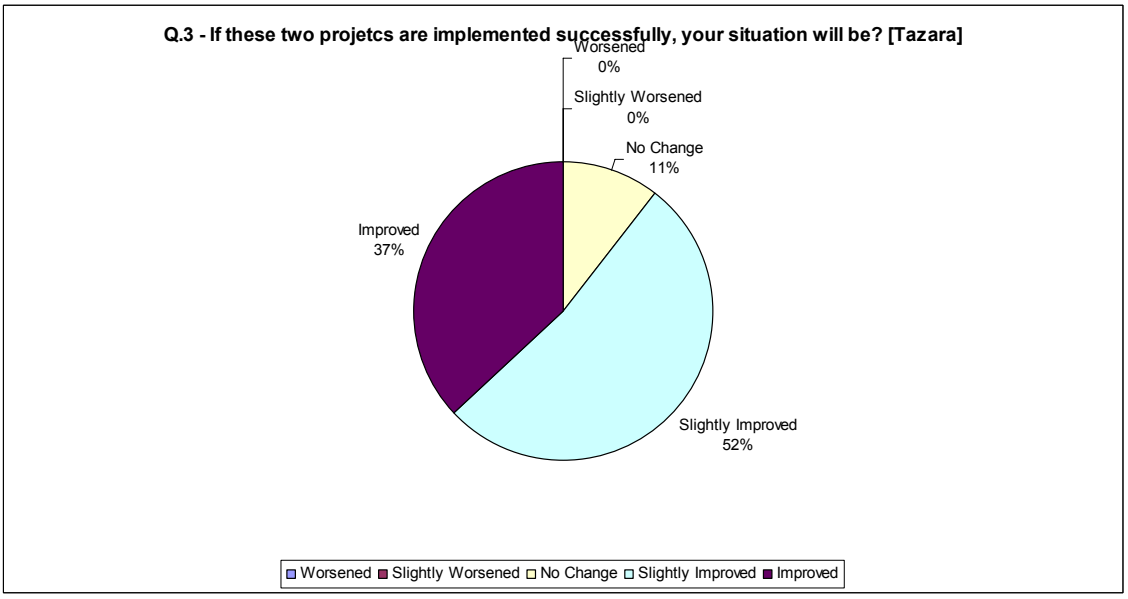


Figure 3.2.6 Post-Meeting Questionnaire Survey: Future situation - Tazara

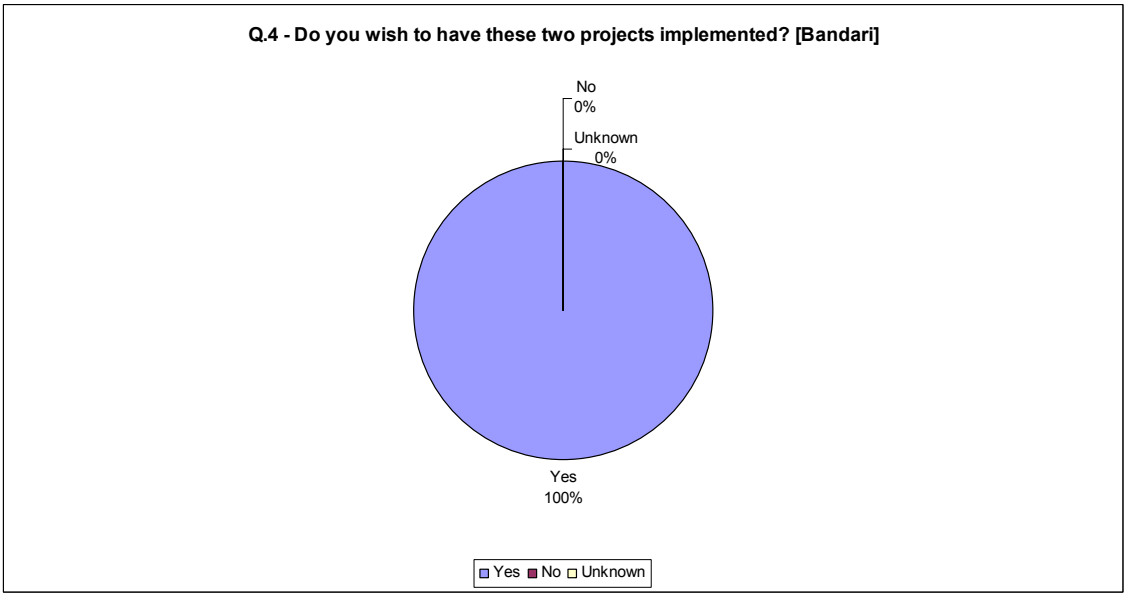


Figure 3.2.7 Post-Meeting Questionnaire Survey: Project Supporting - Gerezani

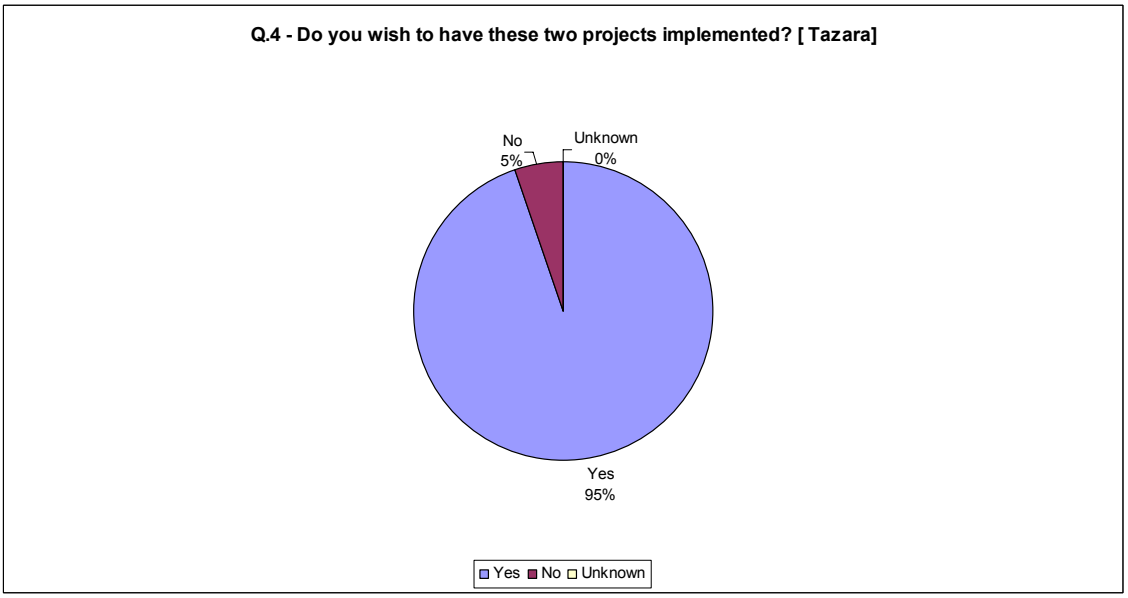


Figure 3.2.8 Post-Meeting Questionnaire Survey: Project Supporting - Tazara

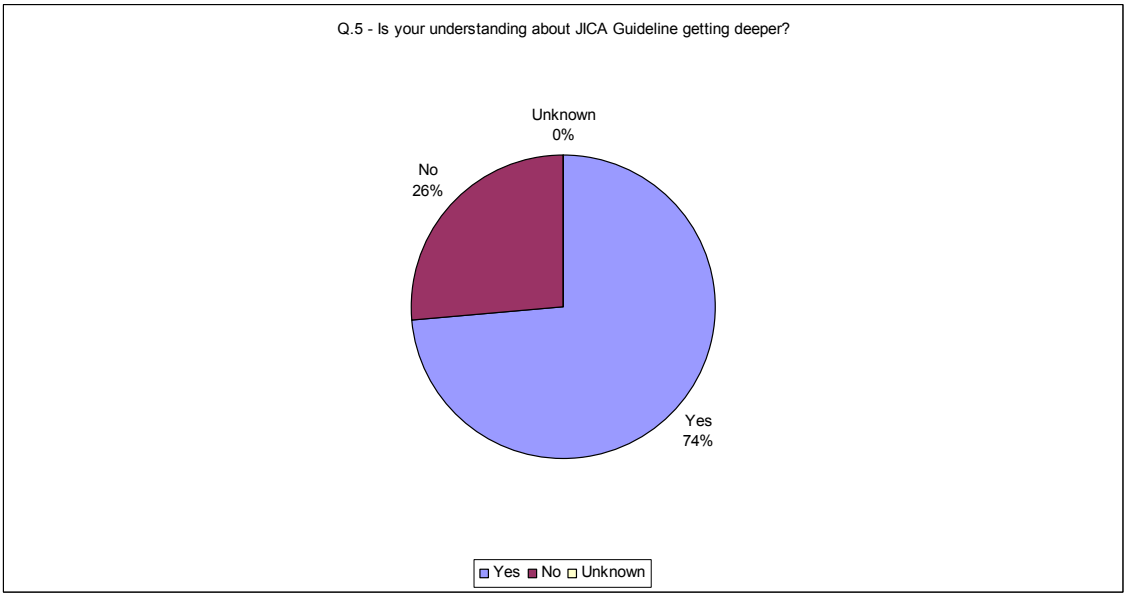


Figure 3.2.9 Post-Meeting Questionnaire Survey: Understanding of JICA Guideline

3.2.2 2nd Stakeholder Meeting

(1) Outline of 2nd Stakeholder Meeting

2nd stakeholder meeting was held on November 28, 2007 at Karimjee Hall, Dar es Salaam. Table 3.2.2 summarizes the adopted agenda of this 2nd meeting. Registration started at 9:00 a.m. of November 28, and meeting itself started at 9:30 a.m. of this morning. Entire process of this stakeholder meeting was recorded. In addition to the originally listed 30 stakeholders, several new stakeholders were added for delivery of the invitation letter. A total of 35 stakeholders attended at this 2nd stakeholder meeting.

Table 3.2.2 Adopted Agenda of 2nd Stakeholder Meeting

(1) Registration
(2) Opening Remarks
(3) Progress of Dar Es Salaam Urban Transport Policy and System Development M/P
(4) Progress of Pre-Feasibility Project Outline
(i) Gerezani Area Transport Enhancement Project
(ii) Tazara Intersection Improvement Project
(6) Review of 1st stakeholder meeting
(7) Progress of environmental field study
(8) Environmental screening/scoping
(9) Q/A Session
(10) Discussions
(11) Post-meeting survey
(12) Closing Remarks

3.2.3 3rd Stakeholder Meeting

(1) Outline of 3rd Stakeholder Meeting

The 3rd stakeholder meeting was held on May 20, 2008 at Karimjee Hall, Dar es Salaam. Table 3.2.3 shows adopted agenda of this 3rd meeting. Registration started at 9:30 a.m. of May 20, and meeting started at 10:15 and ended at 12:30. A total of 20 people attended at this 3rd stakeholder meeting.

Table 3.2.3 Adopted Agenda of 3rd Stakeholder Meeting

(1) Registration
(2) Opening Remarks
(3) Progress of Pre-Feasibility Project Outline
(i) Gerezani Area Transport Enhancement Project
(ii) Tazara Intersection Improvement Project
(4) Environmental study results
(5) Q/A Session
(6) Discussions
(7) Closing Remarks

(2) Summary of Minutes of Meeting

Mr. Julius Maira, head of planning department, Dar es Salaam City Council opened the meeting, followed by the presentation of JICA study team. A summary of the presentation is as follows:

Gerezani Area Transport Enhancement Project

Alternative 1 (for Operation A or C) has been selected as the recommended alternative among the three alternatives. Alternative A requires road widening of Bandari and Gerezani road: from the existing 2-lane to 6-lane road including 2 lanes for BRT operation. Detailed project description is available in the Pre-FS report Volume 1 as a part of the Master Plan documents.

Tazara Intersection Improvement Project

A 4-lane flyover along Nelson Mandela road was recommended as the most preferred option to solve the foreseen traffic congestion and associated projects. The bridge design and costing were updated in accordance with the comments from the stakeholders and steering committee in December 2007.

Environmental Survey

Eight kinds of environmental survey listed below were conducted in December 2007.

① Roadside Air Quality Survey
② Roadside Noise Survey
③ Water Quality Survey
④ Soil Survey

⑤ Regional Drainage Survey
⑥ Roadside House/Facilities Survey
⑦ Questionnaire-based public opinion survey
⑧ Questionnaire-based roadside heath damage survey

The result of each survey was briefly presented to the stakeholders. Detailed documentations are available in Chapter 2 of this technical report.

The air quality and questionnaire-based roadside health damage survey suggests that there might be serious damage in health condition of the people who do social and economic activities near both of the project sites. NOx level of each site may exceed the indicative environmental standards used in other countries.

It was recommended that the result of the environmental surveys shall be used as a baseline condition information in the consequent project implementation stage, that is, this information shall be used as a part of EIA for the projects.

As suggested in the post meeting inquiry survey in the 2nd stakeholder meeting, these two priority projects were generally satisfactory accepted by the stakeholders.

Appendix 1 Questionnaire Survey Sheet for Socio-Cultural Community Survey

No.

Dar Es Salaam Urban Transport and System Development M/P Project

A. BACKGROUND INFORMATION

Survey Date

Occupation (1) Worker

1.Legislator, Administrator and Manager	8. Craftsmen
2. Professionals	9. Farmers
3. Tech & Associate Professionals	10. Livestock Keepers
4. Clerks	11. Fishermen
5. Small Business Managers	12. Plant Operators, Assemblers
6. Service & Shop sales Workers	13. Others (please specify)

(2) Student

1. Elementary	3. University & Institute
2. Secondary	4. Others

(3) Non-Worker

1. Job Seekers	3. Retired
2. Housewives	4. Others

Age Sex M / F

Home Address

Commuting Measure

1. Walking	6. Taxi	11. Trucks
2. Bicycle	7. Bhajaj	12. Railway
3. Motorcycle	8. Dala Dala	13. Ferry/Boat
4. Car	9. Inter-City Bus	14. Others

Commuting Time hr min.

Working Place (or school location)

B. CURRENT ROAD CONDITION

1. What are the road-related concerns or issues?

A. Driving Condition	Less Fair Major
a. Traffic jam	1------2------3------4------5
b. Traffic accident	1------2------3------4------5
c. Inappropriate traffic signal	1------2------3------4------5
d. Poor pavement condition	1------2------3------4------5
e. Inappropriate parking space.	1------2------3------4------5
f. Others (specify)	1------2------3------4------5

B. Pedestrian Condition	Less Fair Major
a. Narrow Sidewalk	1------2------3------4------5
b. Inappropriate crosswalk	1------2------3------4------5
c. Poor pavement condition	1------2------3------4------5
d. Unsafe road crossing	1------2------3------4------5
e. Dusty and/or noisy	1------2------3------4------5
f. Others (specify)	1------2------3------4------5

C. Public Transport System

1. How often do you use the public transport system?
   a. Every Day
   b. Every weekday
   c. Only weekday
   d. Others (please specify) /week

2. What are main public-transport-system-related concerns or issues?	Less Fair Major
a. Bus fare (expensive)	1------2------3------4------5
b. Bus stop locations.	1------2------3------4------5
c. Bus stop structure	1------2------3------4------5
d. Bus-terminal facility	1------2------3------4------5
e. Bus-driver's manner	1------2------3------4------5
f. Driving Safety.	1------2------3------4------5
g. Vehicle conditions (e.g., dirty, poor suspension, not comfortable).	1------2------3------4------5
h. Others (specify)	1------2------3------4------5

D. Public Concern for Transport Improvement Project

1. Do you think any public transport improvement plans and/or projects necessary?

a. No

b. Yes (if Yes, specify)

2. Any opinions or possibility that public transport improvement plans may lead to:

	Less Fair Major
a. Environmental degradation (specify)	1------2------3------4------5
b. More market access	1------2------3------4------5
c. Availability of more services	1------2------3------4------5
d. More educational opportunities	1------2------3------4------5
e. More employment opportunities	1------2------3------4------5
f. Other impacts (specify)	1------2------3------4------5

E. ENVIRONMENT

1. What are the current main local environmental concerns or issues (general environmental issues as well as transport-related one)?

	Less Fair Major
a. Noise/vibration	1------2------3------4------5
b. Vehicular emission	1------2------3------4------5
c. Air quality	1------2------3------4------5
d. Water quality	1------2------3------4------5
e. Vegetation	1------2------3------4------5
f. Fauna	1------2------3------4------5
g. Historical/cultural and/or monumental properties.	1------2------3------4------5
h. Safety	1------2------3------4------5
i. Others (specify)	1------2------3------4------5

2. If the public transport system is to be improved, what will be the most effective ways to improve local environment within this entire transport project?

	Less Fair Major
a. Enhanced Vehicle Inspection/Maintenance	1------2------3------4------5
b. Improve Road Structure	1------2------3------4------5
c. Law Enforcement (e.g., speed limit/frequent patrol)	1------2------3------4------5
d. Improve Traffic Control (e.g., tidal flow)	1------2------3------4------5
e. Set-up Noise Barrier	1------2------3------4------5
f. Integrated Regional Drainage System	1------2------3------4------5
g. Driver's education (e.g., safety drive)	1------2------3------4------5
h. Set-up Bike path	1------2------3------4------5
i. Improve walking path	1------2------3------4------5
j. Others (specify)	1------2------3------4------5

3. How do you feel the road crossing (e.g., crossing of major roads such as Nyerere, Nelson Mandera, Morogoro and other broadways)?

	Less	**Fair**	**Major**
a. Crossing Point is not enough.	1	2 3 4	5
b. Need more pedestrian bridges.	1	2 3 4	5
c. Bad driver's manner (i.e., should be kind to walker).	1	2 3 4	5
d. Strong Sense of Community Separation (e.g., tend to feel difficult meet near relatives/or friends)	1	2 3 4	5
e. Others (specify)	1	2 3 4	5

THANK YOU FOR YOUR COOPERATION !!

Appendix 2 Survey Sheet for Roadside Health Survey

2-1 Survey Sheet for Police Officers and Office Worker

A. BACKGROUND INFORMATION

Survey Date

Rank

Age Sex M / F

Outside Working Place

Working Time Outside hr/week

Inside hr/week

Content of Working (outside): traffic control patrol others (specify)

How long have you been assigned on this outside duty? yrs

B HEALTH-RELATED ISSUES

1. Are you currently suffering following symptoms and/or diseases?

If yes, since when?

a. Chronic Bronchitis since
b. Acute Bronchitis since
c. Chronic Asthma since
d. Acute Asthma since
e. Restricted Activity Days (RAD) since
f. Respiratory Hospital Diseases (RHD) since
g. Coronary Heart Disease since
h. Hypertension since
i. Others (specify: e.g., severe cough, sour throat, congestion, stuffy nose) since

2. Do you go to the hospital/clinic for the treatment of the disease/symptom you mentioned in previous question?

Yes (if yes, specify how often / how long?)

No

3. Did you buy some medicine for the treatment of the disease/symptom you mentioned in question 1?

Yes (if yes, specify how often / how much you spent?)

No

4. Have you suffered following symptoms and/or diseases before?

If yes, please specify the suffering period of that symptoms and/or disease.

a. Chronic Bronchitis month/week
b. Acute Bronchitis month/week

c. Chronic Asthma	month/week
d. Acute Asthma	month/week
e. Restricted Activity Days (RAD)	month/week
f. Respiratory Hospital Diseases (RHD)	month/week
g. Emergency Room Visit (ERV)	times/week, times/month
h. Coronary Heart Disease	month/week
i. Hypertension	
j. Others (specify: e.g., severe cough, sour throat, congestion, stuffy nose)	month/week

5. Did you go to the hospital/clinic for the treatment of the disease/symptom you mentioned in previous question?

Yes (if yes, specify how often / how long?)

No

6. Did you buy some medicine for the treatment of the disease/symptom you mentioned in question 1?

Yes (if yes, specify how often / how much you spent?)

No

2-2 Survey Sheet for Street Vendors

A. BACKGROUND INFORMATION

Survey Date

Survey Place

Age Sex M / F

Working Time Outside hr/week

Inside hr/week

What's for sale (specify)?

Average sales (income?) S./ day/week/month

How long have you been doing this business? yrs

How many family member do you support by this business?

B HEALTH-RELATED ISSUES

1. Are you currently suffering following symptoms and/or diseases?

If you answer yes (**b** or **c**), since when & how often?

1.1. Do you have severe cough?

a. No b. Sometime c. Always since, how often

1.2 Do you have sour throat?

a. No b. Sometime c. Always since how often

1.3 Do have stuffy nose/runny nose/nasal congestion?

a. No b. Sometime c. Always since how often

1.4 Do you have hearing difficulty?

a. No b. Sometime c. Always since how often

1.5 Do you have ear ringing?

a. No b. Sometime c. Always since how often

1.6 Do you have eye itching?

a. No b. Sometime c. Always since how often

1.7 Do have dull headache?

a. No b. Sometime c. Always since how often

1.8 Do you feel tired?

a. No b. Sometime c. Always since how often

1.9 Do you lose your working days due to the illness/symptom mentioned above?

a. No b. Sometime c. Always how often?

2. Do you go to the hospital/clinic for the treatment of the disease/symptom you mentioned in previous question?

Yes (if yes, specify how often / how long?)

No

3. Did you buy some medicine for the treatment of the disease/symptom you mentioned in question 1?

Yes (if yes, specify how often / how much you spent?)

No

Appendix 3 Photo Records

1st Stakeholder Meeting

2nd Stakeholder Meeting

3rd Stakeholder Meeting

Appendix 4 List of Participants

1st Stakeholder Meeting

No.	Name of Participant	Organisation	Mobile No.
1	Issa Mzingo	Sandali	
2	Mwanamkuu M. Dady	Mivinjeni Kurasini	0753 144 441
3	Safina Madenge	Sandali	
4	Hussein Msede	Mivinjeni Kurasini	0754 831 676
5	Sinonge Masiliso	TAZARA	0754 091 705
6	N. R. Mashili	Sandali Mamboleo "B"	0754 059 360
7	Eng. Hashimu Kabanda	Temeke Municipal Council	0784 449 855
8	Takanory Hatashida	Jica Study Team	
9	Shibata Junji	Jica Study Team	0753 714 598
10	Kiminari Takahasmi	Jica Study Team	
11	Hiroshi Aoki	Jica Study Team	
12	Koji koga	Jica Study Team	
13	Ikeda Seiju	Jica Study Team	
14	Enoch Kitandu	DART	0754 304 295
15	Asteria Mlambo	DCC/DART	0754 262 620
16	Mhe. Tarimo W. A	Councillor Temeke	0713 553 180
17	Mgeta S. M.	TANROADS	0754 373 630
18	Jason Rwiza	TANROADS	0784 745 639
19	Salinja Kilima	ZTO DSM	0754 322 277
20	Kato Peter	Tanzania Metrological Agency (TMA)	0784 472 024
21	Eng. Yoeza M. Senzigha	TPA	0784 495 902
22	Sultan A. Mziray	Municipal Welfare Officer Temeke	0786 657 990
23	Stephen Kongwa	DCC	0784 306 342
24	Alex Ngasi	COWI TZ	
25	Salim O. Msangi	Health Officer Temeke Municipal	0754 502 885
26	Tumaini Mwamfupi	Ward Executive Oficer Of Kurasini	0713 570 993
27	Felista N. Komba	Kurasini	0784 311 211
28	Patrick Kasera	COWI TZ	0754 260 418
29	Rose Ndesamburo	TBS	0713 691 943
30	Prof. G. R. John	University of DSM	0754 319 945
31	Restituta P. Mapinduzi	UCLAS	0786 581 333
32	Thabit M. Massa	WEO-Sandari Temeke Municipal	0754 307 505
33	Dr. Robert Ntakamulenga	NEMC	0784 526 470
34	M. M. Katongo	MEO-Mivinjeni	0754 834 221
35	J. Mboneko	COWI TZ	0755 713 880

2nd Stakeholder Meeting

No.	Name of Participant	Organisation	Mobile No.
1	Stephen Kongwa	DCC	0784 306342
2	Eng. Hashimu . I. Kabanda	Temeke Municipal Council	0784 449855
3	Rose Ndesamburo	TBS	0713 691943
4	Eng. Yoeza M. Senzighe	TPA	0784 495902
5	Jackson Mwassa	TMA	0713 268554
6	Mwanamtuli M. Dady	Temeke municipal Council	0753 144441
7	J. Mboneka	COWI Consalt	0755 713226
8	P .Katyega	Ilala Municipal Council	0755 031594
9	Magina J. Lufungulu		0754 760278
10	Sano Takuya	Japan	N/A
11	F. Adachi	JICA Tz Office	0787 464618
12	Mr. Peter Shabani	JICA Tz Office	0784 200120
13	Asteria Mlambo	DCC /DART	0754 262620
14	Mohamed Kuganda	DART	0754 810570
15	Julius Maira	DCC	0754 290132
16	Martha Mkupasa	DCC	0713 300208
17	Mgeta S. M.	TANROADs	0784 373630
18	Daniel Seme	BP (T) LTD	0754 964265
19	Tigakwa Serapion	IMC	0754 372900
20	Eng. K. C. L. Mwambene	DCC 0754 268626	0754 268626
21	Hiroshi Aoki	JICA Team	N/A
22	Koji Koga	JICA Study Team	N/A
23	Hiroshi Metsuoka	JICA Study Team	0762 656678
24	Yoshiyuki Arita	JICA Study Team	0787 859897
25	Shozo Inoot	JICA Study Team	N/A
26	Eddy Declzug	JICA Study team	N/A
27	Junji Shibata	JICA Study Team	N/A
28	Takanori Hayashida	JICA Study Team	N/A
29	Takahashi Kiminari	JICA Study Team	N/A
30	Issa Mzingo	N/A	N/A
31	Salim O. Msangi	Temeke Municipal Council	0754 502855
32	Sultan Mziray	Welfare Of Temeke	0786 657990

3rd Stakeholder Meeting

No.	Name of Participant	Organisation	Mobile No.
1	Thabit M. Massa	Temeke Municipal	0754 307505
2	Patric Kasera	COWI Tz	0754 260418
3	M. M. Katogo	Temeke Municipal	0754 834221
4	Mohamed Kuganda	DART	0754 810570
5	Asteria Mlambo	DART	0754 262620
6	Hussen Msede	Mivinjeni	0754 831676
7	Rose Ndesamburo	TBS	0713 691943
8	Tumain Mwamfupi	Kurasini	0714 979804
9	Felistar Kumba	Kurasini	0784 311211
10	Photidas A. Kagimbo	Temeke Municipal Council	0713 568120
11	Eng. KC. L. Mwambene	DCC	0754 268626
12	Eng. H. I. Kabanda	Temeke Municipal Council	0784 449855
13	Name	Organization	Adress (mobile,L/line,E-mail
14	Hon Abel W. Tarimo	Councillor Temeke Municipal Council	0713 553180
15	Noah Robert Mashili		Box 45909 Dsm
16	Junji Shibata	JICA Study Team	N/A
17	Takanori Hayashida	JICA Study Team	N/A

Chapter 4 Cost Estimates

4.1 Reference Cost Data of the Cost Estimates

The cost estimates for the master plan components and the pre-feasibility study projects are made based on the cost data obtained from similar projects in Tanzania and other countries. Major construction works of the projects proposed in the Master plan and the pre-feasibility study consist of (i) road construction works and (ii) bridge construction works. Details of the reference cost data for each construction work are described hereinafter.

4.1.1 Road Construction Works

The cost estimate of the basic design study on the Kilwa road project, which was made in September 2005, is the most useful data among the cost data of similar projects in Tanzania. All the components of the cost estimate of the Kilwa road project were examined, taking into account the basic conditions such as road design, construction method, work items, natural material resources, foreign exchange rate, base price for labor wage and material price.

As a result, the unit costs for each work item are set as shown in Table 4.1.1. The basic conditions and assumptions are as follows:

- All the unit costs are estimated in terms of US Dollar.
- Unit costs including contractor's overhead & profits should be applied to our cost estimate.
- Contractor's overhead expenses & profits have been allocated to the unit costs of each work item. These expenses are estimated at 19% of the direct unit cost comprising labor wage, material cost and equipment cost. The rate (19%) is decided as a result of the examination of the cost estimate on the Kilwa road project.
- The exchange rates used in the cost estimate on the Kilwa road project as of September 2005 are as follows:
  US$ 1.0 = Tshs 1,122.15 = Yen 109.54

Table 4.1.1 Unit Cost for the Road Construction Works

Unit :US$

	Work item	Unit	Direct unit cost	Unit cost including contractor's overhead & profits	Remarks
1	Earthwork				
	1) Excavation	m3	7.18	8.54	
	2) Embankment	m3	10.76	12.80	Hauling distance :7.2 km
2	Pavement work				
	(1) Main road (carriage way)				
	1) Subbase course, cement stabilization, t=26cm	m2	8.15	9.70	
	2) Base course, selected materials, t=20cm	m2	13.71	16.31	
	3) Surface cource, asphalt concrete, t=7cm	m2	19.23	22.88	
	Total (1)	m2		48.89	
	(2) Access road (carriage way)				
	1) Subbase course, cement stabilization, t=15cm	m2	6.61	7.87	
	2) Base course, selected materials, t=15cm	m2	9.86	11.73	
	3) Surface cource, asphalt concrete, t=4cm	m2	12.7	15.11	
	Total (2)	m2		34.71	
	(3) Shoulder				
	1) Shoulder aggregate course, t=26cm	m2	10.35	12.32	
	2) DBST	m2	6.52	7.76	
	Total (3)	m2		20.08	
	(4) Side walk				
	1) Subbase course, cement stabilization, t=10cm	m2	2.53	3.01	
	2) DBST	m2	6.52	7.76	
	Total (4)	m2		10.77	
	(5) Median				
	1) Sodding	m2	1.24	1.48	
3	Concrete work				
	1) Concrete structures including formwork, reinforcement work and joint work	m3	255.00	303.45	
4	Drainage work				
	1) V-shaped drain ditch	m	50.20	59.74	
	2) Cross drain, RC pipe, dia.= 900 mm	m	410.45	488.44	
	3) Culvert drain, RC box, 3.5 x 5.0 m	m	2,106.47	2506.70	
5	Slope protection work				
	1) Gabion mattress, h = 2.5 m	m	260.20	309.64	
6	Road facilities				
	1) Kerb stone	m	14.26	16.97	
	2) Guard rail	m	282.05	335.64	
	3) Bus stop, L = 500 m	no.	952.99	1,134.06	
	4) Road lighting	no.	2,280.38	2,713.65	
	5) Road Information signs	no.	50.70	60.33	
	6) Lane marking, contineous line, 15 cm in width	m	0.87	1.04	

Source :Engineer's cost estimate of the basic design on the Kilwa Road Widening Projest (September 2005)

4.1.2 Bridge Construction Works

The construction costs for the bridges are generally depending on each type of bridge. In the cost estimates, the following four types of bridge are considered:

(1) PC T girder type (average length between the piers :30 m)

(2) PC hollow slab type (average length between the piers :30 m)

(3) PC box girder type (average length between the piers :70 m)

(4) Extradosed pre-stressing type (average length between the piers :200 m)

Meanwhile, the unit cost per m^2 of the bridge is generally represented by the relation between (i) unit cost per m^2 and (ii) length between the piers of bridge. The above (1) type and (2) type are therefore considered as the same unit cost per m^2 of bridge.

The reference cost data for each type of bridge have been collected as shown in Table 4.1.2. The basic conditions and assumptions are as follows:

- All the unit costs are estimated in terms of the US Dollar.
- Contractor's overhead & profits are included in the unit cost.
- Average unit costs for each type of bridge should be applied to our cost estimate.

Table 4.1.2 Unit Cost for the Road Construction Works

Unit :US$

	Name of Project	Unit	Unit Cost	Remarks
1	PC T girder type/ PC hollow slab bridge			
	1) Agno River Urgent Rehabilitation Project	m2	1,542	Length :392.5 m, Width :7.4 m
	in Philippine			JBIC loan, 1998-2004
	2) Danube Crossing Bridge Project in Belgrade	m2	1,987	Length :1,865 m approach bridge
	in Serbia			Feasibility study in 2007
	Average	m2	1,765	
2	PC box girder type bridge			
	1) Kien Bridge in Vietnam	m2	1,697	Detailed design in August 1999
	2) Kazungura Bridge between Zambia and	m2	3,238	Length :127.5 m approach bridge
	Botswana			Japanese grant aid project in 2001
	3) Kilino Bridge in Philippine	m2	3,589	Length :435 m, Width :10.4 m
				Japanese grant aid project in 2001
	4) Kigamboni Bridge Project in Tanzania	m2	1,776	Length :680 m, Width :22 m
				Feasibility study in 2005
	Average	m2	2,575	
3	Extradosed prestressing type bridge			
	1) Danube Crossing Bridge Project in Belgrade	m2	5,397	Length :420 m main bridge
	in Serbia			Feasibility study in 2007
	2) Kazungura Bridge between Zambia and	m2	6,476	Length :465 m main bridge
	Botswana			Japanese grant aid project in 2001
	3) Kilino Bridge in Philippine	m2	4,814	Length :435 m, Width :10.4 m
				Japanese grant aid project in 2001
	4) Extradosed Bridge in Japan	m2	5,362	Length :500 m
				Cost estimate in 2002
	Average	m2	5,512	

4.2 Cost Estimation Methodology for Master Plan Components

In the master plan there are several types of road proposed, such as urban expressway, primary arterial, secondary arterial, feeder road, and BRT. In addition, land reclamation, Kigamboni bridge, and flyover are proposed as a combination with the above road network scheme. Under such conditions, the unit costs per km for each type of road are estimated based on each of the typical cross sections designed in the master plan, while the costs for the land reclamation and flyover are estimated by multiplying the work quantity and its unit cost in principal.

The costs per km for each type of road and the costs for the land reclamation/ kigamponi bridge/

flyover are summarized in Table 4.2.1 and Table 4.2.2 respectively. The basic conditions and assumptions are as follows:

- The cost estimate is made in Tanzanian Shilling (Tshs).
- The exchange rates as of the 2nd of October 2007 used in the cost estimate are as follows: US$ 1.0 = Tshs 1,271.26 = Yen 116.74
- It has been assumed that the construction work will be undertaken by competent contractors selected through international competitive bidding (ICB).
- Each of the unit costs of major work items is estimated based on the cost data obtained from the Kilwa road project and other similar projects, which is described in the preceding Section 4.1.
- No tax has been included in the cost estimate.

Table 4.2.1 Costs per km for the Road Construction Works

Exchange Rate (as of Oct. 2, 2007) 1US$ = Tshs 1,271.26 1US$ = Yen 116.74

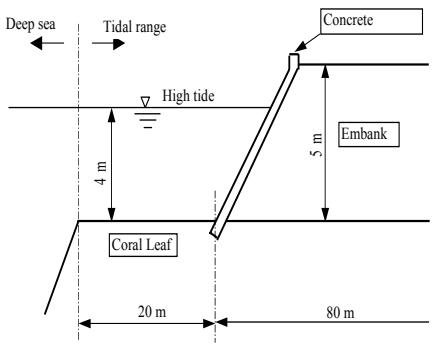
	Classification		No. of lanes	Side walk	Shoulder	Carriage way	Median	Carriage way	Shoulder	Side walk	Unit Cost per km	Unit Cost per km	Remarks
				(m)	(m)	(m)	(m)	(m)	(m)	(m)	(US$/km)	(mil. Tshs/km)	
1	Urban Expressway		4	0.5	3	7	3	7	3	0.5	1,435,263	1,825	
			6	0.5	3	10.5	3	10.5	3	0.5	2,034,165	2,586	
2	Elevated Urban Expressway (PC T girder type)		4	0.5	1.25	7	2.25	7	1.25	0.5	34,858,750	44,315	1,765 US$/m2
			6	0.5	1.25	10.5	2.25	10.5	1.25	0.5	47,213,750	60,021	1,765 US$/m3
3	Elevated Urban Expressway (PC box girder type)		4	0.5	1.25	7	2.25	7	1.25	0.5	50,856,250	64,652	2,575 US$/m2
			6	0.5	1.25	10.5	2.25	10.5	1.25	0.5	68,881,250	87,566	2,575 US$/m2
4	Primary Arterial	w/o BRT	4	3	2.5	7	2	7	2.5	3	1,491,770	1,897	
		w/o BRT	6	3	2.5	10.5	2	10.5	2.5	3	2,090,673	2,658	
		w/o BRT	8	3	2.5	14	2	14	2.5	3	2,689,575	3,420	
		with BRT, w/o station	6	3	2.5	7	9	7	2.5	3	2,256,608	2,869	
		with BRT, w/o station	8	3	2.5	10.5	9	10.5	2.5	3	2,855,510	3,631	
		with BRT, w/o station	10	3	2.5	10.5	17	10.5	2.5	3	3,539,970	4,501	
		with BRT, with station	6	3	2.5	7	11	7	2.5	3	2,427,723	3,087	
		with BRT, with station	8	3	2.5	10.5	11	10.5	2.5	3	3,026,625	3,848	
		with BRT, with station	10	3	2.5	10.5	24	10.5	2.5	3	4,138,873	5,262	
5	Secondary Arterial	w/o bus line	4	3	2	6.5	2	6.5	2	3	1,371,073	1,743	
		w/o bus line	6	3	2	9.75	2	9.75	2	3	1,927,196	2,450	
		with bus line, w/o bus bay	4	3	2	6.5	2	6.5	2	3	1,371,073	1,743	
		with bus line, w/o bus bay	6	3	2	9.75	2	9.75	2	3	1,927,196	2,450	
		with bus line, with bus bay	4	3	2	9.75	2	9.75	2	3	1,927,196	2,450	
		with bus line, with bus bay	6	3	2	13	2	13	2	3	2,483,320	3,157	
6	Feeder Road		2	3	2	3.25	0	3.25	2	3	809,769	1,030	
			4	3	2	6.5	1	6.5	2	3	1,368,483	1,740	
7	Elevated BRT	PC T girder type	2	1	0.5	3.5	1	3.5	0.5	1	19,415,000	24,682	1,765 US$/m2
8	Elevated BRT	PC box girder type	2	1	0.5	3.5	1	3.5	0.5	1	28,325,000	36,009	2,575 US$/m2
9	BRT		2	1	0.5	3.5	1	3.5	0.5	1	674,328	858	
											Unit Cost per m2		
10	Small Bridge	PC T girder type										2,178	thousand Tshs

Note :
The above unit cost per km covers the cost of all the construction works such as earth work, pavement work, structural concrete work, lighting utilities, gued rail, etc.

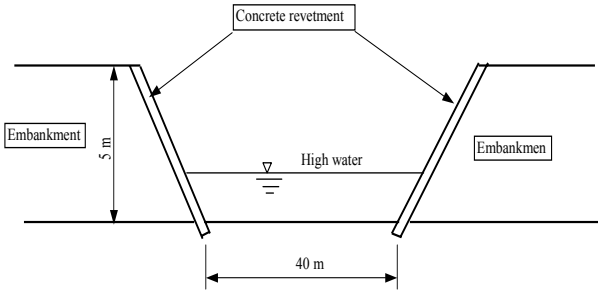
Table 4.2.2 Costs for the Land Reclamation/ Kigamboni Bridge/ Flyover

	Exchange Rate	1US$ = Tshs	1,271.26
	(as of Oct. 2, 2007)	1US$ = Yen	116.74

1	Land Reclamation Works for Nsimbazi River Mouth	
	1) Land reclamation area	: 1,000 m x 80 m = 80,000 m2
	2) Embankment volume	: 80,000 m2 x 5 m = 400,000 m3
	3) Concrete volume	: 1,900 m3
	4) Unit cost of embankment works	: 12.80 US$/m3 x 1.5 = 19.20 US$/m3 = 24,408 Tshs/m3 (hauling distance :20 km)
	5) Unit cost of concrete works	: 303.45 US$/m3 = 385,764 Tshs/m3 (inlcuding reinforcement bar and concrete form)
	6) Total cost of the land reclamation works	: 400,000 m3 x 24,408 Tshs/m3 + 1,900 m3 x 385,764 Tshs/m3 = 10.6 billion Tshs
2	Kigamboni Bridge Project	
	1) Source	: Comprehensive Feasibility Study for Proposed Kiganboni Bridge Project in Dar es Salaam (October 2005)
	2) Bridge (length = 680m, carriageway = 22m)	: 19.6 million Euro = 27.8 million US$ = 35.3 billion Tshs (Exchange rtae : 1 Euro = 1.42 US$ as of Oct. 2, 2008)
	3) Access Road (length = 5,330m, carriage way = 22m)	: 14.2 million Euro = 20.2 million US$ = 25.7 billion Tshs
	4) Others	: 11.2 million Euro = 15.9 million US$ = 20.2 billion Tshs
	5) Total cost of the Kigamboni bridge project	: 35.3 + 25.7 + 20.2 = 81.2 billion Tshs
3	Fly over (4 lanes)	
	1) Bridge portion (PChollow slab type)	: 18 m in width x 280 m in length x 2,178 thousand Tshs/m2 = 11.0 billion Tshs
	2) Approach portion	
	Embankment	: 18 m in width x 320 m in length x 2.5 m in average hight x 24,408 Tshs/m3 = 0.4 billion Tshs
	Retaining wall	: 5 m in height x 320 m in lengh x 0.3 m x 385,764 Tshs/m3 = 0.2 billion Tshs
	Road	: ((10.77US$/m2 x 1.0m + 20.08US$/m2 x 0.5m + 48.89US$/m2 x 7.0m)x2+1.48US$/m2 x 1.0m)x1.75x320m =407,360 US$=0.5 billion Tshs
	3) Total cost of the Fly over	: 11.0 + 0.4 + 0.2 + 0.5 = 12.1 billion Tshs
4	Fly over (2 lanes)	
	1) Bridge portion (PChollow slab type)	: 11 m in width x 280 m in length x 2,178 thousand Tshs/m2 = 6.7 billion Tshs
	2) Approach portion	
	Embankment	: 11 m in width x 320 m in length x 2.5 m in average hight x 24,408 Tshs/m3 = 0.3 billion Tshs
	Retaining wall	: 5 m in height x 320 m in lengh x 0.3 m x 385,764 Tshs/m3 = 0.2 billion Tshs
	Road	: ((10.77US$/m2 x 1.0m + 20.08US$/m2 x 0.5m + 48.89US$/m2 x 3.5m)x2+1.48US$/m2 x 1.0m)x1.75x320m =215,785 US$=0.3 billion Tshs
	3) Total cost of the Fly over	: 6.7 + 0.3 + 0.2 + 0.3 = 7.5 billion Tshs



Typical Section of Land Reclamation



Typical Section of Nsimbazi River Outlet

4.3 Cost Estimation Methodology for Pre-F/S Project

The construction cost for each major work is estimated by multiplying work quantity and unit cost in principal. The unit costs of major work items are estimated based on the cost data obtained from the Kilwa road project and other similar projects, which is described in the preceding Section 4.1. While, the work quantities of major work items are calculated based on the preliminary design, as shown in the following Section 4.4.

The unit costs of major work items are summarized in Table 4.3.1. The basic conditions and assumptions are as follows:

- The cost estimate is made in Tanzanian Shilling (Tshs) for both foreign and local currency components.
- The local currency component covers the costs of local labor and locally available materials such as aggregate, asphalt, cement, reinforcing bars, and fuel. The costs of imported materials, imported facilities and depreciation of construction equipment are allocated in the foreign currency component.
- The exchange rates as of the 2nd of October 2007 used in the cost estimate are as follows:
  US$ 1.0 = Tshs 1,271.26 = Yen 116.74
- It has been assumed that the construction work will to be undertaken by competent contractors selected through international competitive bidding (ICB).
- No tax has been included in the cost estimate.

Table 4.3.1 Unit Cost of Major Work Items

Unit :Tshs

Work Items	Unit	Foreign Currency Portion	Local Currency Portion	Total
1. Earthwork				
Excavation,common	m3	8,686	2,171	10,857
Embankment, common	m3	13,018	3,254	16,272
2. Pavement work				
Carriageway	m2	9,323	52,829	62,152
(subbase course t=26cm, base course t=20cm, asphalt surface t=7cm)				
Shoulder	m2	3,829	21,698	25,527
(shoulder aggregate course t=26cm, DBST))				
Side walk, DBST	m2	2,054	11,637	13,691
(subbase course t=10cm, DBST)				
Median, sodding	m2	0	1,882	1,882
3. Concrete work				
Retaining wall, concrete structure	m3	77,153	308,611	385,764
4. Drainage work				
Cross drain, RC pipe, dia.= 900 mm	m	62,093	558,841	620,934
Culvert drain, RC box, 3.5 x 5.0 m	m	637,333	2,549,334	3,186,667
Ditch drain, V-shaped	m	7,595	68,351	75,945
5. Slope protection work				
Gabion mattress, h = 2.5 m	m	39,365	354,281	393,645
Retaining wall, concrete structure	m3	77,153	308,611	385,764
6. Bridge construction work				
Extradosed prestressing type	m2	4,905,030	2,102,156	7,007,185
PC box girder type	m2	2,291,447	982,049	3,273,495
PC T girder type/ hollow slab type	m2	1,570,642	673,132	2,243,774
7. Road facilities				
Bus stop, L = 500 m	no.	576,674	865,011	1,441,685
Road lighting	no.	2,242,341	1,207,414	3,449,755
Traffic signal	no.	7,012,398	779,155	7,791,553
Road information signs	no.	61,356	15,339	76,695
Lane marking, contineous line, 15 cm in width	m	66	1,256	1,322
Guard rail	m	0	426,686	426,686
Kerb stone	m	1,079	20,494	21,573

4.4 Work Quantity of Pre-F/S

4.4.1 Gerazani Area Transport Enhancement Project

The work quantities for each option are calculated based on each of the preliminary designs prepared for each option. Details of the work quantity calculation sheets for each option are summarized in Table 4.4.1, 4.4.2, 4.4.3, respectively.

Table 4.4.1 Work Quantity Calculation Sheet (Option A, C)

Work Items	Unit	Calculation	Quantity	Remarks
1) Earth works				
Excavation	m3		15,142	
Embankment	m3		29,871	Inc. slope protection
2) Pavement works				
Cariageway	m2	9.5m x 2 x 1,300m	24,700	AC pavement
Side walk	m2	1,300m x 6m	7,800	DBST pavement
Median	m2	1,300 x 9m	11,700	
3) Drainage works				
Cross drain	m	40m x 6	240	900mm dir.
Culvert drain	m		56	3.5m x 5m
Ditch drain	m	Both side	2,600	
4) Bridge structure				
Gerezani bridge	m2	35m x 34m	1,190	PC T post tention girder
5) Flyover, PC hollow slab type				
Bridge portion	m2	150m x 11m	1,650	PC hollow slab
	m2	80m x 11m	880	PC Box girder
Approach portion				
Embankment	m3	From Drawing	6,622	
Retaining wall	m3	(6 m + 3 m) x 0.5 m x 2 x (132 m + 164 m) x 1/2	1,332	
Road				
Guardrail	m	2 x (132 m + 164 m)	592	
Carriageway	m2	4.5 m x 2 x (132 m + 164 m)	2,664	
Median	m2	1 m x (132 m + 164 m)	296	
6) Slope protection work				
Gabion mattress, h=2.5m	m	200m -35m	165	1.25m x 0.5m
7) Road Facilities				
Bus stop	no.		3	500m
Road lighting	no.		26	Every 50m
Traffic sgnal	no.		6	Intersection
Lane marking	m		3,900	Center & side lines
Guard rail	m	(220m-35m)x2	390	More than 4m embankment

Table 4.4.2 Work Quantity Calculation Sheet (Option B)

Work Items	Unit	Calculation	Quantity	Remarks
1) Earth works				
Excavation	m3		20,742	
Embankment	m3		36,713	Inc. slope protection
2) Pavement works				
Cariageway	m2	9.5m x 2 x 2,750m	52,250	AC pavement
Side walk	m2	2,750m x 6m	16,500	DBST pavement
Median	m2	2,750 x 9m	24,750	
3) Drainage works				
Cross drain	m	40m x 6 + 26m x 6	396	900mm dir.
Culvert drain	m		56	3.5m x 5m
Ditch drain	m	Both side	5,500	
4) Bridge structure				
Gerezani bridge	m2	35m x 34m	1,190	PC T post tention girder
5) Flyover, PC hollow slab type				
Bridge portion	m2	250m x 11m	2,750	
Approach portion				
Embankment	m3	10 m width x (145 m + 120 m) x 2.5 m average height	6,625	
Retaining wall	m3	(6 m + 3 m) x 0.5 m x 2 x (145 m + 120 m) x 1/2	1,193	
Road				
Guardrail	m	2 x (145 m + 120 m)	530	
Carriageway	m2	4.5 m x 2 x (145 m + 120 m)	2,385	
Median	m2	1 m x (145 m + 120 m)	265	
6) Slope protection work				
Gabion mattress, h=2.5m	m	200m -35m	165	1.25m x 0.5m
7) Road Facilities				
Bus stop	no.		6	500m
Road lighting	no.		55	Every 50m
Traffic sgnal	no.		10	Intersection
Lane marking	m		8,150	Center & side lines
Guard rail	m	(220m-35m)x2 + 150m	540	More than 4m embankment

Table 4.4.3 Work Quantity Calculation Sheet (Option D)

Work Items	Unit	Calculation	Quantity	Remarks
1. Port crossing bridge including road widening				
1) Bridge portion, PC box girder type	m2	392m x 14m	5,488	
2) Approach portion	m2			
Embankment	m3	14m x 140m x 3.6m	7,056	
Retaining wall	m3	140m x 2m x 0.5m x 2 + 3.6m x 0.5m x 140m x 2	784	
3) Pavement work				
Cariageway	m2	(22.5m-6m-8m) x 368m	3,128	AC pavement
Side walk	m2	6m x 368m x 50%	1,104	DBST pavement
Median	m2	368m x 8m	2,944	
4) Drainage works				
Cross drain	m		26	900mm dir.
Ditch drain	m	Both side	736	
5) Slope protection work				
Gabion mattress, h=2.5m	m		255	1.25m x 0.5m
6) Road Facilities				
Bus stop	no.		1	500m
Road lighting	no.		18	Every 50m
Traffic sgnal	no.		8	Intersection
Lane marking	m		1,104	Center & side lines
Guard rail	m		255	More than 4m embankment
2. Bandari/Gerezani Road widening				
1) Earth works				
Excavation	m3		9,076	
Embankment	m3		21,511	Inc. slope protection
2) Pavement works				
Cariageway	m2	9.5m x 2 x 1,300m	24,700	AC pavement
Side walk	m2	1,300m x 6m	7,800	DBST pavement
Median	m2	1,300m x 2m	2,600	
3) Drainage works				
Cross drain	m	26m x 1 + 40m x 2	106	900mm dir.
Culvert drain	m		43	3.5m x 5m
Ditch drain	m	Both side	2,600	
4) Bridge structure				
Gerezani bridge	m2	35m x 27m	945	PC T post tention girder
5) Slope protection work				
Gabion mattress, h=2.5m	m	200m -35m	165	1.25m x 0.5m
6) Road Facilities				
Bus stop	no.		3	500m
Road lighting	no.		55	Every 50m
Traffic sgnal	no.		7	Intersection
Lane marking	m		3,900	Center & side lines
Guard rail	m		390	More than 4m embankment

4.4.2 Tazara Intersection Improvement Project

The work quantities for each work item are calculated based on the preliminary design. Details of the work quantity calculation sheet are presented in Table 4.4.4

Table 4.4.4 Work Quantity Calculation Sheet (Tazara Intersection)

Work Items	Unit	Calculation	Quantity	Remarks
1) Bridge portion				
PC hollow slab type	m2	17 m width x 180 m length	3,060	
PC box girder type	m2	17 m width x 120 m length	2,040	
2) Approach portion				
Embankment	m3		8,496	From Drawing
Retaining wall	m3	(315 m + 504 m) x 0.5 m x 2	819	
Road				
Guardrail	m	2 x (137 m + 176 m)	626	
Shoulder	m2	0.5 m x 2 x (137 m + 176 m)	313	AC pavement
Carriageway	m2	7 m x 2 x (137 m + 176 m)	4,382	AC pavement
Median	m2	1 m x (137 m + 176 m)	313	
3) Improvement of intersection at grade				
Carriageway (widening of 4 lane)	m2		14,633	From Drawing