

**BASIC DESIGN STUDY REPORT  
ON  
THE PROJECT FOR  
UPGRADING MASASI-MANGAKA ROAD  
IN  
THE UNITED REPUBLIC OF TANZANIA**

**MARCH 2007**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

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**CONSTRUCTION PROJECT CONSULTANTS, INC.**

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## PREFACE

In response to a request from the Government of the United Republic of Tanzania, the Government of Japan decided to conduct a basic design study on the Project for Upgrading Masasi-Mangaka Road in the United Republic of Tanzania and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Tanzania a study team from July 23 to August 30, 2006.

The team held discussions with the officials concerned of the Government of Tanzania, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Tanzania in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the United Republic of Tanzania for their close cooperation extended to the teams.

March 2007

Masafumi Kuroki  
Vice-President  
Japan International Cooperation Agency

March 2007

## LETTER OF TRANSMITTAL

We are pleased to submit to you the basic design study report on the Project for Upgrading Masasi-Mangaka Road in the United Republic of Tanzania in the United Republic of Tanzania.

This study was conducted by Construction Project Consultants, Inc., under a contract to JICA, during the period from July, 2006 to March, 2007. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Tanzania and formulated the most appropriate basic design for the project under Japan's Grant Aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Hideaki Morita  
Project manager,  
Basic design study team on the Project  
for Upgrading Masasi-Mangaka Road in  
the United Republic of Tanzania  
Construction Project Consultants, Inc.

## **SUMMARY**

# SUMMARY

## 1. Country Outline

The United Republic of Tanzania (hereinafter referred to as Tanzania), located half way up the eastern coast of Africa facing the Indian Ocean, has a national land area of approximately 945,000 km<sup>2</sup>. Inland it consists of vast tableland ranging between 1,000~2,000 m in altitude, and the north is dominated by the towering presence of Mt. Kilimanjaro (5,895 m). The Project road is situated in the south of Tanzania and crosses gently undulating land at an altitude of between 250~420 m. Annual rainfall is around 1,000 mm per year and the rainy season lasts from November to April. Average monthly temperature ranges between 24~28 and remains fairly constant throughout the year.

After achieving independence, Tanzania promoted a policy of socialism, however, due to the effects of the oil shocks, war with Uganda and drought, the economy reached a critical state in the 1980s. In order to improve this situation, from 1986 onwards, Tanzania implemented economic reforms under guidance from the World Bank and IMF, and recently the GDP has displayed growth of 7.1% in 2003 and 6.3% in 2004. Moreover, per capita GNP has also shown steady improvement, growing from US\$210 in 1997 to US\$330 in 2004.

## 2. Background, History and Outline of the Requested Project

In the Poverty Reduction Strategy Paper (formulated in October 2000), which is regarded as the national development plan for Tanzania, high priority is given to improvement of access to cities and rural villages, repair of trunk and local roads, and maintenance of already repaired trunk and local roads, in order to improve the level of services available for transporting goods and people. Regarding road development, the 10-Year Road Sector Development Plan (10Y-RSDP, 2001~2011) that was compiled in 2001 is the superior plan to the Project. This aims to promote development and maintenance of national trunk roads and provincial roads divided according to nine road corridors, and eventually, it aims to link all provinces by trunk roads and provincial roads in order to secure stable supply of agricultural products to consumer centers and promote economic growth of rural areas.

The Project road between Masasi and Mangaka is regarded as an important trunk road forming part of the southern development corridor (Mtwara Corridor) that is composed of Highway 6 and Highway 12 in the 10Y-RSDP. Moreover, in line with development related to the Mtwara Corridor, for example, the start of construction of the Unity Bridge connecting Tanzania and Mozambique south of the Project road, it is anticipated that the Project, which will be part of the corridor, will also function as an international route.

The Project target area in the south of Tanzania has historically been underdeveloped, however, it is blessed with agricultural production resources, mineral resources and tourism resources and has a lot of potential for economic development. The population of Mtwara Province where the Project is situated is approximately 1,130,000 (440,000 in Masasi Prefecture where the road is situated), and this accounts for roughly 3% of the national population of 38,300,000 (2005). The main industry in the area is agriculture, which accounts for between 70~75% of production and employs roughly 80% of the working population. The major crop is cashew nuts, with this area accounting for 50% of national production and having a reputation for good quality; however, due to the inadequate development of the access road network, half of the cashew crop cannot be shipped. Accordingly, development of the road network is urgently required.

In April 2004, the Government of Tanzania implemented a feasibility study on the Mtwara Corridor (road between Mtwara and Mbamba Bay) under support from the Kuwait Fund. Furthermore, in view of the importance of road development along the Mtwara Corridor, the Government of Tanzania in November 2004 issued a request to the Government of Japan for the provision of grant aid assistance for the section between Masasi and Tunduru (190 km).

In response to the request, due to concerns over the effect on the environment of the Project, JICA implemented a Project formation study from July to August 2005. Through this study, it was reported that the impact could be mitigated through balancing development with environmental conservation and the importance of development along this route was reaffirmed.

In addition to confirming the advantages of the Project based on the findings of the Project formation study, the Government of Japan narrowed down the total route of 190 km to a relatively high priority section of approximately 54 km between Masasi and Mangaka and dispatched the preliminary survey team to investigate it. In this survey, it was confirmed that the Project entails no major problems regarding the natural environment and is valid for development in view of the work being done on the trunk road from Dar es Salaam to the target area.

Table 1 Past Studies/Surveys

Study/Survey	Year Implemented	Agency	Target Section	Outline of Results
Feasibility Study (F/S)	April 2004	Kuwait Fund	Mtwara - Mbamba Bay	All 839 km targeted
Project Formation Study	2005 July - August	JICA	Masasi - Tunduru	190 km section targeted
Preliminary Survey	2006 February	JICA	Masasi - Mangaka	Approximately 54 km section

### 3. Outline Results of the Study and Contents of the Project

The Japan International Cooperation Agency dispatched the Basic Design Study Team from July 23 to August 30, 2006. In addition to holding discussions with related government agencies in Tanzania, the Study Team implemented field surveys in the target area and confirmed the need and urgency of road repair on the requested section upon investigating production conditions of the major local crop of cashew nuts, progress of development of the area around the terminus of the target section, progress in construction of Unity Bridge on the border with Mozambique, and so on. Upon conducting work in Japan after returning home, the Study Team compiled the rehabilitation plan for the requested road as shown in the next table, returned to Tanzania to explain the draft report of the basic design between December 1~28, 2006 and secured the basic consent of the Government of Tanzania for this.

Table 2 Outlined Design Contents

Design item		Design contents
Length of the section covered by the Project		55.1 km
Pavement structure	Surface course	DBST paving (main road, access road, bus stops, etc.)
		SBST (shoulder, entrance, etc.)
	Base/Subbase	Base course 15 cm (cement stabilization – main road, access road, bus stops, etc.)
		Subbase course 20 cm (granular materials – main road, shoulder)
Road width	Pavement width	6.5 m (single side 3.25 m, 2 lanes)
	Shoulder width	1.5 m, both sides
Improvements to crosswise traversing drainage structures		74 points (including 60 pipe culverts, box culverts at 11 points and 3 bridges)
Other auxiliary facilities		Side ditches, retaining walls, bus stops, protective fences, partition lines, signs, etc.

### 4. Project Schedule and Estimated Project Cost

As a result of the above study, in the event where the Project is implemented under the Grant Aid Scheme of the Government of Japan, it is estimated that tender-related work will require 3 months, construction works will require 36 months, and that the rough Project cost will be 2.45 billion yen (approximately 2.409 billion yen on the Japanese side, 41 million yen on the Tanzanian side).

### 5. Verification of Project Appropriateness

Since implementation of the Project will lead to the improvement of road conditions and realization of safe and smooth traffic on the target section, the entire population of Mtwara Province of approximately 1,130,000 people will realize the benefit. The following effects are anticipated from Project implementation.

### Direct effects

- Increase in road traffic volume due to improvement in the road standard
- Shortening of travel times for vehicles using the road
- Improvement in safety on the target road through securing road alignment and sight distance corresponding to the design speed, improvement in road flatness, separation of vehicles from pedestrians and bicycles through provision of a shoulder, and so on

### Indirect effects

- Reduction of transportation costs due to shortening of transportation times and improvement of flatness
- Contribution to local development, rectification of regional disparities, expansion of the market area, and stabilization of access to medical and education facilities through improvement in road reliability
- Contribution to stronger and more stable physical distribution through improvement in access

As can be seen, since the Project will impart major benefits to the population of Tanzania and greatly contribute to improving convenience for local residents, it is deemed to have major significance for implementation under the Grant Aid Scheme of the Government of Japan. Moreover, concerning maintenance aimed at ensuring the long-term functioning of the facilities following completion, the Tanzanian implementing agencies are considered to have ample capability in view of their past experience.



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Perspective



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## ABBREVIATIONS

AfDB	African Development Bank
BS	British Standard
CBR	California Bearing Ration
CRB	Contractor Resistration Board
DANIDA	Danish International Development Assistance
DBST	Double Bituminous Surface Treatment
DCP	Dynamic Cone Penetration
EIA	Environmental Impact Assesment
EU	European Union
GNI	Gross National Income
GDP	Gross Domestic Product
GNP	Gross National Product
GOT	Government of Tanzania
JICA	Japan International Cooperation Agency
M/D	Minutes of Discussion
MoID	Ministry of Infrastructure Development
NDC	National Development Cooperation
NEMC	National Environmental Management Council
NSGRP	National Strategy for Growth and Reduction of Poverty
OPEC	Organization of Petroleum Exporting Countries
RAP	Resettlement Action Plan
RC	Reinforced Concrete
ROW	Right of Way
SADC	Southern African Development Community
SATCC	Southern African Transport and Communications Commission
SBST	Single Bituminous Surface Treatment
TANROADS	Tanzania National Roads Agency
TLC	Traffic Load Crass
Tshs	Tanzania Shillings

## **CHAPTER 1**

### **BACKGROUND OF THE PROJECT**



# CHAPTER 1

## BACKGROUND OF THE PROJECT

### 1-1 Background and Outline of the Request for Grant Aid

The construction of trunk roads in Tanzania is an indispensable policy issue from the viewpoints of securing stable supply of agricultural products to consumer areas and promoting tourism, mining and international transportation. Moreover, in the National Strategic Poverty Reduction Plan (NSGRP), construction of regional roads is raised as necessary to vitalize the agricultural sector and promote the economic growth of rural areas, and the Government of Tanzania is working on social infrastructure development including roads as a priority issue.

Regarding road development, the 10-Year Road Sector Development Plan (10Y-RSDP, 2001~2011) that was compiled in 2001 is the superior plan to the Project. The Project road between Masasi and Mangaka is regarded as an important trunk road forming part of the southern development corridor (Mtwara Corridor) that is composed of National Route 6 and 12 in the 10Y-RSDP. Moreover, in line with development related to the Mtwara Corridor, for example, the start of construction of the Unity Bridge connecting Tanzania and Mozambique south of the Project road, it is anticipated that the Project, which will be part of the corridor, will also function as an international route.



Figure 1.1 Project Target Section

In April 2004, the Government of Tanzania implemented a feasibility study on the Mtwara Corridor (road between Mtwara and Mbamba Bay) under support from the Kuwait Fund. Furthermore, in view of the importance of road development along the Mtwara Corridor, the Government of Tanzania in November 2004 issued a request to the Government of Japan for the provision of grant aid assistance for the section between Masasi and Tunduru (190 km).

In response to the request, due to concerns over the effect on the environment of the Project, JICA implemented a Project formation study from July to August 2005. Through this study, it was reported that the impact could be mitigated through balancing development with environmental conservation and the importance of development along this route was reaffirmed.

In addition to confirming the advantages of the Project based on the findings of the Project Formation Study, the Government of Japan narrowed down the total route of 190 km to a relatively high priority section of approximately 54 km between Masasi and Mangaka and dispatched the preliminary survey team to investigate it.

In this survey, it was confirmed that the Project entails no major problems regarding the natural environment and is valid for development in view of the work being done on the trunk road from Dar es Salaam to the target area.

Following on from this, the Basic Design Study was implemented and as a result of field surveys conducted in the target area, the need and urgency of improvement on the requested section was confirmed upon considering production conditions of the major local crop of cashew nuts, progress of development around the area at the terminus of the target section, progress in construction of Unity Bridge on the border with Mozambique, and so on.

Table 1.1 Past Studies/Surveys

Study/Survey	Year Implemented	Agency	Target Section	Outline of Results
Feasibility Study (F/S)	April 2004	Kuwait Fund	Mtwara - Mbamba Bay	All 839 km targeted
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## 1-2 Natural Conditions

The United Republic of Tanzania (hereinafter referred to as Tanzania), located half way up the eastern coast of Africa facing the Indian Ocean, has a national land area of approximately 945,000 km<sup>2</sup>. Inland it consists of vast plains ranging between 1,000~2,000 m in altitude, and the north is dominated by the towering presence of Mt. Kilimanjaro (5,895 m). The Project road is situated in the south of Tanzania and crosses gently undulating land at an altitude of between 250~420 m. Annual rainfall is around 1,000 mm per year and the rainy season lasts from November to April. Average monthly temperature ranges between 24~28 and remains fairly constant throughout the year.

### (1) Topographical conditions

The road between Masasi and Mangaka reaches a peak altitude of around 420 m in the vicinity of Masasi and gently slopes downwards to around 400 m moving west. The area around Mbangala river basin at the 35 km point is at the lowest altitude of around 250 m, and from there it undulates at around 300 m and reaches around 350 m at the terminal point. The topography in

general is gently undulating, and there are only a few sections where the longitudinal profile exceeds 5%.

(2) Geological conditions

The geological makeup sharply divides at Nganga, situated approximately 60 km in the direction of Mtwara (east side) going from inland Masasi. The area east of Nganga (towards Mtwara) comprises Mesozoic sand and peat soil, whereas land on the west (towards Masasi), crossing over Mtwara District and entering Ruvuma District, consists of marble, quartz and black coal from the Paleozoic age. Moving from the Project start point of Masasi towards the terminal point, rock hills (sandstone) are scattered on both sides of the road at intervals of a few kilometers.



Photo 1.1 Rock Hill

(3) Implementation of natural conditions surveys

1) Surveying

Implementation of topographical surveying over the target road section (approximately 55 km) was consigned to a local contractor over approximately one month between July 25 and August 25. The surveying work comprised the installation of benchmarks, surveying of the road centerline (longitudinal), road lateral surveying and surveying of existing structures. The results of the surveying work are as follows:

- Benchmark setting .....Set at 34 points (surveying reference points)
- Road centerline surveying (longitudinal) ...Standard measurement interval 25 m
- Road lateral surveying .....Standard measurement interval 25 m, 25 m left and right
- Surveying of existing structures .....From the start point to the terminal point along the existing road

2) Soil Condition

Sampling and indoor testing were consigned to a local contractor over approximately one month from July 25 to August 25 in order to conduct dynamic penetration testing and confirmation of ground materials and works materials on the existing road and road shoulder. The indoor testing consisted of physical tests and CBR (bearing power) tests on soil samples. As a result of the investigations, it was confirmed that the existing subgrade generally possesses bearing power well in excess of 20, except for some minor parts that are lower than the general value of 10.

### 3) Geology (boring survey)

Boring surveys were conducted at the three following points with the goal of confirming the bearing strata around structures. The local ground generally consists of sandy soil including silt in places, and soil depth above the bearing layer is roughly between 5~15 m. In strata deeper than this, it was confirmed that the N value is 50 or higher and that rock strata exist. The boring survey points were as follows.

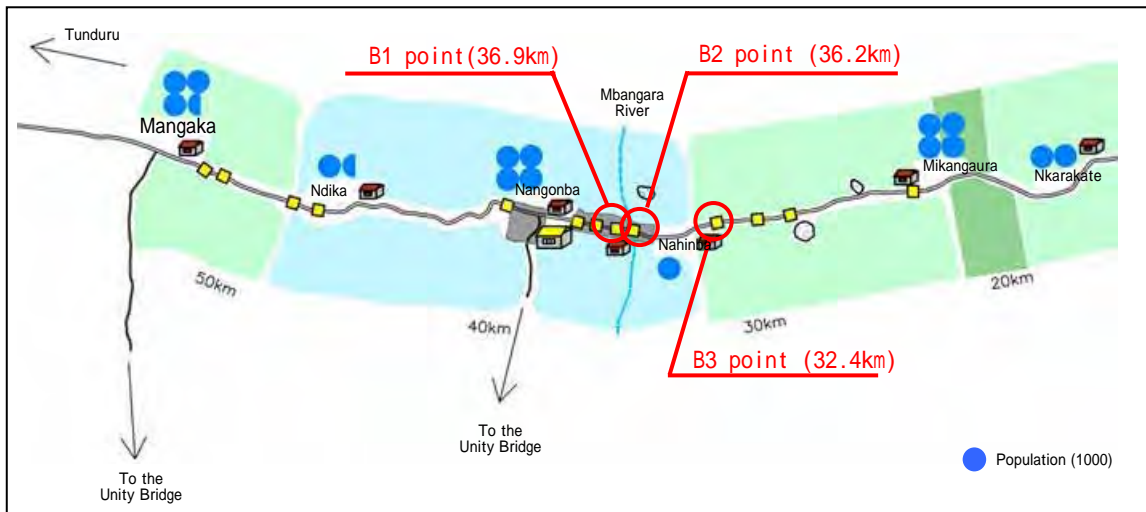


Figure 1.2 Geological Survey (Boring) Positions



Photo 1.2 Boring Conditions

## 1-3 Environmental and Social Consideration

### (1) EIA progress

Concerning environmental procedures in Tanzania, based on the environmental management approach (EMA), it is obligatory to implement environmental impact assessment (EIA) and take the EIA procedures required in screening conducted by the National Environmental Management

Committee (NEMC). The EIA flow concerning the Project is as shown below, and work so far has reached procedure .

Table 1.2 EIA Implementation Procedure

Project application and registration Screening by the review agency (NEMC) Implementation of scoping Preparation of draft EIA report Review and comments for modification and issue of TOR by the review agency
Amendment (finalization) of the EIA based on the comments and TOR, compilation of the Resettlement Action Plan (RAP) or Resettlement Policy Framework (RPF) and compilation of the Environmental Management Plan (EMP)
Submission of the final EIA report Implementation of public hearings Review and approval by the review agency Announcement of permission Implementation of environmental monitoring at time of execution

Source Project formation study

Concerning the EIA, the above progress was confirmed in discussions with TANROADS during the field survey in August 2006. Moreover, upon confirming conditions in the field survey of December 2006, little progress had been made due to transfer of the person in charge on the NEMC side, and comment was being sought from the National Environmental Management Committee (NMEC) in readiness for finalization of the EIA. Accordingly, the Study Team explained in detail to TANROADS the deadline for responsibilities of the Tanzanian side in the Project and strongly requested urgent action. NEMC delivered provisional approval to TANROADS in February 2007.

Concerning finalization of the EIA, the plan was to enter the finalization procedure after structures targeted for relocation were identified after determination of the final road alignment, and the environment for this was prepared with submission of the final alignment (draft) by the Study Team in December 2006.

(2) Progress of the resettlement action plan (RAP)

**Existing buildings**

The right of way (ROW) of the target road is 45 m, i.e. 22.5 m each way from the centerline of the existing road. Houses that exist within this right of way have received advance notification from TANROADS that they will be targeted for relocation (a red 'X' mark has been painted on the building walls). The number of such buildings in the preliminary study was counted as 202

(see the following table), and Mangaka suburban district had the highest number of 55. As is indicated above, because TANROADS has painted 'X' marks on targeted buildings, almost all the owners of buildings inside the ROW can understand that they will need to relocate.

Accordingly, the chances of the resettlement of residents becoming a major issue in the Project are slim. Having said that, development alongside the route has been steadily advancing in recent years and the number of illegally occupied buildings is increasing; in particular, this trend is marked in Mangaka, where the pace of urbanization has been dramatic. However, since the houses concerned are simple wooden structures temporarily assembled directly on the ground, there should be no major problems in moving them outside of the ROW. Furthermore, in addition to houses, hand-pump wells are located 6 m from the edge of the existing road in Mangaka, and it will be necessary to examine the relocation of these too. An estimate of the excavation costs for transferring such wells has been obtained from the local Masasi district office.



Photo 1.3 Houses inside the Existing Right of Way (ROW)

Table 1.3 Houses and Facilities inside the ROW

Village	Right Side (Mangaka Direction)				Left Side (Mangaka Direction)				Total
	Houses/Shops	Kiosks	Others	Total	Houses/Shops	Kiosks	Others	Total	
Masasi	18	-	-	18	10	2	-	12	30
Mtapika	1	-	-	1	8	-	-	8	9
Mkapunda	1	-	-	1	5	-	-	5	6
Sululu	3	-	-	3	1	-	-	1	4
Mkarakate	-	-	-	0	-	-	-	0	0
Namatumbushi	-	-	-	0	1	-	-	1	1
Kilosa	1	-	-	1	-	-	-	0	1
Mikangaula	3	1	-	4	18	4	-	22	26
Mkwajuni	-	-	-	0	-	2	-	2	2
Nahimba	6	-	-	6	-	2	-	2	8
Nangaramo	-	-	-	0	-	3	-	3	3
Nangomba	19	-	-	19	29	1	-	30	49
Ndwika	3	-	-	3	5	-	-	5	8
Mangaka	29	6	-	35	17	2	1	20	55
Total	84	7	-	91	94	16	1	111	202

Source: Preliminary Survey Report

### **Resettlement action plan**

Advance notifications have already been given to house owners located within the ROW based on the existing road, however, the houses targeted for eventual relocation will be decided when the final alignment of the Project road is determined. Accordingly, it is not possible to compile the resettlement action plan (RAP) until the road alignment is set. However, the Japanese side presented the road alignment in December 2006 and it is scheduled for the Tanzanian side to compile the RAP.

#### (3) Wildlife migration paths

Numerous wildlife (elephant) migration paths are located over the 190 km section between Masasi and Tunduru, and it appears the path situated west of the terminal point of the Project route is the closest one. In this Study, as a result of confirming local conditions through holding discussions with wildlife department officials and interviewing residents, it was confirmed that such paths do not change and there are no elephant paths on the Project route.



Source: Project Formation Study

Figure 1.3 Two Main Wildlife Migration Corridors

## **CHAPTER 2**

### **CONTENTS OF THE PROJECT**



## **CHAPTER 2**

### **CONTENTS OF THE PROJECT**

#### **2-1 Project Outline**

##### **(1) Superior Objectives**

Concerning road development plans in Tanzania, in the Poverty Reduction Strategy Paper (formulated in October 2000), which is regarded as the national development plan for the country, high priority is given to improvement of access to cities and rural villages, repair of trunk and local roads, and maintenance of already repaired trunk and local roads, in order to improve the level of services available for transporting goods and people.

Regarding road development, the 10-Year Road Sector Development Plan (2001~2011) was compiled in 2001. This aims to promote development and maintenance of national trunk roads and provincial roads divided according to nine road corridors, and eventually, it aims to link all provinces by trunk roads and provincial roads. Through doing this it is anticipated that stable supply of agricultural products to consumer centers will be secured and the economic growth of rural areas will be promoted. The Project road between Masasi and Mangaka is regarded as an important trunk road forming part of the southern development corridor (Mtwara Corridor), which traverses the southern part of the country, and it is anticipated that the Project road will also function as an international route of physical distribution.

##### **(2) Project goals**

The Project target area in the south of Tanzania has historically been underdeveloped, however, it is blessed with agricultural production resources, mineral resources and tourism resources and has a lot of potential for economic development. Concerning the main industry, agriculture accounts for 70~75% of local production, and many households are engaged in farming. The major crop is cashew nuts, with this area accounting for 50% of national production and having a reputation for good quality; however, due to the inadequate development of the access road network, half of the cashew crop cannot be shipped, so development of the road network is urgently required.

The Project target road, which forms part of an important access road network in the area, is only 3~5 m width, which is too narrow to allow safe two-way traffic. Moreover, it suffers from impassability caused by rain corrosion, while rutting of the road surface leads to contact between vehicles and falls by pedestrians and bicycles. Against such a background, the Project has the

objective of securing the safe and smooth flow of traffic along the target section through upgrading the section between Masasi and Mangaka.

### (3) Project outline

In the Project, the following road repairs and improvements will be implemented in order to realize the above goals.

Target section	: Between Masasi and Mangaka, on the National Route 6,
Section length	: 55.1 km
Road specifications	: Roadway = 3.25 m single side, total 6.50 m Shoulder width = 1.5 m, both sides
Paving specifications	: Roadway = double bituminous surface treatment (DBST) Shoulder = single bituminous surface treatment (SBST)
Road drainage facilities	: 60 pipe culverts, 11 box culverts, bridge rebuilding in 3 places, 800 m of stone ditches
Road incidental facilities	: Guard rail/posts, bus stops, kilometer posts, surface markings, etc.

## **2-2 Basic Design of the Project**

### **2-2-1 Design Policy**

#### **2-2-1-1 Basic Policy**

This Grant Aid Project has been planned according to the following policy based on the request of the Government of Tanzania and the results of field surveys and discussions. The Project aims to upgrade and pave the existing dirt road, with the objectives of improving inadequate social infrastructure and resolving the serious poverty situation in the southern part of Tanzania.

- 1) The geometric structure of the Project road shall satisfy the required conditions of a trunk road.
- 2) A plan that ensures compatibility with the overall Mtwara Corridor shall be examined.
- 3) The composition and characteristics of traffic on the road (automobiles, trucks, buses, bicycles, pedestrians, etc.) shall be examined and reflected in the Project.
- 4) The Project road shall consider the right of way of the existing road.

## 2-2-1-2 Policy Concerning Natural Conditions

### (1) Rainfall

The rainy season in central Tanzania generally starts in March, however, in the southern part of the country including Masasi, it starts slightly earlier and rain is mainly concentrated between late November or December and April. On the other hand, hardly any rain falls in the dry season. The following graph shows monthly rainfall in Masasi over the past five years. In the Project, the overall schedule was examined upon taking into account impact of the rainy season on execution and procurement.

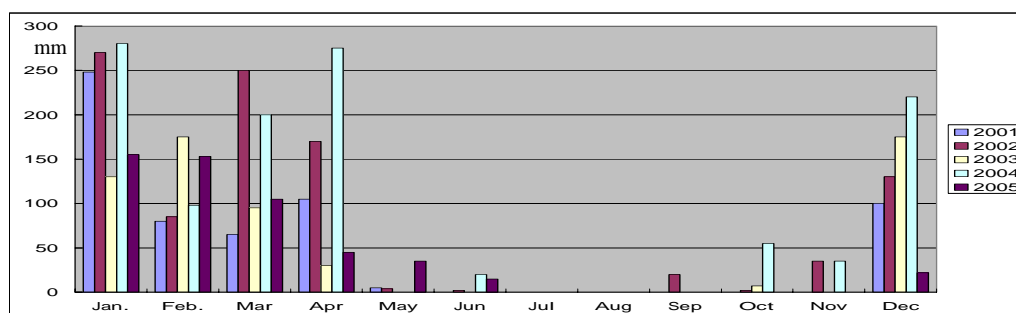


Figure 2.1 Monthly Rainfall in Masasi

### (2) Soil Condition

The soil between Masasi and Mangaka is sand-based (according to Pavement and Materials Design, MOW 1999). This soil is prone to the effects of rainfall, so the existing unpaved road deteriorates and some sections become almost impassable during the rainy season.

Furthermore, black cotton soil is distributed around the low and damp sections of the Project road at intervals of around 1 km from the starting point to around the 35 km point and around major culverts on other parts. Although black cotton soil is found on both sides of the road in these sections, no major subsidence of the existing road has been observed because traffic over many years has compacted the road into a stable state.

Accordingly, in the Project, ways were examined to make full use of such stable existing road parts in order to achieve sustainable road development and reduction of work costs. However, according to interviews with TANROADS officials and local residents, inundation of the road has been observed during flooding in these sections. Therefore, in the Project, it will be necessary to raise the height of bridges by 1.5~2.5 m over the present level, meaning that the sections in question (approximately 1 km) will become banked sections. Even if the existing road is traced, since banked slopes will encroach on black cotton soil parts, some kind of countermeasures will be needed. The method and area of response were examined according to Pavement and Materials Design, MOW 1999.

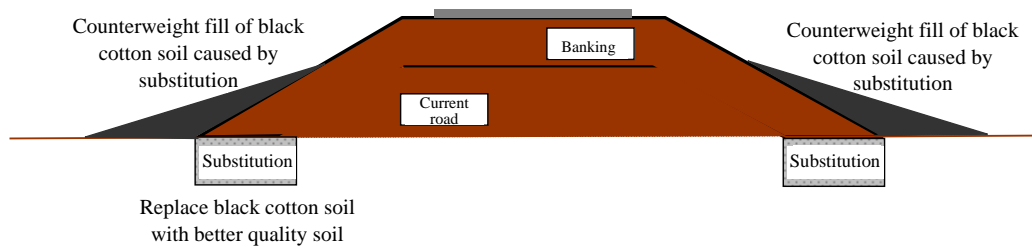


Figure 2.2 Response to Black Cotton Soil

### 2-2-1-3 Policy Concerning Social Conditions

#### (1) Land use conditions along the route

There are 14 village communities situated alongside the route between Masasi and Mangaka. Each village has an elementary school, however, secondary schools can only be found in Masasi (near the start point), Mikangaula (around the 24 km point) and Mangaka (near the terminal point). The main industry in the local area is cultivation and shipping of cashew nuts, and cashew plantations are scattered along the whole target route. Conditions of land use along the route are indicated below. Moreover, population is increasing in Mangaka at the end of the target route, and this area newly ceded from Masasi district as Nanyumbu district in July 2006. Furthermore, there is expected to be more development in line with the opening of Unity Bridge connecting Tanzania to Mozambique in future.

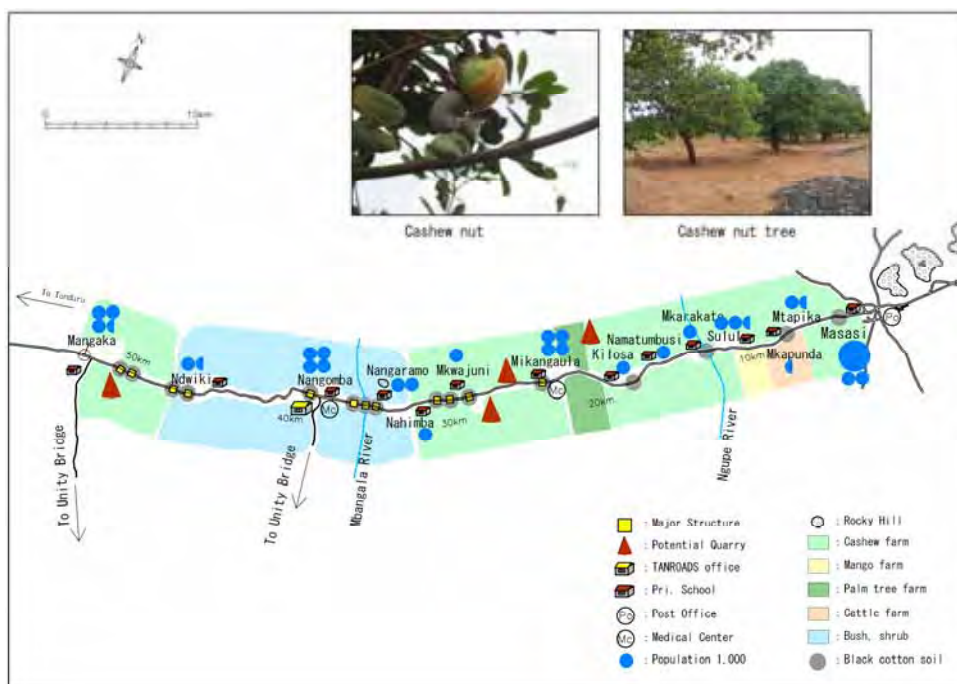


Figure 2.3 Land Use along the Route

Means of public transport in the area are regular buses that also carry mail, private minibuses and small-size trucks that serve as shared-ride buses, however, the numbers of such vehicles are limited. Accordingly, citizens mainly depend on walking and bicycles to get around and they are able to travel up to around 20 km on foot and 50 km by bicycle. In severely rutted sections of road along the route, conditions are extremely dangerous because pedestrians and bicycles sometimes stumble as vehicles are passing. Such conditions were taken into account when examining the road design.

(2) Mitigation of social impacts

The right of way (ROW) of the target road is 45 m, i.e. 22.5 m each way from the centerline of the existing road. Existing public facilities within the ROW comprise power lines, telephone lines and water pipes and are found mainly in Masasi. Houses that exist within the ROW have received advance notification from TANROADS that they will be targeted for relocation (a red 'X' mark has been painted on the building walls), however, this is only a provisional measure. The houses that will be definitely targeted for relocation will be determined after the final alignment is decided. TANROADS intends to remove or relocate all houses and public facilities within the ROW from outside of the ROW. The following table indicates the public facilities and houses that currently exist in the ROW.

Table 2.1 Existing Public Facilities

Item	Location	Remarks
1. Power line	Masasi town	Approx. 2.4km
2. Telephone line	Masasi town	Approx. 1.7km
3. Water pipe	Masasi town	Approx. 3.5km
4. Well	Mangaka town	1 site (6 m on left of existing road)
5. Existing houses	14 villages along the route	201 places

**Possibility of mitigating impacts through the road plan**

The houses and facilities that will be subject to relocation or removal are concentrated in Masasi town and village areas, however, the existing road alignment on these sections is basically able to secure the design speed. Moreover, since the houses in question have free land to the rear, it should be possible to avoid any major impacts through simply setting back the existing buildings.

Moreover, on other sections, since it may be possible to reduce the number of houses requiring relocation through shifting the road centerline to one side, effort was made to limit the affected number of houses through adjusting the alignment upon giving consideration to design speed and safety.

## 2-2-1-4 Policy Concerning the Building Situation and Procurement Conditions

### (1) Procurement routes of main equipment and materials

Some construction equipment and materials can be supplied locally, however, almost all items have to be transported either overland from Dar es Salaam, which is 600 km away, or by sea to Mtwara Port and from there approximately 200 km overland to the target area. Concerning road conditions for overland transportation, parts of the road from Dar es Salaam to Mingoyo are in an atrocious state, in particular a stretch around the midway point at around 60 km, and traffic impasses caused by rainfall and so on give rise to critical problems.

The road sections in question are undergoing successive repairs, however, it is forecast that these will take until around 2010 to be finished. The current transportation time from Dar es Salaam to Masasi is one day (approximately 12 hours) for four-wheel-drive vehicles and two days for trucks transporting equipment and materials. As for the road from Mingoyo to Masasi, a bridge that was washed away by torrential rains in 1990-1991 has only been replaced with a temporary structure with a passing load limit of 20 tons. In the Project, the optimum works schedule was examined upon taking the said conditions fully into account.

### (2) Procurement of aggregate materials for surface paving

In addition to the procurement route for equipment and materials, another major problem in Project implementation will be the procurement of aggregate materials for surface paving. Rocky outcrops are situated along the target route, however, since the base rock consists of sandstone, it is unsuitable for use as surface paving material. Accordingly, it is likely that hard crushed stone and aggregate materials will need to be procured from sites located approximately 60~70 km away, thereby leading to inflated unit prices.



Photo 2.1 Candidate Site for Aggregate Quarrying (Chepite)

Therefore, when examining the structure of pavement in the Project, the optimum plan was considered upon fully considering the said conditions.

### (3) Labor recruitment policy

Concerning labor recruitment, the employment of workers will be in line with the labor law of Tanzania (Employment and Labour Relations Act, 2004). The labor law revised in 2004 includes regulations governing working hours, working conditions, social insurance, extra pay conditions,

and so on. Further, while the said law stipulates that the number of working days shall be six days per week and shall not exceed 45 hours, private enterprise generally adopts a five-day workweek.

(4) Construction material procurement policy

It is possible to procure the main types of constructions materials such as road aggregate, bitumen, cement, reinforcing bars, concrete aggregate, timber and fuel in Tanzania. Moreover, imported reinforcing bars and so on can also be procured locally. Therefore, the procurement method will be examined upon taking quality, ease of procurement and economy into account.

(5) Construction equipment procurement policy

The TANROADS Mtwara Office has some construction machinery for hire, however, it only leases machines to local construction companies because maintenance is contracted to the private sector. Furthermore, there are no specialized rental/lease firms in Tanzania. However, the individual construction companies that possess various items of construction machinery mutually borrow and lend equipment and hence it is possible to procure ordinary construction equipment locally. Therefore the policy regarding the procurement of construction equipment in the Project will be to engage local firms as subcontractors. However, in cases where the availability of local construction equipment is insufficient to meet the schedule requirements, procurement of the necessary construction equipment from Japan will be studied.

Further, the policy regarding the procurement of special items will be to carry out comparative cost studies on renting / leasing them locally versus importing them.

### **2-1-1-5 Policy Concerning Utilization of Local Contractors**

All private construction firms in Tanzania permitted to undertake construction work are registered with the officially approved Contractors Registration Board (CRB). Registration is divided into that for locally capitalized firms and that for foreign capitalized firms and is classified into seven classes, namely 1 through 7, based on annual sales per category of work, construction equipment available, assets, and so on.

With regard to road construction work, it is considered that firms registered with the CRB as Class 1 (20 firms) and Class 2 (11 firms) in the civil division will be capable of working as subcontractors for Japanese contractors. As it is common practice among the construction firms concerned to mutually borrow and lend personnel and equipment, the policy will be to actively engage the services of Tanzanian construction firms.

### **2-2-1-6 Policy Concerning Operation and Maintenance**

On the route between Mtwara and Masasi, apart from a temporary Bailey bridge used to replace a bridge of around 40 m that was damaged in the torrential rain of 1990-1991, TANROADS has started repair of other short-span bridges. Moreover, grass cutting, pothole filling and patchwork repairs can be observed at numerous points along the main route, and the road is maintained at a sufficient level to almost ensure safe passage at a certain speed. In the field surveys, it was confirmed that road maintenance is conducted at all times within the scope of the allocated budget.

The organization and implementation capacity of TANROADS, which is the implementing agency in the Project, and the MoID, which is the supervisory agency, is deemed to be high considering past performance in construction and maintenance of numerous roads. Furthermore, since the technical cooperation project currently being implemented by JICA in TANROADS can be expected to enhance work implementation capacity even further, it is deemed that the organizational capacity of TANROADS and the MoID as well as the budget capability, technical capability and maintenance capacity following completion in Tanzania are at a satisfactory level.

### **2-2-1-7 Policy for Determining the Scale and Details of the Planned Facilities for the Project**

The design work for the Project was performed and reviewed mainly on the basis of the design standards of Tanzania (1989, Ministry of Public Works) and the Southern Africa Transport and Communications Committee (SATCC 1998), while other international standards such as the British Standard (BS) were referred to as required. Concerning the road grade, design speed of 80 km/hour was applied upon basically tracing the alignment of the existing road, and in line with this the minimum flat curve radius was set at 230 m and the maximum gradient at 5.0%. For design load, TLC3, which is the national standard in Tanzania, was adopted. Regarding bridges in the Project, the optimum locations, structures and spans of bridges were decided upon taking cross-sectional area of flow during flooding, geological and topographical conditions, reduction of works costs and ease of execution, etc. into overall account. Based on the above thinking, the optimum scale of the Project was examined.



## **2-2-1-8 Policy Concerning Work Methods and Schedule**

The works schedule in the Project was divided into three phases assuming the following important points.

### Important points

- 1) It is necessary to include time necessary for implementing ground improvement on black cotton soil sections.
- 2) It is necessary to include time for the relocation of public utilities equipment (electricity, telephones, water supply) by the implementation agency on the local side.
- 3) It is necessary to take into account the large size, i.e. 55.1 km of the target road section.
- 4) Since major equipment and materials will be imported from Dar es Salaam, it will be necessary to take road conditions into account and include time necessary for long-distance haulage.

### Predicted works period

Phase 1: Paving of the whole road over the 15 km section from the start point (15 km)

Period: Tender 3 months + works 12 months

Phase 2: Paving of the whole road over the 15 km ~ 35 km section (20 km)

Period: Tender 3 months + works 12 months

Phase 3: Paving of the whole road over the section from 35 km to the terminal point (20.1 km)

Period: Tender 3 months + works 12 months

## **2-2-2 Basic Plan**

- (1) Scope and scale of facilities in the Project

The requested contents in the Project comprise the paving of two lanes of the existing unpaved road as well as the rehabilitation of traversal drainage structures and other auxiliary facilities. The necessity of realizing such contents was checked through field survey. Moreover, the length of the target section was confirmed to be 55.1 km upon identifying the start and terminal points.

The existing bridges and box culverts shall structurally be enlarged so that the road will not be covered by water based on hydrological study.

(2) Existing road

The existing road is a dirt road consisting of roughly 3~5 m of roadway and shoulders of around 0.5 m on either side, and it passes over gently undulating land. Nowhere along the route is the road wide enough to allow the safe two-way passage of vehicles. On some parts, muddy ruts on the road surface are a major safety risk for passing vehicles, pedestrians and bicycles. However, in spite of these safety concerns, vehicles can travel at speeds of 40~60 km/h. In the latter part of the Project, since there are parts where the road gradient exceeds 5%, it will be necessary to adopt some kind of countermeasures concerning the road alignment and drainage. The plan was examined while taking such points into account.

(3) Design section

Concerning the Project target section, study was made for 55.1 km of road from the intersection with Newala road in the center of Masasi, past the intersection to Unity Bridge in Mangaka and to the intersection of the new government office buildings of Nanyumbu district some 650 m past there according to the request.

The existing road is a dirt road comprising 3.5 ~ 5.0 m width for roadway and shoulders of 0.5 m on both sides, and it passes through gently undulating areas. Traffic on the roadway on parts of the route has caused rutting on the surface and this constitutes a major safety hazard.

Major structures along the route consist of the bridge constructed over Mbangala River around the 35 km point, box culverts, pipe culverts and side ditches, etc. Since these existing structures suffer from advancing deterioration such as deformation and cracking, etc., it will be necessary to replace existing facilities and install new auxiliary facilities in the Project. Moreover, including the incidental temporary facilities plan, types and sizes aimed at securing the maximum effect for the minimum cost shall be selected.

(4) Start and termination points of the Project

As was the case in the previous examination, the Nawala-Nachingwea Junction close to the center of Masasi district was set as the start point. The same point was also assumed in previous surveys. The current road is paved for around 50 m from this point in the direction of Mangaka, however, because there are deteriorated spots, the road including the subbase course will be reconstructed according to the standards prescribed in the Project.

As for the termination point, one possibility is the junction near the 54.5 km point, where the Project road in Mangaka district joins with the connecting road to Unity Bridge, which is currently being constructed over the border between Tanzania and Mozambique. However,

because there is a concentration of shops around this junction, it would be unnatural to cut short the road improvement at the center of the intersection.

Moreover, there is a right-turning road about 650 m away from this intersection in the direction of Tunduru (roughly the 55.1 km point), and this area contains a secondary school and 11 district government office buildings that were newly constructed when Nanyumbu district was independently established apart from Mangaka in July 2006. Accordingly, since it is predicted that this point will become the central point of Mangaka district in future, examination was advanced assuming the junction with this right-turning road to be the termination point. As a result, the length of road over the Project target section is 55.1 km.

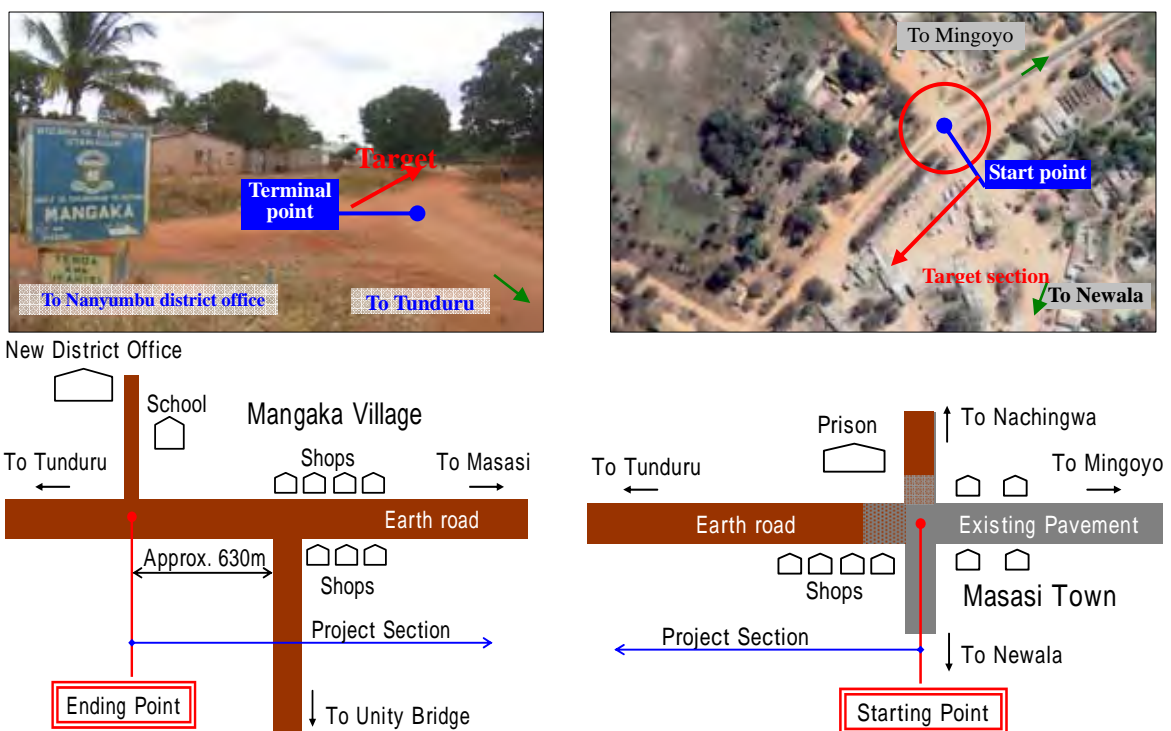


Figure 2.4 Outline of the Start and End Points

### 2-2-2-1 Overall Plan

#### (1) Design Criteria

The design work for the Project was performed and reviewed mainly on the basis of the design standards of Tanzania (1989, Ministry of Public Works) and the Southern Africa Transport and Communications Committee (SATCC 1998), while other international standards such as the British Standard (BS) were referred to as required. The following table shows the basically adopted standards and criteria.

Table 2.2 Design Standards and Criteria

Item		Standards, etc. applied for the Project	Reasons for application
1	Section covered by the Project	L = 55.1 km	From the start point at Newala junction to the terminal point at the junction of the new Nanyumbu government building just past Mangaka intersection
2	Road classification	Regional trunk road	Classification by the Ministry of Infrastructure Development (MoID)
3	Applicable design standards for geometric design	In principle, the design standards of the MOW (1989) and SATTC (1998) shall apply. International standards such as BS, etc. as well as the Road Structure Ordinance of Japan shall be referred to.	Priority was given to the road design standards of the MoID.
4	Road alignment	A design speed of 80 km/h shall be taken as the basis.	According to judgment based on the results of field survey.
5	Road width	Roadway: 6.5 m; shoulder: 1.5 m	The road design standards of the MoID were taken into account.
6	Pavement structure Roadway / sidewalk / service road	The road specifications of the MoID shall apply.	The road design standards of the MoID were taken into account.
7	Improvements to crosswise traversing drainage structures	Live load B according to the specifications for highway bridges of Japan shall apply. (These cover the HA and HB load standards of the BS).	It is possible and convenient for design to cover the local standards by the standards of Japan.
8	Auxiliary structures	In principle, the design standards of the MoID (1989) and SATTC (1998) shall apply.	Priority was given to the road design standards of the MoID.

The following table shows the design values that have been adopted in the Project.

Table 2.3 List of Design Values Adopted in the Project

Description		Units	Value		
			Flat Section	Rolling	Mountainous
Design Speed		Km/hr	100 (80)	80 (65)	60 (40)
No. of Lanes		No.	2		
Right of Way Width		m	45		
Carriageway Width		m	6.5		
Shoulder width		m	1.5		
Cross Fall on Carriageway		%	2.5		
Cross Fall on Shoulder		%	4.0		
Minimum Radius of Horizontal Curve		m	380	230	125
Maximum Gradient		%	3 (8)	5 (10)	8 (10)
Maximum Superelevation		%	8	8	8
Minimum Sight Distance		m	205 (157)	140 (113)	85 (74)
Fill Slope	Granular soil	Angle	1:1.5 ~ 2.0 (depend on soil type)		
	Hard Rock	Angle	1:0.5		
	Decomposed Rock	Angle	1:0.75		
	Other than Rock	Angle	1:1.0 ~ 1.5 (depend on soil type)		
Pavement Design Load		-	TLC 3		
Structure Live Load		-	Class B Load of Japan Road Association (This is more than HA, HB load on the British Standard which applied as Tanzania Standard)		
Seismic		Kh	0		

Note : ( ) = Minimum value

## 2-2-2-2 Facilities Plan

### (1) Design speed

In topographical terms, the target route consists of 75% flat terrain, 24% rolling terrain and 1% mountainous and hilly terrain. Moreover, in terms of plane curve, the route is composed of relatively gentle curves except for one spot. Accordingly, in consideration of the current state of the road and its relationship with surrounding road sections, a design speed of 80 km/hr was examined over the whole route assuming that the existing road alignment is traced as much as possible.

### (2) Alignment

The existing road generally consists of gentle curves, however, there are two sharp curves (radius 50~60 m) at points 40.5 km and 41.3 km from the start. Since these two curves do not satisfy the curve radius limit of 230 m for a design speed of 80 km, alignment that is set apart from the existing road has been designed in order to improve the road line over this section of approximately 700 m. Moreover, since the area affected by this realignment is shrub land and includes no houses or farmland, it will not lead to any major problems of relocation, etc.

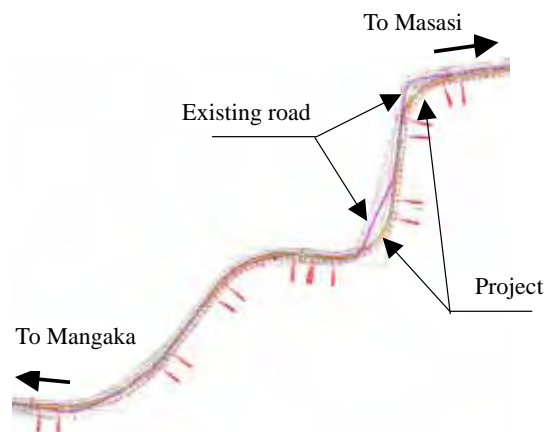


Figure 2.5 Planned Alignment around 41km

As for the rest of the road, since the existing road alignment constitutes curves that satisfy the design speed standard values, the existing road alignment has basically been traced. Accordingly, most of the Project road fits in the existing ROW.

### (3) Longitudinal alignment

Concerning the longitudinal alignment, gradient of the existing road is slightly steep towards the end of the Project route, however, even so the gradient here is only around 5% and the distance in question is short, so it falls within the scope of the design speed standard. Since other sections pass through gently sloping terrain, the basic policy shall be to trace the existing terrain as much as possible. Moreover, the longitudinal alignment shall be examined so that the vertical interval with surrounding terrain doesn't become too large. However, concerning the catchment area of Mbangala River, which has a history of inundation damage, since it will be necessary to bank soil up to the design height derived from examination of structures assuming the flood level, the road here shall be raised approximately 1.5~2.5 m over the current height.

(4) Standard cross section

The standard cross section shall take into account the right of way of the target road (45 m), its function as a two-lane road, the positional relationship with roadside obstructions, and traffic safety.

Since the target road forms part of a major trunk route expected to serve as a basic core route of the regional road network, the facilities plan was examined with a view to balancing these functions with the need to minimize cost.

The gradient of slopes on cutting and banking sections shall be determined upon taking current conditions and soil conditions into account. Upon considering the soil conditions of the existing road, the gradient of cutting slopes was examined as 1: 1.5 and that of banking slopes as 1: 2.0.

Width of the roadway and shoulder has been set at 6.0 m and 1.5 m respectively based on the dimensions confirmed in the F/S and preliminary survey. The envisaged standard cross section is indicated below.

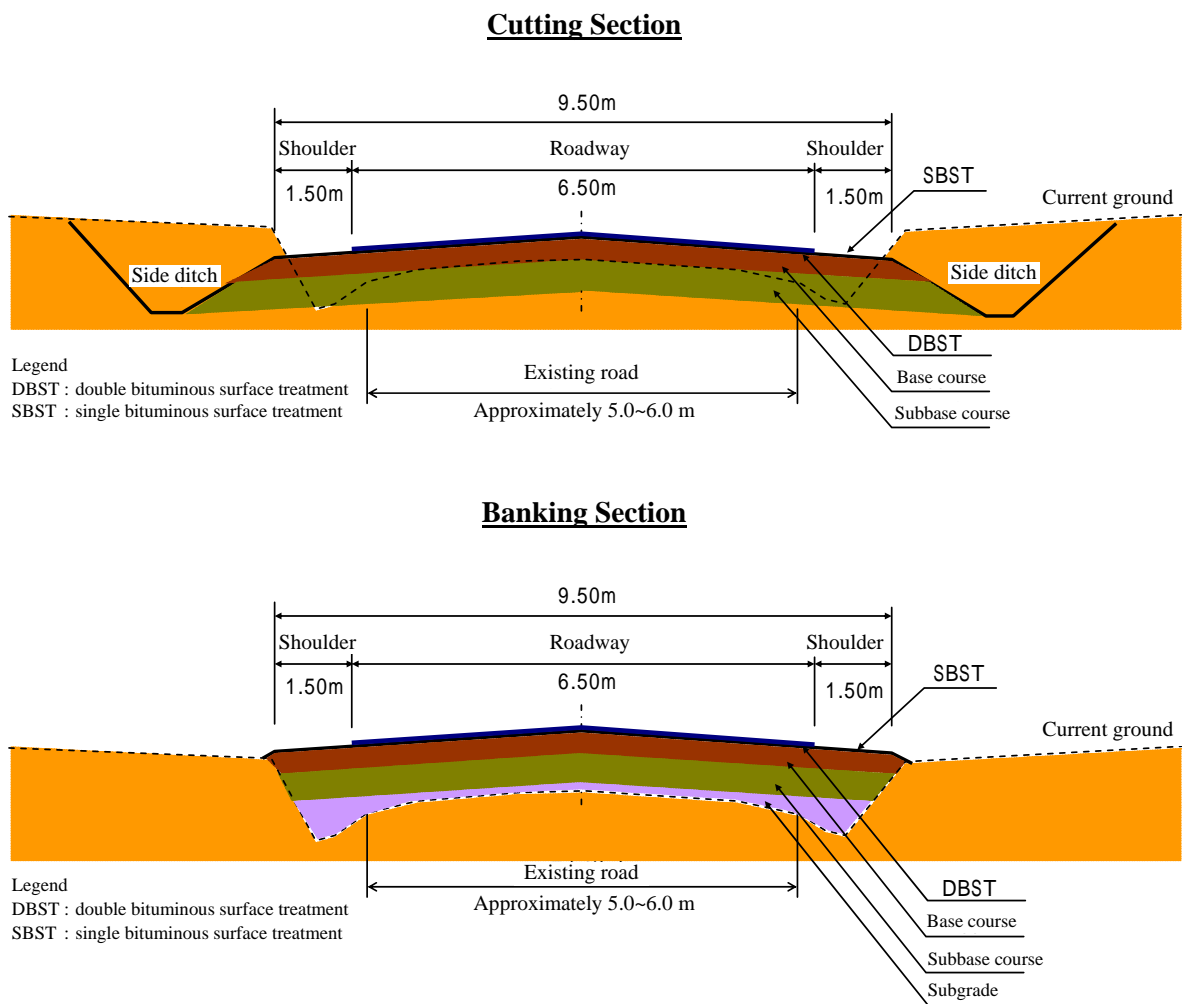


Figure 2.6 Standard Road Cross Section

## (5) Paving Plan

### 1) General items

Paving structure in Tanzania is based on the combination of bituminous surface + base course (granulated crushed stone or cement stabilization) + subbase course (granulated material).

On the Project route, although sandstone hills are scattered around, it is difficult to find materials suited to this type of paving. Accordingly, the type and size of paving that enables the optimum cost balance, for example, base formation by cement stabilization that uses less aggregate, was examined taking into account conditions regarding the local procurement of materials.

### 2) Type and structure of paving

Concerning traffic load conditions on the target section, in consideration of the traffic volume surveyed so far and the expected rate of increase in future, TLC (Traffic Load Class) 3 as designated in the Pavement and Materials Design Manual in Tanzania is deemed appropriate on the Project section.

Moreover, because weather in the Masasi area is classified as moderate, when these conditions are applied to the said manual, the structure of double bituminous surface treatment + base course + subbase course is deemed appropriate.

Concerning the paving surface aggregate, since materials that satisfy the required specifications cannot be found on the target section, it will be necessary to procure from a site some 70 km away.

Concerning the base course, since it is deemed possible to build the base course through combining locally found materials with cement stabilization, the type and size of feasible paving that enables the optimum cost balance upon taking into account the conditions of procurement of these materials have been adopted.

Concerning the paving of shoulders, considering that there are numerous pedestrians and bicycle users, surface treatment and lower layer were examined.

### 3) Paving design

In the Project, taking into account the said current conditions, upon analyzing and examining the expected traffic load and bearing force of the existing road, the composition

and thickness of paving on the Project road were examined. The design conditions and paving composition and specifications are shown below.

Design conditions

Design axial load : TLC3  
Subgrade bearing force : CBR15

Road paving specifications

Surface layer : DBST (double bituminous surface treatment)  
Base course : 15 cm cement stabilization base (local materials + cement stabilization)  
Subbase course : 20 cm granular materials (local materials)

Shoulder paving specifications

Surface layer : SBST (single bituminous surface treatment)  
Foundation materials : Subbase equivalent granular materials (local materials)

(6) Drainage Facilities Plan

1) General conditions

Road drainage facilities are intended to smoothly remove water from the road and surrounding area to ensure that people can safely and pleasantly use the road. At the same time, such facilities are very important in that they have a major impact on the service life of the road body and paving.

On the existing road, because a lot of road maintenance entailing the cutting and shaping of the base ground has been implemented so far, rainwater running off the surrounding land ends up flowing down the road course. Although earth side ditches have been adopted on some parts, these are conversely thought to be one of the main factors exasperating the current road deterioration. Moreover, in the Mbangala river basin around the 35 km point of the route, there have been reports of the road becoming inundated at times of high water.

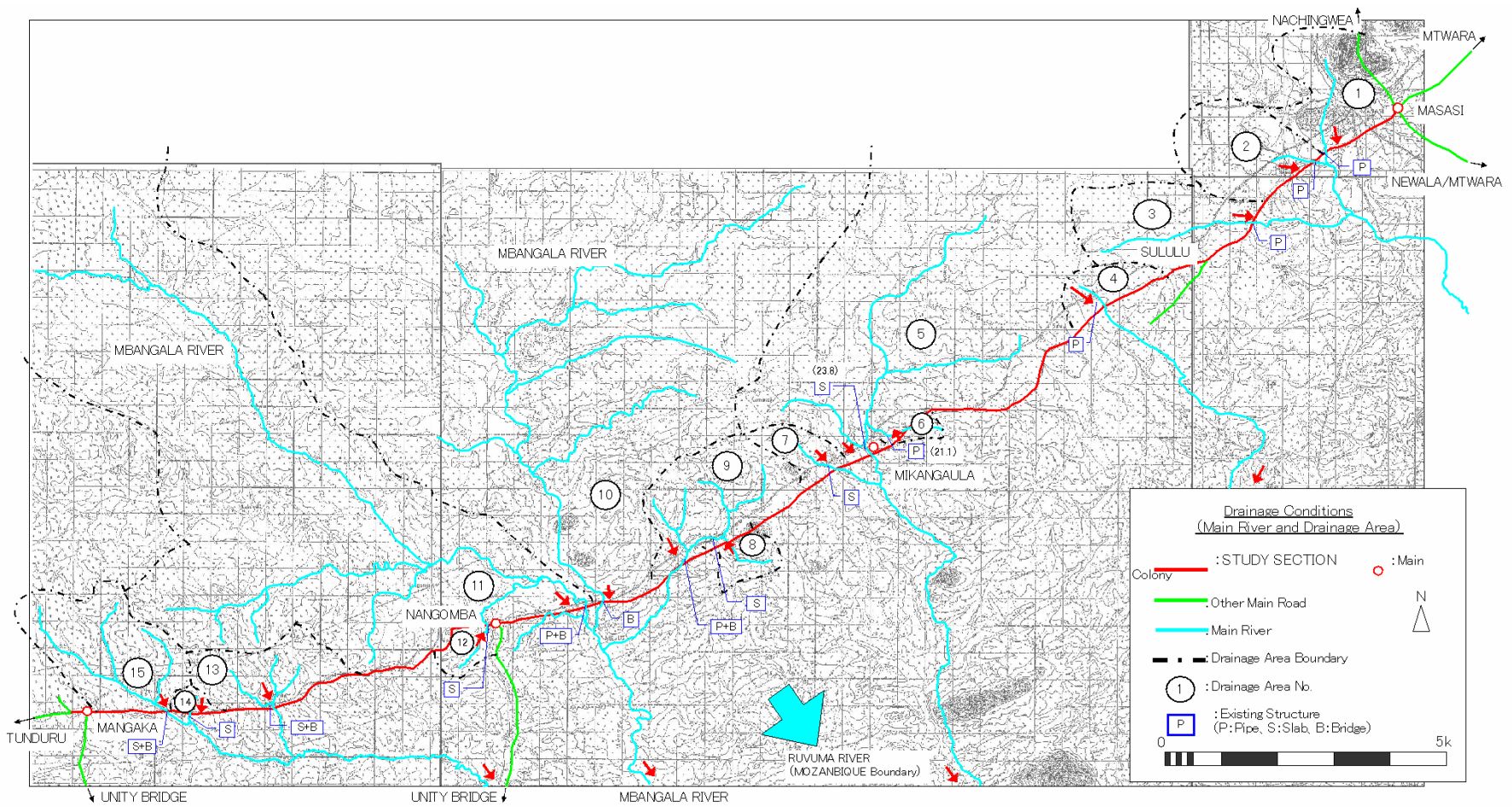
Accordingly, in the Project, it was decided to examine the optimum plan of drainage facilities based on consideration of these local conditions.

2) Outline of drainage conditions on the target section

Figure 2.7 shows the current drainage systems compiled based on the results of site surveys and topographical maps (obtained during the site survey) of the target section.



Figure 2.7 Current Drainage Systems



No.	Drainage Area (km <sup>2</sup> )	Existing Structure	Structure Name
1.	5.75	Pipe 1600x1	2.6
2.	3.75	Pipe 1200x1 600x4 1200x1	3.2
3.	3.50	Pipe 600x1 900x1	7.4
4.	1.25	Pipe 1200x1	13.4
5.	16.38	Slab Slab Length 5.32	23.8
6.	0.50	Pipe 900x1	21.1
7.	1.00	Slab Slab Length 5.00	24.4
8.	1.00	Slab Slab Length 4.40	29.8

No.	Drainage Area (km <sup>2</sup> )	Existing Structure	Structure Name
9.	3.63	Pipe+Bridge 1200x1 Bridge Length 13+12=25	32.4
10.	46.88	Pipe+Bridge 1200x1 Bridge Length 12.00 12+12=24	36.1, 36.2
11.	47.75	Pipe+Bridge 1200x2 900x2 600x2 900x1 Bridge Length 9+12=21	36.9
12.	1.00	Slab Slab Length 5.30	40.7
13.	2.50	Pipe+Bridge Slab Length 5.00 Bridge Length 9.30	49.6, 50.1
14.	0.38	Slab Slab Length 2.40	53
15.	6.25	Pipe+Bridge Slab Length 2.40 Bridge Length 9.20	53.8, 53.9

Outline of current drainage systems

Drainage systems over the target section can be summarized as follows.

From the lowest point (altitude 250 m) at Mbangala River around the 35 km point, the road rises as it moves towards the start point (altitude 420 m) and terminal point (altitude 350 m).

The target route is divided into 15 catchment areas, and the overall direction of flow is towards the south (towards Ruvuma River on the border with Mozambique).

Of these, catchment areas 8 to 12 belong to Mbangala River, which forms the largest catchment area on the route, and these traverse the existing road. Concerning catchment areas 10 and 11 in particular, waters flowing down from the north side of the road have caused inundation in the past.

The other catchment areas are deemed to drain water outside of the Project right of way judging from the terrain and current layout of facilities.

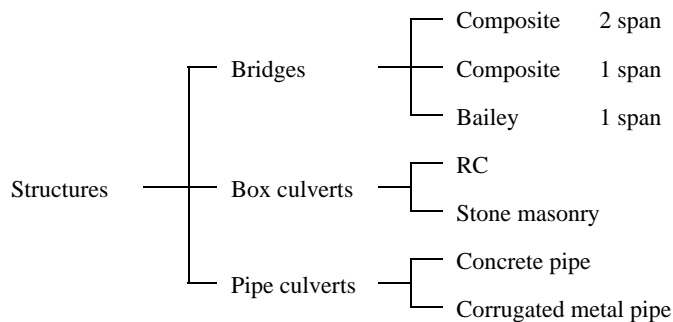
3) Current condition of traversal facilities and outline of rehabilitation methods

Existing traversal drainage facilities

There are currently 81 traversal drainage facilities, and the following table gives a breakdown of these according to type and design policy.

Table 2.4 Existing Structures

Item	Quantity	Size	Remarks
1. Corrugated metal pipe culvert	52	0.6 ~ 1.8 m	
2. Concrete pipe culvert	10	0.6 ~ 0.9 m	
3. Box culvert	10	1.2 ~ 5.3 m	
4. Bridge	9	5.3 ~ 25.0 m	Including 4 bridges with 2 spans
Total	81	-	



Of the above items, corrugated metal pipes and bridges are in particularly bad condition, while other structures are too narrow to allow two-way traffic. Corrugated metal pipe type culverts account for roughly 60% of all culverts and judging from their state it is guessed they were installed at the same time. Numerous deformations arising from problems in the method of installation seem to have occurred. Concerning concrete pipes, these have been installed recently as part of the maintenance effort of TANROADS, and they are generally in good condition apart from their narrow installed width. The details of problems by type of structures are described below.

Problems according to type of structures

#### Existing corrugated pipe culverts

The structure of existing corrugated metal pipes is such that strength as pipe differs greatly depending on the degree of bolt tightening when the different parts are joined during assembly.

In the existing corrugated metal pipes, serious problems have been confirmed in the actual pipe structures, for example, the number of tightening bolts has been pared down or reinforcing bars have been bent in order to fill the role of bolts. Moreover, because sufficient soil covering has not been secured between the pipes and surface of roads, the pipes have been subjected to direct loads, which in turn have caused deformation and other problems.



Photo 2.2 State of Damage in Corrugated Metal Pipe Culverts

#### Existing concrete pipe culverts

The existing concrete pipes consist of relatively old pipes that were installed before and after the said corrugated pipes, and new pipes that have been installed in

maintenance activities by TANROADS. The old pipes have problems in terms of the pipe bodies and the state of installation, while earth covering is thought to be insufficient for both the new and old pipes.

#### Existing box culverts

Existing box culverts are divided into two types, i.e. stone sidewalls with concrete slabs on top, and concrete sidewalls with concrete slabs on top. Both types have problems: the stone sidewall box culverts suffer from advanced deterioration, whereas the concrete sidewall types have warped floor plates.

#### Existing bridges

There are currently nine bridges comprising the one-span type (five bridges, 5.3~12.0 m) and the two-span type (four bridges, 21.0~25.0 m). In terms of structural type, there is only one Bailey bridge, while the remaining eight bridges are composite structures (H-shaped steel and concrete floor plates). All the bridges are too narrow to allow two-way traffic, i.e. they are 3.5~5.4 m in width, and all of them are in badly deteriorated condition characterized by damaged concrete floor plates, cracking of joints between beams, abutments and piers resulting from the omission of pedestals under main beams and so forth.



Damage to floor plate concrete

Base below beams abbreviated

Damage to abutment and bridge pier

Photo 2.3 State of Damage in Bridges

#### Examination of rehabilitation methods

##### Pipe culverts and box culverts

It has been decided to replace all the existing corrugated metal pipe culverts in view of their critical structural damage. Furthermore, concerning the existing concrete pipe culverts and box culverts, the soundness and state of structures were confirmed and examination was advanced with a view to utilizing the existing structures that can be

used by extending their ends as much as possible. As a result, it was confirmed that utilizing the existing structures in the Project is difficult.

The following table gives an outline of the plan for pipe and box culverts.

Table 2.5 State of Utilization of Existing Structures

Item	Structure	Places	Countermeasures
Pipe culverts	Corrugated metal pipe	52	Poor existing state replacement
	Concrete pipe	10	Poor existing state; problems exist with the height adjustment of pipes to the Project replacement
Box culverts	RC slab + stone side walls	9	State of side walls is poor replacement
	RC slab + RC side walls	1	Floor plates are warped replacement

### Bridges

In view of the poor state of existing bridges, examination of rehabilitation was advanced upon confirming the flow of water at each bridge position and considering the possibility of replacing with box culverts. In Tanzania, the British Standard (BS HA and HB loads) is applied to the design of such structures, however, since it is considered that the design of structures in the Project fully satisfies these standards, we explained to the TANROADS side our intention to apply the Japanese design B load standard and obtained its consent.

Existing bridges are no larger than two spans and around 20 m length and they are composite structures made from steel girders and concrete floor plates. All existing bridges are around 4.5 m width and only wide enough to allow one-way passage. Water rose to almost the height of the structures during the flooding of 1990 and 1997.

The section where there are continuous two-span bridges corresponds to the flow channel of Mbangala River (around the 35 km point). This point constitutes a relatively large catchment area, and the flow channel of the river cannot be pinpointed. Moreover, because the interviews with TANROADS officials and local residents revealed that the road here was inundated to depths of approximately 30~40 cm during the flooding that struck the coast of Tanzania in 1990 and 1997, consideration was given to the design height of the road and cross-sectional area of flow. As a result, upon also taking into account the pier height of new bridges, it was concluded that the existing road needs to be raised by around 1.5~2.5 m on this section. As for the bridge structure, it was decided to adopt a superstructure comprising three 10 m spans of RC

simply supported girders, and a substructure of spread foundations in view of the geological conditions.

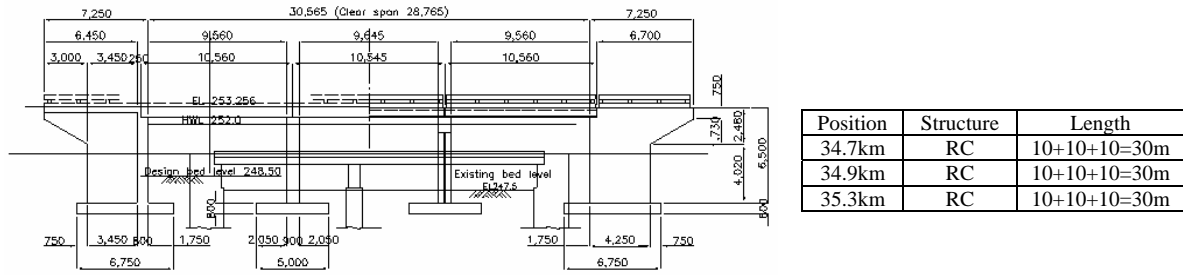


Figure 2.8 Project Bridges

### Traversal structures plan

The following table outlines the examination findings regarding culverts and bridges in the Project.

Table 2.6 Traversal Structures Plan

Item	Existing Number	Proposed				Remarks
		Type	Number			
			Breakdown	Total		
Pipe	62	D900mm	1Cell	35	60	Use pipes as small-scale boxes
			2Cell	16		
			3Cell	5		
			4Cell	4		
Box	10	4x3m	1Cell	4	11	Change four small-scale boxes into pipes
			1Cell	4		
		5x4m	2Cell	2		
			4Cell	1		
Bridge	9	10m	3Span	3	3	Change 5 bridges to boxes, and consolidate the remaining 4 bridges into 3.
Total	81				74	

### Inlets and outlets

To ensure the constant drainage of water and prevent scouring of the riverbed and slopes, traversal drainage structures have been designed with inlets installed on the upstream side and outlets on the downstream side. As for the structure of inlets and outlets, concrete standing walls and floors have been adopted.

### Roadside ditches

It has been decided to adopt a combination of earth ditches and stone masonry ditches for roadside ditches. Concerning the stone masonry ditches, these are intended for

areas where there is risk of scouring. In consideration of the above points, the quantity of side ditches to be installed in the Project shall be as follows.

Table 2.7 Outline of Side Ditches

Type of Side Ditch	Installation Length	Remarks
Earth ditch	18500 m	Cuttings
Stone ditch	800 m	Areas at risk from scouring

(7) Retaining walls

Installation of wire mat retaining walls was examined on parts susceptible to the effects of flowing water, i.e. inlets and outlets, in line with construction of the bridge over Mbangala River around the 35 km point of the existing road.

(8) Intersection and Diversion Plan

1) Main intersections

Intersections of the Project road with other main roads were examined upon considering the ease of maintenance, ease of connections with the existing road and adaptability. The following table gives a list of the major intersections.

Table 2.8 Major Intersections

No.	Position	Section Distance	Uses
1	0.0 km	Start point	Start point, intersection with Newala road
2	1.0 km	1.0km	Intersection leading to the district hospital
3	3.5 km	2.5km	Masasi suburbs, intersection leading to the airport
4	38.6 km	35.1km	Nangonba district, intersection leading to Unity Bridge
5	54.4 km	15.8km	Mangaka district, intersection leading to Unity Bridge
6	55.1 km	0.7km	End point, intersection leading to, Nanyumbu government office buildings

2) Diversions

Concerning traffic control during execution of the works, since current traffic volume is between 100~200 vehicles per day, it should be possible to manage traffic through enforcing single lane passage on the works sections. Moreover, even if it becomes necessary to divert traffic, it should be possible to establish diversions inside the existing ROW of 45 m.

(9) Traffic Safety Facilities Plan

1) Road lines and road signs

Centerlines and sidelines have been planned over the whole length of the target road. Furthermore, pedestrian crossing lines have been planned in the necessary areas. Concerning road signs, the necessary points have been narrowed down and the types of signs examined.

2) Protective fence

The equipment required for traffic safety on the target road section shall be installed as follows:

Guardrails : before and after major structures where height difference with the road exceeds the safe limit.

Guard posts : sections before and after guardrails

3) Kilometer posts

Considering the status of the target road as a regional trunk road and from the viewpoint of utilizing for road maintenance, kilometer posts shall be installed at set intervals.

4) Bus stops

The roadside area in the Project has spaces for buses and so on to stop in the center of roadside communities. Bus users and truck drivers, etc. use these spaces as rest areas in order to purchase drinks and souvenirs, etc. Since it is forecast that the number of passengers traveling between regions will increase in the future, it is planned to install bus stops of the type shown below (length 18.0 m, width 4.0 m + run-off area, DBST paving) in 14 communities on the target route in the Project.

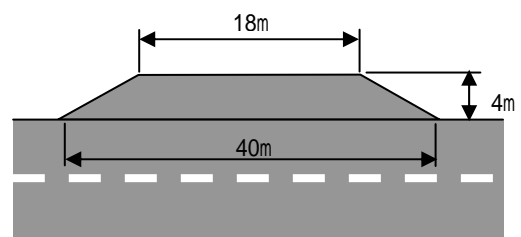


Figure 2.9 Bus Stop Plan



### 2-2-3 Basic Design Drawings

The following table gives an outline of the basic design drawings that have been prepared based on the above basic plan.

Moreover, related drawings are given in the appendices.

Table 2.9 List of Basic Design Drawings

Drawing No.	Contents of Drawings	Number of Sheets
A-1 ~ A-7	Road standard cross sections, road top views and longitudinal sections	7
B-1 ~ B56	Road standard cross sections, road top views and longitudinal sections	56
C-1 ~ C-6	Standard drawings of traversal drainage structures	6
D-1 ~ D-4	Drawings of auxiliary related facilities and safety facilities	4

### 2-2-4 Scheme of Execution

#### 2-2-4-1 Guideline for Execution

This Project will be implemented under the framework of the Grant Aid Scheme of the Government of Japan, so the following points have to be taken into consideration as a guideline for execution.

- Local engineers, workers and materials shall be utilized as much as possible for contribution to employment creation, promotion of technology transfer and vitalization of local economy.
- A close communication system shall be established between the Tanzanian government, the consultant and the contractors to smoothly implement the Project.
- Temporary works for road construction shall be planned by assuring efficient materials delivery and efficient equipment operation. The local topographic and geological features, etc. shall be well grasped and reflected on the temporary work plan.
- A realistic execution scheme shall be formulated in consideration of rainfall patterns, time requirement for equipment and materials procurement, proper working methods, etc.
- Proper schedule for detour and time schedule of construction shall be drawn up in order to avoid any excessive hindrance to current traffic flow.

## **2-2-4-2 Precautions for Work Execution**

The following points shall be considered in the Project implementation phase:

(1) Observance of labor standards

The contractor shall observe the presently applicable laws and regulations of Tanzania concerning construction, pay serious attention to appropriate working conditions and practices in relation to employment, prevent any dispute with workers and secure safety.

(2) Environmental conservation during the construction period

The contractor shall conduct and supervise construction works while paying attention to the environmental precautions that have been given on receipt of the “construction permit” as the premise for the permit. In addition, the contractor shall take care of environmental preservation by taking measures against dust, turbid water, etc. which may arise out of waste disposal, surplus soil disposal, filling, paving, etc. in relation to removal of the existing structures (longitudinal and crosswise traversing drainage structures).

(3) Necessity of communicating means on the site

On Project works sites, since cellular phones cannot be used any more than 10 km out of Masasi, alternative communications shall be established by means of satellite telephones and car radios in order to ensure safety for general traffic, the neighboring residents and the works personnel during construction as well as in emergency situations.

(4) Respect for local customs

A construction time schedule in accordance with the local religious customs and daily habits shall be considered in the phase of formulating the execution scheme.

(5) Securing of traffic safety

In consideration of safety during the roadworks, detour routes shall be provided at necessary points in order to ensure an efficient and comprehensive road plan that can be maintained.

(6) Circumstances around customs clearance

The execution scheme shall allow for the time required for import, unloading, customs clearance, etc.

(7) Procurement of land for construction work

It shall be confirmed that pre-agreement for land use and payment of guarantee money, etc. will properly be undertaken by the Tanzanian government.

(8) Coordination of construction time schedule with others

Progress of works on the Tanzanian side shall sufficiently be verified for coordination.

### **2-2-4-3 Scope of Works/Procurement and Installation**

The scope of performance of Japan and that of the Tanzanian government are described below.

(1) Scope of work by Japan

1) Construction work

Paving and improvements to traversal drainage structures over the target road length of 55.1km;

- Road construction including earth works, pavement works, and the necessary incidental temporary works;
- Installation of drainage structures and auxiliary facilities, and the necessary incidental temporary works;
- Installation of temporary facilities (base camp, office, storage, etc.).

2) Procurement of equipment and materials

Procurement of construction materials and equipment for construction of the road and structures.

3) Safety measures

Safety management and measures concerning execution of the construction works.

4) Consulting service

Drawing up of tender and contract documents, assistance for bidding and works supervision as described in 2-2-4-4 “Works Supervision Plan”.

(2) Scope of work by Tanzania

1) Acquisition of permission for construction works

Acquisition of permission for the construction works concerning the Project by TANROADS before bidding by contractors.

2) Customs clearance and procedure for tax exemptions

Support to facilitate customs clearance and procedure for tax exemptions at the Tanzanian port facilities concerning import of the equipment and materials for construction based on the list of imported articles prior to commencement of the construction works.

3) Expropriation of land and compensation

Insurance of the land necessary for facilities such as base camp, etc. given in the “Work execution plan” as well as of the place for disposal of wastes and surplus soil.

4) Support to facilitate relocation of public facilities, etc.

- Relocation of obstructing facilities (telephone cables, electric cables, sewer pipes, wells);
- Securing of temporary yards (camp yards, office sites, etc.);
- Provision of rock and earth quarries necessary for the works, and disposal sites for waste materials arising from the removal of existing bridges; and
- Assignment of supervisory staff of TANROADS to relocated facilities, including securing of office, means of transport and expenses for them.

5) Others

- Support to facilitate immigration and stay, etc. of the Japanese and people from any third country (other than Tanzanian people) engaged in implementation of the Project;
- Exemption or refunding of customs, domestic taxes and other tax surcharges, etc. imposed by the Tanzanian government;
- Appointment of counterpart as well as securing of means of transport and expenses for the personnel.
- Cost arising from registration of local contractors in the Project.

**2-2-4-4 Works Supervision Plan/Procurement Supervision Plan**

(1) Procedure for implementation of consulting service

Conclusion of the exchange of notes (E/N) concerning grant aid for the Project between the governments of Japan and Tanzania forms the precondition for implementation of the Project.

After conclusion of the E/N, the consultant shall conclude a consultancy agreement with TANROADS as the implementation organ on Tanzanian side according to the scope and procedure of the grant aid by Japan on the basis of the letter of recommendation by JICA to proceed with execution design, assistance for bidding and execution control. Following the signing of the agreement, the tender assistance work and works supervision shall be advanced. The principal contents of service to be contained in the consultancy agreement are as follows.

1) Stage of drawing up tender documents

According to the results of the basic design study report, the tender documents shall be prepared and approval for them obtained from TANROADS.

2) Tender stage

TANROADS will select a contractor of Japanese nationality by open bidding with assistance by the consultant. The representatives of the Tanzanian government participating the bidding and conclusion of construction contract will have to own the authority for contract approval and to be capable of making judgment on technological matters. The assistant services by the consultant in the tender stage shall be as follows:

Announcement of tender, Pre-qualification, Bidding and evaluation of tenders, Contract conclusion.

3) Organization for execution control (organization for site control by the consultant)

After contract conclusion with the contractor, the consultant shall issue the notice to commence to him and proceed with execution control. Within the framework of execution control, the consultant shall directly report to TANROADS about the progress of construction, control the progress, quality and safety of the contractor's work, manages payment to him and make proposal for betterment of the construction works, etc. Furthermore, the consultant shall make monthly report to the Japanese Embassy in Tanzania and the Tanzanian office of JICA. One year after completion of execution control, the consultant shall perform inspection of the completed construction works to terminate his consulting service.

## 2-2-4-5 Quality Control Plan

In the quality control setup, a laboratory shall be provided in the base camp. For this, the minimum necessary equipment for implementing quality tests on road soil, paving and concrete shall be procured from Japan. Concerning the staffing plan, one execution control engineer in charge of quality control shall be employed locally and placed in charge of all tests, and the following support staff shall be recruited. Tests that can be conducted at local public testing facilities will be consigned. The following table shows the main quality control plan arising in line with Project construction.

Table 2.10 Quality Control Items

Item		Test Method	Test Frequency	
Base/Subbase	Mixing materials	Liquid limit, plastic limit	Each mixture	
		Particle size distribution (mix)		
		Aggregate strength test		
		Aggregate density test		
	Laying	Maximum dry density (compaction test)	Once/day	
Asphalt	Materials	Bitumen	Quality certificate and content analysis sheet	Each material
		Aggregate	Particle size distribution	Each mixture, once/month
	Water absorption rate		Each material	
	Aggregate strength test			
Concrete	Materials	Cement	Quality certificate, physical and chemical test results	Each material
		Water	Constituent test results	
		Admixture	Quality certificate and content analysis sheet	
		Fine aggregate	Absolute dry specific gravity	
			Particle size distribution	
			Clay lump and soft mote ratio	
		Coarse aggregate	Absolute dry specific gravity	
	Particle size distribution (mixed)			
	Mixing	Test samples	Compressed strength test (using samples)	Each mixture
	Placement		Slump (concrete)	Each material
			Air quantity	
		Temperature		
Strength		Compressed strength test (July 28)	Each mixture sample	
Reinforcing bars	Materials	Quality certificate, tensile test results	Each lot	
Others		Various tests	Implement as required	

## 2-2-4-6 Equipment and Materials Procurement Plan

### (1) Circumstances around procurement of equipment and materials for construction

Regarding procurement of the necessary equipment and materials for the Project, crushed stone and concrete aggregate can be obtained within around 70 km of the target section, whereas basic materials such as cement, asphalt materials, reinforcing bars, timber, plywood and square timber will need to be transported from Dar es Salaam Port or Mtwara Port. As for fuel and asphalt materials, imported products can be procured on the local market.

It is thought that the biggest problem in the Project will be the procurement of paving aggregate. Rock formations can be seen around the target route, however, because these comprise sandstone, they are unsuitable in terms of quality for paving surface materials. Accordingly, it is likely that hard crushed stone and aggregate materials for use in surface paving and concrete will need to be procured from sites located approximately 60~70 km away, thereby leading to inflated unit prices of crushed stone and aggregate. Candidate sites for the procurement of aggregate are as indicated below.

Table 2.11 Candidate Sites for Aggregate Procurement

Name	Location	Remarks
Chepite	Approximately 66 km towards Mtwara from the start point	Materials used for pavement surface material by TANROADS on existing road from Masasi to Mtwara
Lumesule	Approximately 67 km towards Tunduru from the terminal point	Underground reserves are abundant and quality is suited to use in base course.
Newala	Approximately 49 km towards Newala from the start point	Underground reserves are abundant and quality is suited to use in structures.
53 km along the route	Within the Project route	Quality is quite good but the amount of underground reserves is uncertain.
Near Unity Bridge	Approximately 69 km towards Unity Bridge from Nangonba Village on the Project section	Materials are currently used as concrete aggregate in construction of Unity Bridge. Underground reserves are abundant and are suited to use in structures and base course.
Chikunde	Approximately 31 km towards Mtwara from the start point	Underground reserves are abundant and quality is suited to use in base course.

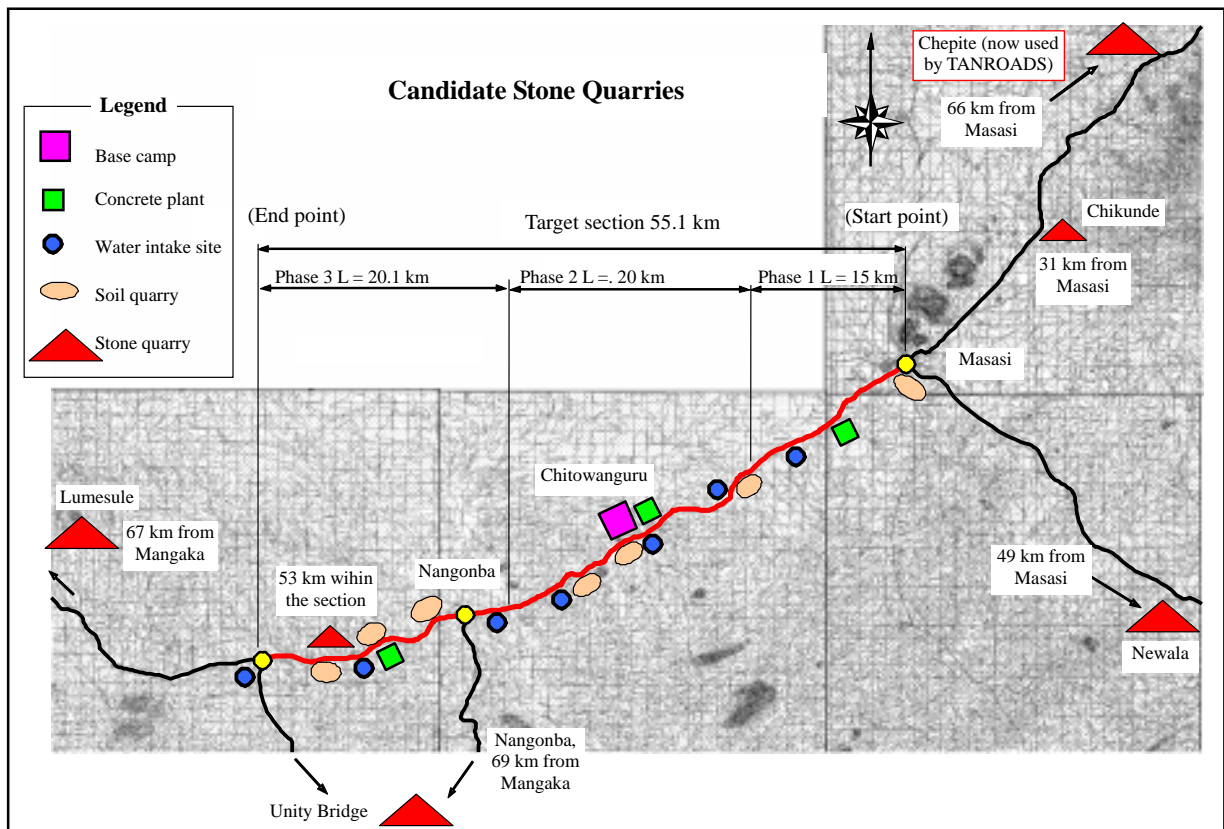


Figure 2.10 Candidate Sites for Aggregate Procurement

Moreover, because existing aggregate producers have limited production capacity, some time (approximately 1~3 months) will be required to apply for a license to produce crushed stone including the use of explosives before the start of works.

Tanzanian cement is satisfactory in terms of quantity and quality and can be procured locally. However, even though these raw materials can be procured locally, due to the high cost of electricity supply during manufacture, prices still work out higher than in Japan. Moreover, it is difficult to obtain imported cement because the Tanzanian government places restrictions on it.

Concerning reinforcing bars, there are six processing plants in the country and each of them imports block raw materials from South Africa and produces reinforcing bars according to AASHTO standards. However, because fluctuations can be seen in tensile strength and bar dimensions due to quality problems, it is necessary to compare cost and quality, etc. with imported products. Incidentally, imported products from South Africa, Egypt, Ukraine and Slovakia, etc. can be procured locally in Tanzania.

As for fuel and asphalt materials, these are commonly purchased as imports through agents of Total Kenya, Olix Tanzania and TERMCOTANK (T), etc. In each case, prices are linked to market movements.

The following table shows the procurement plan for the main materials.

Table 2.12 Procurement Sources of Construction Materials

Materials	Source			Remarks
	Tanzania	Japan	Third Country	
Road crushed stone and concrete aggregate (sand, aggregate)				Can be procured locally
Reinforcing bars				Imports from South Africa, Egypt, etc.
Timber (plywood, square timber, logs)				Can be procured locally
Cement				Can be procured locally. Expensive, but this is due to government restriction on imports. Separate importing is difficult.
Bitumen				Imports from Saudi Arabia, etc.
Fuel, lubricant				Imports from Saudi Arabia, etc.
Guard rails				Imports from South Africa, etc.
Road line paint				Imports from South Africa, etc.
Ratio of procurement cost (%)	70	0	30	



(2) Plan for carry-in of procured materials

1) Method of carry-in from Dar es Salaam

Some of the construction equipment and materials can be supplied locally, however, almost all other items have to be transported overland from Dar es Salaam, or carried by sea to Mtwara Port and overland from there to the Project site.

Concerning the road situation in overland transportation, parts of the road from Dar es Salaam to Mingoyo are in a terrible state. Although successive works are being implemented on these sections, the section around approximately the 60 km point is very poor and becomes impassable when heavy rain falls. However, since improvements are now being carried out in a phased program, it is anticipated that the whole section will be paved by around 2010.

Incidentally, the current transportation time from Dar es Salaam to Masasi is one day (approximately 12 hours) for four-wheel-drive vehicles and two days for trucks transporting equipment and materials.

As for the road from Mingoyo to Masasi, a bridge that was washed away by torrential rains in 1990-1991 has only been replaced with a temporary structure with a passing load limit of 20 tons. Accordingly, a procurement plan that takes these points into account will be needed.

2) Use of Mtwara Port

Mtwara Port possesses ample facilities as a carrying-in route for equipment and materials from Dar es Salaam and foreign countries. The port itself can be used, however, because there are not any regular cargo services now, shipments have to be arranged one-way and are thus relatively more expensive.

Incidentally, there is a cement supply company in Mtwara and an irregular service directly transports Tanga cement from Tanga Port to Mtwara Port.

In the absence of regular carrier services, there are not many transportation operators in Mtwara and equipment is limited to 7-ton trucks. In the case of transporting equipment and materials for large-scale works, it is necessary to contract operators based in Dar es Salaam and overland transportation from Mtwara Port is expensive.

### (3) Works Equipment

#### 1) Procurement of construction machinery

It is possible to locally procure construction machinery for roadworks. As was mentioned above, Class 1 companies (20 companies) and Class 2 companies (11 companies) in the civil engineering sector registered with the CRB own their own roadworks equipment.

The TANROADS Mtwara Regional Office has some construction machines available for lease, however, this machinery is leased to local operators for road maintenance; moreover, since these machines are limited in number and type and are deteriorated, it is unlikely they can be leased for the Project. Meanwhile, Tanzania has no companies or systems for renting construction machinery. However, companies that own machinery mutually share machines, so the necessary machines apart from specialized items can be secured locally. When construction companies borrow machines from each other, expensive charges are applied for long-term use in the same way as rental lease activities.

Concerning the procurement of construction machinery in the Project, it is possible to procure machinery through utilizing the machines owned by local subcontractors, however, since rates are expensive, it will be necessary to compare costs with machines brought in from Japan and third countries. As for specialized machines, it will be necessary to examine the import of machines from foreign countries.

Table 2.13 Procurement Sources of Construction Machinery

Equipment	Specifications	Procurement Source			Remark
		Tanzania	Japan	Third Country	
Bulldozer	21t				
Back hoe	Level loading 0.6m <sup>3</sup>				
Wheel loader	2.1m <sup>3</sup>				
Dump truck	10t				
Motor grader	Blade width 3.1m				
Road roller	10t-12t				
Tire roller	8t-20t				
Vibrating roller	0.8-1.1t				
Stabilizer	Truck type, mix width 2.0m				
Concrete plant	Capacity 30m <sup>3</sup> /h				
Agitator truck	3.0m <sup>3</sup> -4.5m <sup>3</sup>				
Distributor	6,000 liter				
Chip spreader	Tail gate 0.25m <sup>3</sup>				
Truck crane	Hydraulic telescopic jib 20t				
Surface cleaning truck	Vacuum type, hopper capacity 5.0m <sup>3</sup>				
Air compressor	Portable, 7.5m <sup>3</sup> /min				
Motor generator	10KvA-300KvA				
Ratio of procurement cost (%)		51	49	0	

2) Power supply and water supply for works

Power supply to the base camp will largely be determined by the location of the camp. In the case of the outskirts of Masasi, where the start of works is located, it will be possible to utilize the general power supply (purchase power). Meanwhile, because the Project road is long at 55.1 km, if the base camp is located on the start point side, transportation distances along the route will become long and uneconomical, so it will be necessary to compare economy with the case of power supply by private generator.

Since it will be difficult to secure power supply for vibration hammers in diversion and coffering works for bridges and culverts, submersible pumps in dewatering works, and for concrete plants, power supply from private generators shall be examined.

Concerning water supply for works and concrete production, rivers are available, however, since it will be difficult to secure sufficient water throughout the year (rivers only have flowing water from December to March), it may be necessary to secure alternative water supply from deep wells. Deep wells (water depth 80~100 m) are currently excavated at intervals of 5~10 km along the route, however, half of these have not yet been used due to pump and generator failures. It is thought that these wells can provide the necessary quantity of water supply according to the Masasi district water department, however, it will be necessary to take the impact on wells used by residents into account.

3) Supply of means of communication

In Masasi district, since telephone lines have been installed and cellular phones with international call capability are in use, these can be utilized in the Project. However, since cellular phones cannot be used any more than 10 km out of town between Masasi and Mangaka, alternative communications shall be established by means of satellite telephones, etc.

4) Other items (candidate sites for base camp and disposal sites for surplus soil and waste

A number of candidate sites for the base camp and disposal sites for surplus soil and waste were examined with members of the Tanzanian implementing agency.

Concerning the base camp, which needs to be approximately 10,000 m<sup>2</sup> of temporary land next to the target road, candidate sites were examined out of part of government-owned land on the outskirts of Masasi and a site at around the midway point of the road (Chitwangule Village around the 27 km point). Both sites are state-owned land and they can be rented as temporary sites through taking the proper procedure via TANROADS.

Concerning the candidate sites for surplus soil and waste disposal sites, sites other than those stipulated by the government via TANROADS under the environmental impact method in Tanzania (rivers, communities, areas around wells, etc.) were considered.

#### **2-2-4-7 Soft Component Plan**

In the Project, it has been deemed unnecessary to invest soft components because JICA is currently conducting a technical cooperation project aimed at improving the efficiency of maintenance contracting and works management capacity of directly managed work.

#### **2-2-4-8 Implementation Schedule**

The Project implementation schedule (draft) that was prepared based on the procedure of Japan's Grant Aid Scheme is indicated below. Considering the diversity and scale of works in the Project, execution plans and works schedules shall be separately compiled and examined for the roadworks and the traversal structural works, and the execution schedule and overall works plan shall be compiled upon considering the execution divisions and connections at the time of execution. The overall Project schedule is divided into works over three phases. The reasons for dividing it into three are as follows.

- 1) Since major equipment and materials will be imported from Dar es Salaam, it will be necessary to consider road conditions over the transportation route of approximately 600 km and include time necessary for long-distance haulage.
- 2) It is necessary to take into account the large size, i.e. 55.1 km of the target road section.
- 3) Limitations exist concerning road conditions for carrying in equipment and materials and executing civil works during the rainy season.
- 4) It is necessary to include time necessary for implementing ground improvement on black cotton soil sections.
- 5) It is necessary to include time for the relocation of public utilities equipment (electricity, telephones, water supply) by the implementation agency on the local side.

For these reasons, since it is considered difficult to implement the Project over a single fiscal year and as two phases, it has been decided to split it into three phases. The contents of each phase are indicated below.

Phase 1: Paving of the whole road over the 0 ~ 15 km section (15 km)

Phase 2: Paving of the whole road over the 15 ~ 35 km section (20 km) (including two bridges)

Phase 3: Paving of the whole road over the 35 ~ 55.1 km section (20.1 km) (including one bridge)

Table 2.14 Works Implementation Schedule

Item	Budgetary Year	1st Year										2nd Year										3rd Year										4th Year									
	Cumu. Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
E/N	Approval by the Cabinet	▼ (Term-1)										▼ (Term-2)										▼ (Term-3)																			
	Exchange of Note (E/N) Phasing	←										←										←										←									
Tendering	Consultant Agreement	=										=										=																			
	Terndering	=										=										=																			
Works for Term 1 (Km0 - Km15 portion)	Works for Term 1 (Km0 - Km15 portion)											█																													
	Preparation	█																																							
	Clearing Earth work	█																																							
	Pavement Work	█																																							
	Drainage Work, Ancillaries	█																																							
Works for Term 2 (Km15 - Km35 portion)	Works for Term 2 (Km15 - Km35 portion)																					█																			
	Preparation											█																													
	Clearing Earth work											█																													
	Pavement Work											█																													
	Drainage Work, Ancillaries											█																													
Works for Term 3 (Km35 - Km55.1 portion)	Works for Term 3 (Km35 - Km55.1 portion)																															█									
	Preparation																					█																			
	Clearing Earth work																					█																			
	Pavement Work																					█																			
	Drainage Work, Ancillaries																					█																			

Note : Rainy Period (Masasi)

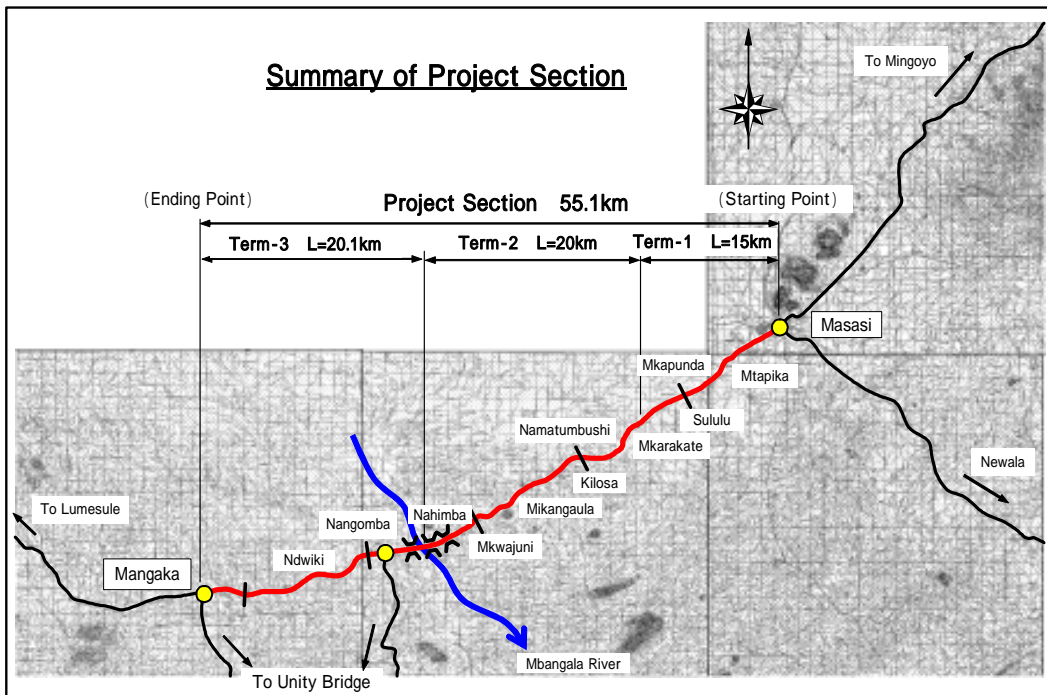


Figure 2.11 Phased Plan

## 2-3 Outline of the Work Undertaken by the Tanzanian Side

### 2-3-1 General Requirements for the Grant Aid Assistance Project of Japan

The following lists the general items of the Project undertaken by the Tanzanian side stipulated in the minutes of meeting agreed upon and later confirmed by the both governments.

- Secure the land needed for the Project before the commencement of construction work.
- Exempt Japanese nationals from customs tax, domestic tax and other forms of public charges for service and materials that are supplied under approved contracts.
- Provide necessary convenience and assistance to the Japanese nationals who enter and reside in Tanzania for the Project implementation in order to facilitate supply of service and materials under approved contracts.

### 2-3-2 Specific Requirements for This Project

The items undertaken by the Tanzanian side that are specific to this Project and not included in the general requirements are as follows.

#### 1) Relocation of obstacles

Within the ROW (45 m, i.e. 22.5 m to the right and left of the centerline of the existing road) in Masasi district, there are houses, electricity, telephone and water supply lines. Moreover, over a section of around 1 km out of Masasi, there are three water mains (4~6 inches) and around 30 smaller pipes (1~1/3 inch) feeding roadside houses. Moreover, wells are located close to the road in Mangaka district near the terminal point.

Table 2.15 List of Obstacles

Obstacle	Related Agency	Address	TEL	Relocation Cost Estimate (mill. T.Shs)
Electricity	TANESCO, Masasi	P.O.Box207 Masasi	023-2510041	88.3
Telephone	TTCL, Mtwara	P.O.Box860 Mtwara	023-2333015	31.0
Water supply	Water Department, Masasi D.C. (Urban)	P.O.Box113 Masasi	0745-516544	146.4
Well	Water Department, Masasi D.C. (Rural)	P.O.Box113 Masasi	0745-516544	-
Note:D.C.=District Council			Total	Approx. 27 million yen

Based on the scope of impact envisaged by the Study Team, the estimates submitted by each related agency indicate a total relocation cost of 265.7 million T. Shs (approximately 27 million yen). Since these facilities will be relocated in the first year of the Project, it will be necessary for the Tanzanian side to incorporate this cost into the TANROADS budget for 2007/2008.

2) Relocation in consideration of socio-environmental issues

The government of Tanzania will need to shoulder the following relocation costs to ensure socio-environmental consideration

Houses that exist within the ROW have received advance notification from TANROADS that they will be targeted for relocation (a red 'X' mark is painted on the building walls). Once the final Project alignment has been decided, since it will be necessary to give final notification and take relocation procedures, this will be an item for consideration when examining the works sections.

Table 2.16 Cost Estimate for Relocation

Item of relocation	Estimated cost (T. S)	Remarks
Houses	120	Estimate by Study Team
Total	120	Approx. 12,000,000 yen

3) Land acquisition cost

In line with curve improvements at two points around the 41 km point, expropriation of land will be needed. However, relocation of buildings and other facilities concerning the construction is not required.

4) Responsibility for securing temporary construction yard

Construction yard for contractors will be required as follows.

- Size of construction yard: 100m×100m
- Duration of use: 3 years

5) CRB cost

Construction operators in Tanzania have found it necessary to register with local construction company associations in recent years. Accordingly, concerning Japanese operators associated with grant aid Projects, the Tanzanian government will need to bear the necessary operator registration expenses.

Table 2.17 Construction Operator Registration Expenses

Item	Cost	Remarks
Registration fee	\$7,000	
Annual dues	\$30,000	\$10,000 per year, for 3 years
Total	\$37,000	Approx. 45 million Tshs.

### 2-3-3 Requests to the Government of Tanzania

The following are the requests to the Government of Tanzania for smooth implementation of the construction.

1) Holding explanatory meetings with the residents living along the Project route

TANROADS will hold meetings with the residents along the Project road or with their representatives to explain the Project immediately after the E/N for official implementation of the Project is signed and decided.

2) Traffic safety

The Tanzanian side is expected to inform general road users of the construction work and to instruct them to follow the directions of traffic control personnel.

3) Assuring publicity of inconveniences during construction

Since certain degree of inconveniences caused by the construction work are anticipated, the Tanzanian side is expected to thoroughly inform the residents, via public media such as radio broadcast, of inconveniences during the construction.

## 2-4 Project Operation and Maintenance Plan

### 2-4-1 Operation and Maintenance Setup

(1) Road operation and maintenance setup

TANROADS currently has an office in each region (21 offices) and four zonal offices overseeing the regional offices in each zone. The Project road between Masasi-Mangaka comes under the jurisdiction of the Mtwara Regional Office, which currently supervises the maintenance of trunk roads and regional roads in Mtwara Province and part of Ruvuma Province. The budget for trunk



roads (including trunk roads in part of Ruvuma) and regional roads maintenance in 2005 was approximately 12 billion Tshs.

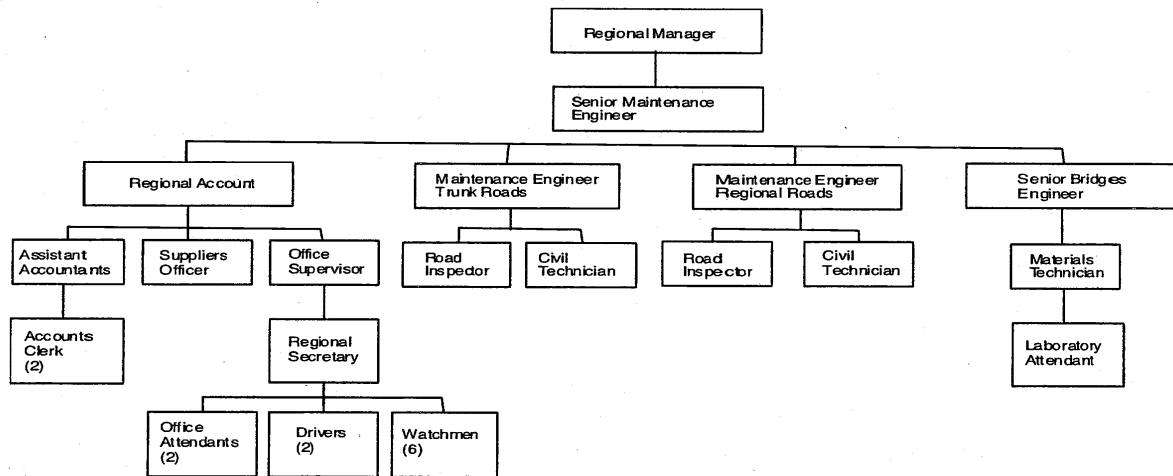


Figure 2.12 Organization Chart of Mtwara Regional Office (TANROADS)

The organization and implementation capacity of TANROADS, which is the implementing agency in the Project, and the MoID, which is the supervisory agency, is deemed to be high considering past performance in construction and maintenance of numerous roads. Furthermore, since the technical cooperation project currently being implemented by JICA in TANROADS can be expected to enhance work implementation capacity even further, it is deemed that the organizational capacity of TANROADS and the MoID is at a satisfactory level.

#### 2-4-2 Maintenance Work Following Completion of the Project

The following maintenance work for the facilities will be required during the operational stage after the completion of the Project.

##### (1) Regular maintenance work

The maintenance such as repair work regularly required throughout the year, especially after the rainy season, is listed below.

- Patching up the damaged road surface (filling potholes)
- Repairing the road foundation as required
- Reshaping the road shoulders
- Cleaning of side ditches and traversal drainage structures

(2) Periodic maintenance work

- Repair of road foundation
- Repair of road surface
- Repair of road shoulders
- Repair of structures

TANROADS Mtwara Regional Office currently contracts out repair work such as those described above to local contractors and no operational problems are found. In particular, since it is important to repair damaged parts immediately, the local side will be expected to conduct regular rounds of inspection at sufficient intervals for early detection.

## 2-5 Estimated Cost for the Grant Aid Project

### 2-5-1 Estimated Cost of the Project

The total cost in the event where the Project is implemented will be 2.45 billion yen, and the division of costs of the Japanese and Tanzanian sides based on the aforementioned scope of works is estimated as follows according to the estimation conditions. However, this amount does not exceed the limit designated in the exchanged notes.

(1) Cost shouldered by the Japanese side

Table 2.18 Estimated Project Cost

#### Road Construction Project between Masasi and Mangaka

Length: 55.1 km

Estimated Project cost: 2.409 billion yen

Cost Item				Estimated Cost (million yen)	
Construction cost	Facilities (direct works cost)	Road works	Site clearing, earth work, pavement work, slope treatment work, etc.	1610.3	2246.0
		Drainage works	Pipe culverts, box culverts, bridges, inlets and outlets, stone side ditches	587.1	
		Incidental works	Guard rail/post, road markings, traffic signs, kilometer posts	48.6	
Design and supervision cost				162.6	
Total				2408.6	

(2) Cost shouldered by the Tanzanian side

As was indicated in 2-3 Outline of the Work Undertaken by the Tanzanian Side, the cost for the Tanzanian side is estimated to be approximately 432 million Tshs (approximately 41 million yen) for relocation of obstacles, relocation of facilities for socio-environmental consideration, land

acquisition, securing temporary construction yard and CRB (construction operator registration cost). The following table shows the contents of costs borne by the Tanzanian side.

Table 2.19 Costs Borne by the Tanzanian Side

Cost Item	Application	Related Agency	Local Currency (million Tshs)
Obstacles	Electricity	TANESCO	88.3
	Telephones	TTCL	31.0
	Water supply	Masasi D.C. Water Dept.	146.4
Relocation of houses	Between Masasi-Mangaka	TANROADS	120.0
Registration of construction operators		CRB	45.9
		Total	431.6 (41 million yen)

(3) Conditions for cost estimation

1) Foreign exchange rate

1 US dollar = 116.77 Japanese yen (as of the end of August 2006)

2) Duration of construction

Dividing the works into three phases, the time required to implement tender assistance and construction works will be 41 months as shown in the implementation schedule.

3) Other conditions

- This Project is implemented in accordance with the grant aid scheme of the government of Japan
- The exchange rate above is subject to change by the Government of Japan

**2-5-2 Operation and Maintenance Cost**

(1) Road maintenance cost

The main operation and maintenance work to be implemented on the Project road is the routine and periodic maintenance indicated below, and the maintenance cost is estimated as approximately 280 million Tshs per year on average. Since this is 2.2 % of the total annual maintenance budget of TANROADS Mtwara Office (approximately 12 billion Tshs in 2004/2005), it is deemed that adequate maintenance will be possible.

Table 2.20 Major O/M Items and Cost

(Unit: Tshs)

O/M Type	Frequency	O/M item	Specifications	Unit	Unit cost	Unit work amount	Number of work	Cost (TS)
Regular	Every year	Patching	2.0% of the total paved area	m <sup>2</sup>	17,200	7,163	9	1,108,832,400
		Roadbed repair	2.0% of the total paved area	m <sup>2</sup>	13,800	7,163	9	889,644,600
		Road shoulder repair	2.0% of the total road	m <sup>2</sup>	10,500	3,306	9	312,417,000
		Cleaning of structures	-	m <sup>3</sup>	2,000	9	9	159,840
		Subtotal – I	10 year cumulative =					
							Annual =	231,105,384
Periodic	5 <sup>th</sup> year	Roadbed repair	2.0% of the total paved area	m <sup>2</sup>	17,200	7,163	1	123,203,600
		Overlay	2.0% of the total paved area	m <sup>2</sup>	13,800	7,163	1	98,849,400
		Road shoulder repair	2.0% of the total road	m <sup>2</sup>	10,500	3,306	1	34,713,000
		Repair of structures	-	m <sup>3</sup>	161,000	89	1	14,296,800
		Subtotal – II						
Sum of regular and periodic maintenance – III (=I+II)								2,582,116,640
General administrative cost			10% of III	Formula	-	-	1	258,211,664
10 year total cost								2,840,328,304
Per year cost								284,032,830

## 2-6 Important Points to Consider in Project Implementation

Houses have been confirmed inside the right of way of the Project road (22.5 m left and right of the road centerline, 45 m in total), and these will obstruct the Project works. Similarly, since some telephone lines, power lines and water pipes within the ROW will hinder the works, they will need to be relocated under the responsibility of the Tanzanian side. Accordingly, since the Tanzanian side must complete relocation before the works are started, it will need to plan and implement adequate budget arrangements. Also, it will need to execute the various required procedures for the EIA and so forth. These points have been fully discussed and confirmed in the Study and recorded in the minutes of meetings.

Following the signing of the E/N officially deciding Project implementation, it will be necessary for TANROADS to immediately assemble the roadside residents or their representatives and stage explanatory meetings. Furthermore, in order to mitigate traffic congestion and avoid unnecessary trouble with residents, it will be necessary for TANROADS give thorough advance notification to road users and residents.

## **CHAPTER 3**

# **VERIFICATION OF PROJECT APPROPRIATENESS**

## CHAPTER 3

### VERIFICATION OF PROJECT APPROPRIATENESS

#### 3-1 Project Effects

Since implementation of the Project will lead to the improvement of road conditions and realization of safe and smooth traffic on the target section, the entire population of Mtwara Province of approximately 1,130,000 people, and especially the 440,000 residents of Masasi district living along the road, will realize the benefits. Table 3.1 indicates the anticipated effects of Project implementation.

Table 3.1 Project Effects

Current Conditions and Problems	Project Measures	Direct Effects and Degree of Improvement	Indirect Effects and Degree of Improvement
<p>The present road is too narrow and rutted to allow safe and smooth traffic.</p> <ul style="list-style-type: none"> <li>• Safe two-way traffic is not possible due to the narrow width and rutting of the road.</li> <li>• Safe running speeds are slow due to the state of the road surface and narrow width.</li> <li>• Safety problems such as falling and contact of pedestrians and bicycles are occurring due to the state of the road surface and narrow width.</li> </ul>	Road upgrading	<ul style="list-style-type: none"> <li>• Increase in road traffic volume due to improvement in the road standard</li> <li>• Shortening of travel times for vehicles using the road</li> <li>• Improvement in road safety through improving road flatness, separation of vehicles from pedestrians and bicycles through provision of shoulders, and so on</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction of transportation costs due to shortening of transportation times and improvement of flatness</li> <li>• Contribution to stronger and more stable physical distribution through improvement in access</li> <li>• Contribution to local development, rectification of regional disparities, expansion of the market area, and stabilization of access to medical and education facilities through improvement in road reliability</li> </ul>

#### 3-2 Issues and Recommendations

##### 3-2-1 Issues and Recommendations to be Addressed by the Tanzanian Side

- (1) Implementation of items to be borne by the Tanzanian side

It is indispensable that the Tanzanian side secures the right of way around the Project road and certainly completes the necessary procedures without hindrance to the Project by the time of Cabinet approval in Japan for construction of the Project facilities.

- (2) Education about traffic safety

Since the road repair works in the Project will lead to improvement in road conditions, vehicle speeds will be faster than they are now. Accordingly, in order to prevent an increase in major

accidents, it is desirable that the Tanzanian side conducts educational activities to road users and local residents about traffic safety.

### (3) Overall development plan for Mtwara Development Corridor

The development of national highways 6 and 12, which include the Project route, is expected to promote development in Southern Tanzania and help realize functions of the international road connecting with neighboring Mozambique. Accordingly, promoting works on other roads requiring repair at the same time as conducting the Project works will be essential for development of the local area.

### **3-2-2 Collaboration with Technical Cooperation and Other Donors**

Road development between the economic capital of Dar es Salaam and Mtwara is currently being implemented by the Government of Tanzania, international donors and agencies. Moreover, since donors and agencies are conducting studies and improvements on other parts of the Mtwara Corridor that includes the Project route, the Study Team checked these implementation conditions, gauged any problems and designed the Project plan to ensure that it is in harmony with the overall road network. Concerning technical cooperation, this will not be required in the Project because JICA is currently implementing technical cooperation with TANROADS.

### **3-3 Project Appropriateness**

The Project entails improvement of a major trunk road in the southern part of Tanzania. Implementation of the Project will improve the quality of transport on the target section and thereby improve the passenger and goods distribution environment; moreover, ongoing maintenance of high quality pavement will ensure the effects are sustained over the long term. Doing this will directly contribute to improving the living standard of local residents; moreover, since improvement of roads connected to the Project route will greatly contribute to the establishment of an international route with the neighboring country, the appropriateness of the Project is confirmed.

### **3-4 Conclusion**

Since the Project can be expected to impart major benefits for the whole population of Tanzania and will contribute to widely improving the convenience of local residents, it is deemed to be highly significant for implementation under the Grant Aid Scheme of the Government of Japan. Moreover, judging from past experience, the Tanzanian implementing agency is deemed to possess ample capacity to handle maintenance of the completed road to ensure these effects continue long into the future.

# **APPENDICES**



## [Appendices]

### 1. Composition of the Study Team

#### (1) During the field surveys for the Basic Design Study

Table A-1 Study Team Members (during the field surveys)

Responsible Area	Organization	Name
Team Leader	JICA Tanzania Office, Manager	Toshihiro Obata
Planning Management	JICA, Grant Aid Division, Work Group 1, Transportation and Electric Power Team	Ken Imai
Work Chief /Road Planning / Environmental and Social Consideration I	Construction Planning Consultants Inc.	Hideaki Morita
Road Design	Construction Planning Consultants Inc.	Takuji Kono
Natural Conditions Survey	Construction Planning Consultants Inc.	Masahiro Yoshizawa
Execution Planning / Cost Estimation	Construction Planning Consultants Inc.	Tetsumi Masui
Environmental and Social Consideration II / Community Development	Construction Planning Consultants Inc.	Tadanori Kumano

#### (2) During outline explanation of the draft basic design

Table A-2 Study Team Members (during outline explanation of the basic design)

Responsible Area	Organization	Name
Team Leader	JICA Tanzania Office, Manager	Toshihiro Obata
Planning Management	JICA, Grant Aid Division, Work Group 1, Transportation and Electric Power Team	Ken Imai
Work Chief /Road Planning / Environmental and Social Consideration I	Construction Planning Consultants Inc.	Hideaki Morita
Road Design	Construction Planning Consultants Inc.	Takuji Kono
Execution Planning / Cost Estimation	Construction Planning Consultants Inc.	Sin Onoda

#### (3) During outline explanation of the study outputs

Table A-3 Study Team Members (during outline explanation of the study outputs)

Responsible Area	Organization	Name
Team Leader	JICA Tanzania Office, Manager	Koji Makino
Work Chief /Road Planning / Environmental and Social Consideration I	Construction Planning Consultants Inc.	Hideaki Morita
Road Design	Construction Planning Consultants Inc.	Takuji Kohno

## 2. Study Itinerary

### (1) Field surveys for the Basic Design Study: July 22~August 31, 2006

Table A-4 Study Schedule (field surveys)

No.	Mth	Day	Team Leader JICA Tanzania office, Resident representative Toshihiro OBATA	Project coordinator Grant Aid Management Department, JICA Ken IMAI	Chief consultant/Road planner/Specialist on the Environment & Hideaki MORITA	Road Design Takuji KONO	Natural Investigation Masahiro YOSHIZAWA	Construction Planner/Estimator Tetsumi MASUI	Specialist on the Social and Environment Tadanori KUMANO
1	Jul.	22	Sat				JPN-DXB		
2		23	Sun				BDX-Dar es salaam		
3		24	Mon				Site invest. Arrangement		
4		25	Tue				Dar-Masasi		
5		26	Wed				Site reconnaissance		
6		27	Thu				Soil, Geo. Invest. Check		
7		28	Fri				Masasi-Dar.		
8		29	Sat			JPN-DXB	Data classification	JPN-DXB	
9		30	Sun			BDX-Dar es salaam	Data classification	BDX-Dar es salaam	
10		31	Mon				TANROADS, MoID, JICA Tanzania		
11	Aug.	1	Tue				TANROADS, Discussion		
12		2	Wed				Dar-Masasi		
13		3	Thu				Site Investigation		
14		4	Fri				Site Investigation		
15		5	Sat				Site Investigation		
16		6	Sun				Internal meeting		JPN-DXB
17		7	Mon				Site Investigation		BDX-Dar es salaam
18		8	Tue				Site Investigation		Dar-Masasi
19		9	Wed		Move		Site Investigation		
20		10	Thu		Dar es salaam, JICA		Site Investigation		
21		11	Fri	Dar-Masasi		Discussion (Masasi)	Site Investigation		Discussion (Masasi)
22		12	Sat				Site Reconnaissance		
23		13	Sun			Masasi-Dar.	Internal meeting		
24		14	Mon			Discussion	Site Investigation		
25		15	Tue			Discussion	Site Investigation		Masasi-Dar.
26		16	Wed			MD sign, EOJ, JICA	Site Investigation		Data correction
27		17	Thu		Dar-DXB	TANROADS, MoID	Site Investigation		Dar-DXB
28		18	Fri		DXB-JPN	TANROADS, MoID	Dar-Masasi	Site Investigation	DXB-JPN
29		19	Sat			TANROADS, MoID	Site Investigation		
30		20	Sun			Data preparation	Internal meeting	Internal meeting	Internal meeting
31		21	Mon			TANROADS, MoID	Site Investigation		
32		22	Tue			TANROADS, MoID	Site Investigation		Masasi-Dar.
33		23	Wed			JICA, EOJ	Site Investigation		JICA, EOJ
34		24	Thu			Dar-DXB	Site Investigation	Dar-DXB	Data correction
35		25	Fri			DXB-JPN	Site Investigation	DXB-JPN	Data correction
36		26	Sat				Masasi-Dar.		Data correction
37		27	Sun				Data preparation		Data preparation
38		28	Mon				Data correction		Data correction
39		29	Tue				Data correction		Data correction
40		30	Wed				Dar-DXB		Dar-DXB
41		31	Thu				DXB-JPN		DXB-JPN

(2) Outline explanation of the basic design: November 30 ~ December 29, 2006

Table A-5 Study Schedule (outline explanation of the draft basic design)

No.	Mth	Day	Team Leader JICA Tanzania office, Resident representative Toshihiro OBATA	Project coordinator Grant Aid Management Department , JICA Ken IMAI	Chief consultant/Road planner/Specialist on the Environment & Hideaki MORITA	Road Design Takuji KONO	Construction Planner/Estimator Sin ONODA
1	Nov.	30	Thu			JPN-DXB	
2	Dec.	1	Fri			BDX-Dar es salaam	
3		2	Sat			Internal meeting	
4		3	Sun		Move	Data preparation	
5		4	Mon		Discussion	TANROADS, MoID, JICA Tanzania	
6		5	Tue	TANROADS, MoID, JICA Tanzania			
7		6	Wed	TANROADS, Discussion			
8		7	Thu	MD sign, EOJ, JICA			
9		8	Fri		(Discussion)	TANROADS, Discussion	
10		9	Sat	Dar-Masasi	Dar-DXB	Dar-Masasi	
11		10	Sun	Site reconnaissance	DXB-JPN	Site reconnaissance	
12		11	Mon	Masasi-Dar		Site Investigation	
13		12	Tue			Site Investigation	
14		13	Wed			Masasi - Mutwara	
15		14	Thu			Mutwara-Dar	
16		15	Fri			TANROADS, Discussion	
17		16	Sat			Internal meeting	
18		17	Sun			Data preparation	
19		18	Mon			Data correction	
20		19	Tue			Data correction	
21		20	Wed			Data correction	
22		21	Thu			TANROADS, Discussion	
23		22	Fri			Data correction	
24		23	Sat			Internal meeting	
25		24	Sun			Data preparation	
26		25	Mon			Data preparation	
27		26	Tue			Data correction	
28		27	Wed			JICA, EOJ	
29		28	Thu			Dar-DXB	
30		29	Fri			DXB-JPN	
		30	Sat				
		31	Sun				

(3) Outline explanation of the study outputs: March 4 ~ March 16, 2007

Table A-6 Study Schedule (outline explanation of the study outputs)

No.	Mth	Day	Team Leader JICA Tanzania office, Dep. resident representative  Koji MAKINO	Chief consultant/Road planner/Specialist on the Environment & Social Consideration  Hideaki MORITA	Road Design  Takuji KONO
1	Mar.	4	Sun		JPN-DXB
2		5	Mon		BDX-Dar es salaam
3		6	Tue	JICA(Discussion), TANROADS(Discussion)	
4		7	Wed	TANROADS (Discussion)	
5		8	Thu	EOJ(Report), TANROADS(Discussion)	
6		9	Fri	MoID(Discussion), TANROADS(Discussion)	
7		10	Sat	Data correction/arrangement	
8		11	Sun	Data correction/arrangement	
9		12	Mon	TANROADS (Discussion)	
10		13	Tue	TANROADS (Discussion)	
11		14	Wed	TANROADS (Discussion)	
12		15	Thu	M/D sign, MoID, TANROADS, JICA, Dar es salaam-DXB	
13		16	Fri	DXB-JPN	

### 3. List of Related Officials (Persons Interviewed)

Table A-7 List of Related Officials

<b>Ministry of Infrastructure Development (MoID)</b>		
Omary A. Chambo	Deputy Permanent Secretary	
Leopold J. K.N. Mujjungi	Director for Trunk Roads	
Edwin Mujwahuzi	Assistant Director for Trunk Road Division	
A. N. Temba	Director of Policy and Planning	
A. B. Meena	Acting Head of Research & Studies	
J. J. Msugupaleulya	Senior Engineer	
<b>Tanzania National Roads Agency (TANROADS )</b>		
F.Y. Addo - Abedi	Chief Executive	
Boniface H.P. Nyiti	Acting Chief Executive	
Arnold . J. Maeda	Acting Manager Project Preparation Unit	
W. Shila	Coast Zonal Manager	
Hassan Matimbe	Project Engineer	
Mohamed Besta	Materials Engineer	
Josephine Mwakusyu	Senior Social Scientist	
Emmanuel Msumba	Principal Structure Design Engineer	
Noel K. Ngowi	Design Engineer	
Augsut Byabato	Zonal Manager	
Mohamed Besta	Pavement and Materials Engineer	
Ebenezer R. Molllel	Acting Manager Design	
Damian R. Ndbalinze	Regional Manager Mtwara	
Hubert Swai	Project Engineer Mtwara	
Fred Han Kipamila	Resident Engineer Masasi	
<b>National Development Cooperation (NDC )</b>		
Pascal E. Malesa	Project Engineer	
<b>Masasi District Office</b>		
S.A. Amanzi	District Commissioner	
Farid Mmna-Teo	Town Executive Officer	
Rasmon Nambuta	District Water Engineer	
<b>Cashew nut Board Tanzania in Mtwara</b>		
H.H. Amma	Marketing Director	
<b>National Social Security Fund</b>		
Bajumuzi P.M	District Fund Manager	
<b>Tanzania Electric Supply Company Limited : TANESCO</b>		
Rosemary Chijendi	Project Engineer	
<b>Tanzania Telecommunications Company Limited (TTCL )</b>		
M.H. Mnimbo	Regional Network Manager	
<b>Embassy of Japan</b>		
Makoto Ito	Ambassador	
Hiroshi Ito	First Secretary	
<b>JICA Tanzania Office</b>		
Toshihiro Obata	Resident Representative	Upto Feb./2007
Makoto Kashiwaya	Resident Representative	From Feb./2007
Koji Makino	Deputy Resident Representative	
Takeshi Oikawa	Assistant Resident Representative	
Asuka Tsuboike	Assistant Resident Representative	

#### 4. Minutes of Discussions (M/D)

##### (1) Field surveys for the Basic Design Study

**Minutes of Discussions  
on the Basic Design Study  
on the Project for Upgrading Masasi-Mangaka Road  
in the United Republic of Tanzania**

Referring to the results of the Preliminary Study which was conducted in March 2006, the Government of Japan decided to conduct a Basic Design Study on the Project for Upgrading Masasi-Mangaka Road (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to the United Republic of Tanzania (hereinafter referred to as "Tanzania") the Basic Design Study Team (hereinafter referred to as "the Team"), headed by Mr. Toshihiro Obata, Resident Representative, JICA Tanzania Office, and is scheduled to stay in the country from July 23 to August 30, 2006.

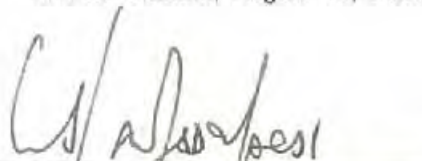
The Team held discussions with the officials concerned from the Government of Tanzania and conducted a field survey in the study area.

In the course of the discussions and the field survey, both sides confirmed the main items described in the attached sheets.

Dar es Salaam, August 16, 2006




Toshihiro Obata  
Leader  
Basic Design Study Team  
JICA

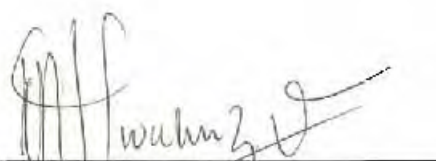


F.Y. Addo-Abedi (Dr.)  
Chief Executive  
Tanzania National Roads Agency  
Tanzania

Witness:



Ngosha Said Magonya  
Acting Commissioner for External Finance  
Ministry of Finance  
Tanzania



Edwin H. T. Mujwahuzi  
Acting Director for Trunk Roads  
Ministry of Infrastructure Development  
Tanzania

## ATTACHMENT

### 1. Objective of the Project

The objective of the Project is to upgrade the road from Masasi to Mangaka.

### 2. Project Site

The Project site is the road from Masasi to Mangaka (approximately 54km), as shown in Annex-1.

### 3. Responsible and Implementing Organization

The responsible ministry is the Ministry of Infrastructure Development (hereinafter referred to as "MoID").

The implementing organization is the Tanzania National Roads Agency (hereinafter referred to as "TANROADS").

The organization charts of MoID and TANROADS are shown in Annex-2 and 3.

### 4. Items Requested by the Government of Tanzania

As the result of discussions, requested components were confirmed as below:

- Redesign and upgrading to Bitumen Standard of the existing road from Masasi to Mangaka section
- Carriageway width 6.5m (2 lanes)
- Shoulder width 1.5m each side
- Pavement surfacing DBST
- Start point: Newala-Nachingwea Junction in Masasi
- End point: Junction to Nanyumbu District Council Office in Mangaka

The final components of the Project will be decided after further studies, and JICA will assess the appropriateness of the request and will report to the Government of Japan.

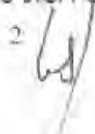
### 5. Japan's Grant Aid Scheme

The Tanzanian side understands the Japan's Grant Aid scheme explained by the Team, as described in Annex-4.

### 6. Environmental and Social Considerations

The Team explained the outline of JICA Environmental and Social Considerations Guideline (hereinafter referred to as "the JICA Guideline") to the Tanzanian side. The



2  




Tanzanian side took the JICA Guideline into consideration, and shall complete the necessary procedures.

#### 7. Schedule of the Study

- (1) The consultants will continue with the studies in Tanzania until August 30, 2006.
- (2) The Study consists of two phases (Phase I and II). In Phase I, JICA will prepare a draft report which includes a basic concept of the Project and its basic design. In Phase II, JICA will prepare a draft final report which includes the engineering design on the basis of the study results of Phase I. The final report will be completed by JICA through integration of the study results of both Phase I and II.
- (3) JICA will prepare the draft report in English and dispatch a mission to Tanzania in order to present the report in December 2006.
- (4) Based on the results of discussions of the draft report, JICA will proceed with further review of the study results in Japan and complete by the middle of February 2007.
- (5) JICA will prepare the final draft report in English and dispatch a mission to Tanzania in order to present the report in March 2007.

#### 8. Other Relevant Issues

- (1) The Tanzanian side shall allocate the budget for its undertakings to be done in a timely manner, which are shown in Annex-5.
- (2) The Tanzanian side agreed that it would carry out the Environmental Impact Assessment (EIA) in accordance with the Tanzania National EIA Guidelines by the end of November, 2006.
- (3) The Tanzanian side agreed that it would formulate the Resettlement Action Plan (RAP) to mitigate the negative impacts to the Project Affected Persons (PAPs) by the end of February, 2007.
- (4) The Tanzanian side agreed that the Team would prepare an economical and efficient design, which might differ from the standards prescribed in the Tanzanian Road Design Manuals, on the conditions that the Team would show the Tanzanian side that the design is equal or better than that to be achieved using the Tanzanian Design Manuals.

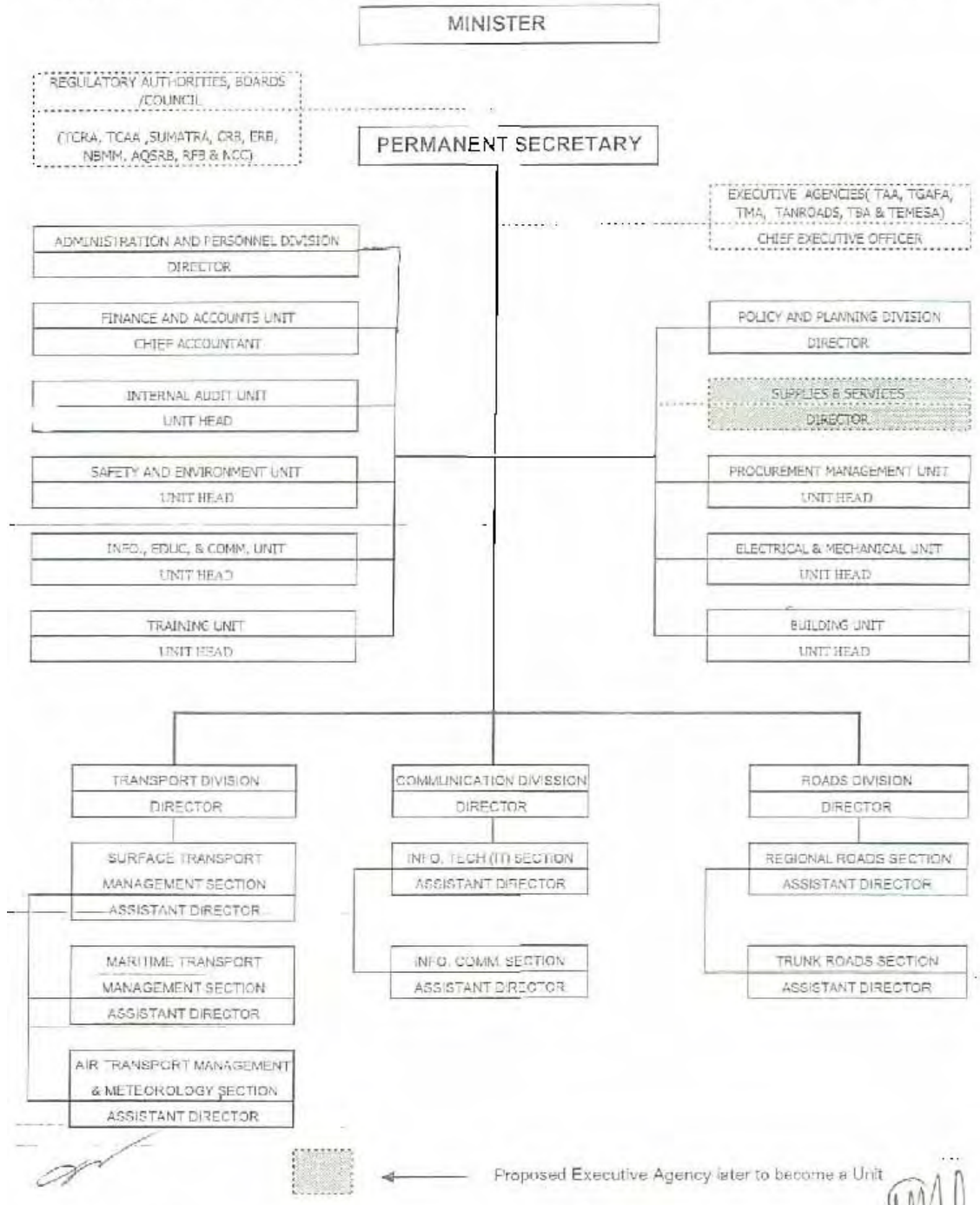






Site Map

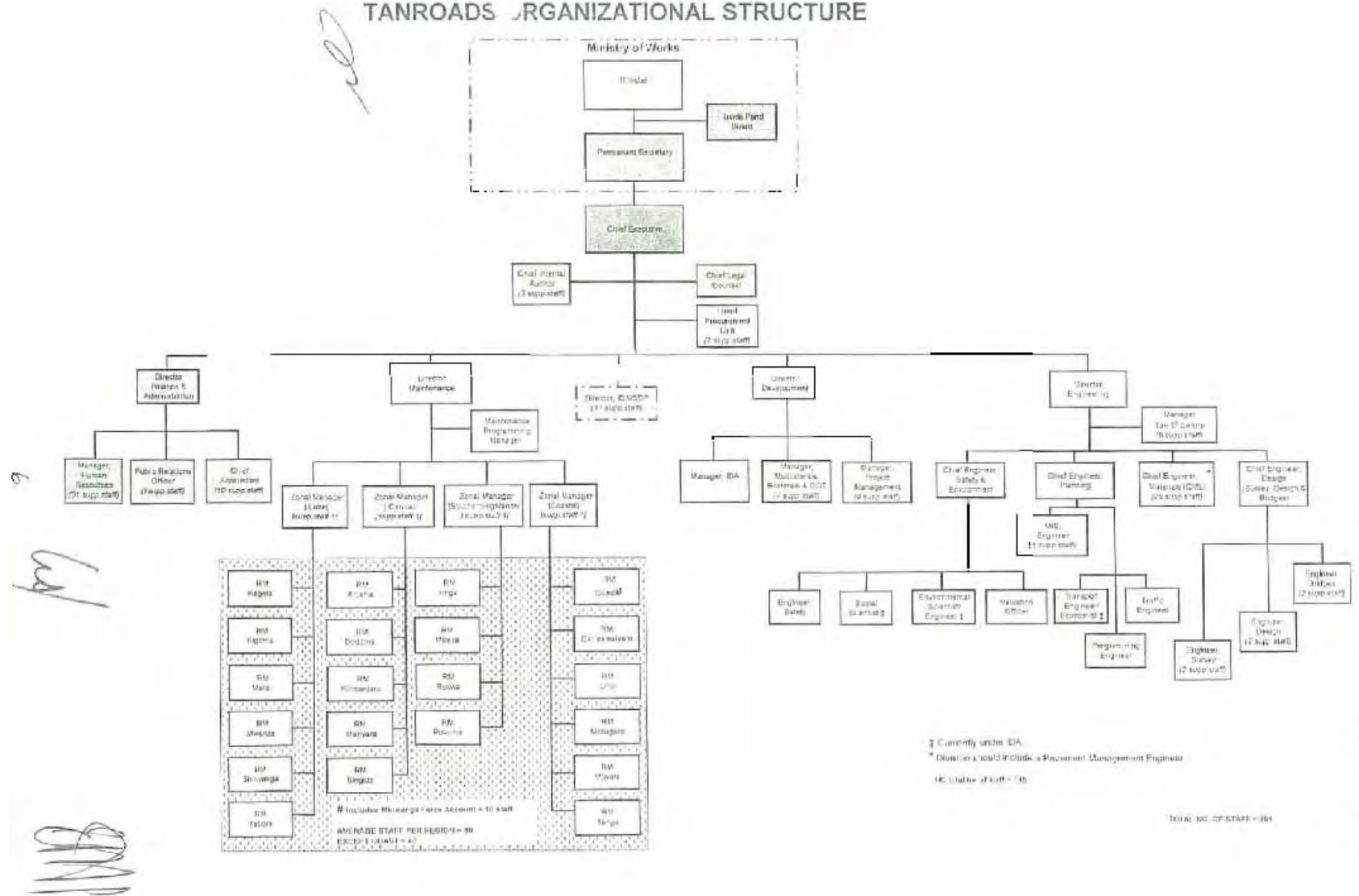
ORGANIZATIONAL STRUCTURE OF THE MINISTRY OF INFRASTRUCTURE DEVELOPMENT



5 *CSP*

*EMD*

# TANROADS ORGANIZATIONAL STRUCTURE



II - A

ANNEX-3

## JAPAN'S GRANT AID SCHEME

The Grant Aid scheme provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

### 1. Grant Aid Procedures

Japan's Grant Aid Scheme is executed through the following procedures

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using Japanese consulting firms.

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Scheme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Governments of Japan and the recipient country.

Finally, for the smooth implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

### 2. Basic Design Study

#### 1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"),

conducted by JICA on a requested project (hereinafter referred to as "the Project"), is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

1. Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
2. Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view;
3. Confirmation of items agreed upon by both parties concerning the basic concept of the Project.
4. Preparation of a basic design of the Project.
5. Estimation of cost of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even through they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

## 2) Selection of Consultants

For smooth implementation of the Study, JICA uses registered consulting firms. JICA selects firms based on proposals submitted by interested firms. The firms selected carry out a Basic Design Study and write a report, based upon terms of reference set by JICA.

The consulting firms used for the Study are recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

## 3. Japan's Grant Aid Scheme

### 1) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

2) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the project for. Within the fiscal year, all procedure such as exchanging of the Notes,



concluding contracts with consulting firms and contractors and final payment to them must be completed.

However, in case of delays in delivery, installation or construction, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

3) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However, the prime contractors, namely consulting, contracting and procurement firm(s), are limited to "Japanese nationals", (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability of Japanese taxpayers.

5) Undertakings required to the Government of the recipient country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as the following:

1. To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the Project,
2. To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,
3. To secure buildings prior to the procurement in case the installation of the equipment,
4. To ensure all the expense and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,
5. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the verified contracts,
6. To accord Japanese nationals, whose services may be required in connection with supply of the products and services under the Verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

6) "Proper Use"

The recipient country is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

7) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

8) Banking Arrangement (B/A)

- a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the verified contracts.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of recipient country or its designated authority.

9) Authorization to pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.



10 



## Major Undertaking to be taken by Each Government

NO	Items	To be covered by Grant Aid	To be covered by Recipient side
1	To secure land		•
2	To clear, level and reclaim the site when needed		•
3	To construct gates and fences in and around the site		•
4	To construct the parking lot	•	
5	To construct roads		
	1) Within the site	•	
	2) Outside the site		•
6	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	1) Electricity		
	a. The distributing line to the site		•
	b. The drop wiring and internal wiring within the site	•	
	c. The main circuit breaker and transformer	•	
7	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Advising commission of A/P		•
	2) Payment commission		•
8	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	1) Marine(Air) transportation of the products from Japan to the recipient country	•	
	2) Tax exemption and customs clearance of the products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site	•	
9	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
10	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		•
11	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		•
12	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment		•

(B/A: Banking Arrangement, A/P: Authorization to Pay)



(2) Outline explanation of the draft basic design


**Minutes of Discussions  
on the Basic Design Study on  
the Project for Upgrading Masasi – Mangaka Road  
in the United Republic of Tanzania  
(Explanation on the Draft Report)**


In August 2006, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Basic Design Study Team on the Project for Upgrading Masasi – Mangaka Road (hereinafter referred to as "the Project") to the United Republic of Tanzania (hereinafter referred to as "Tanzania") and through discussion, field survey, and technical examination of the results in Japan, JICA prepared a draft report of the study.

In order to explain and consult the Government of Tanzania on the components of the draft report, JICA sent to Tanzania a Draft Report Explanation Team (hereinafter referred to as "the Team"), headed by Mr. Toshihiro Obata, Resident Representative, JICA Tanzania Office, and is scheduled to stay in the country from December 1 to 28, 2006.

In the course of the discussions and field survey, both sides have confirmed the main items described in the attached sheets. The Team will proceed with further studies and prepare the Basic Design Study Report.

Dar es Salaam, December 7, 2006

  
Toshihiro Obata  
Leader  
Draft Report Explanation Team  
JICA

  
F. Y. Addo-Abedi (Dr.)  
Chief Executive  
Tanzania National Roads Agency  
Tanzania

Witness:

  
Ngosha Said Magonya  
Commissioner for External Finance  
Ministry of Finance  
Tanzania

  
Edwin H. T. Mujwahuzi  
Acting Director for Trunk/Roads  
Ministry of Infrastructure Development  
Tanzania

## ATTACHMENT

### 1. Components of the Draft Report

The Tanzanian side agreed and accepted in principle the components of the draft report explained by the Team, as shown in Annex 1.

### 2. Japan's Grant Aid Scheme

The Tanzanian side reconfirmed the Japan's Grant Aid scheme and the necessary measures to be taken by the Tanzanian side as explained by the Basic Design Study Team in August 2006 and described in the Annex 4 of the Minutes of Discussions signed by both sides on August 16, 2006.

### 3. Schedule of the Study

- 3-1. The Consultants will proceed with further studies in Tanzania until December 28, 2006.
- 3-2. The consultants will proceed with further examination of the study results in Japan until the middle of February 2007.
- 3-3. JICA will prepare the draft final report in English, which will include the engineering design, and dispatch a mission to Tanzania in order to present the design around the beginning of March 2007.
- 3-4. Based on the results of discussion of the draft final report, JICA will complete the final report and send it to the Government of Tanzania by the beginning of April 2007.

### 4. Other Relevant Issues

- 4-1. The Team handed one copy of the basic engineering design of the facilities to the Tanzanian side. Both sides agreed that this design is confidential and should not be duplicated or released to any third parties.
- 4-2. The Tanzanian side confirmed that the following undertakings should be taken by the Tanzanian side at its cost.
  - (1) To allocate necessary budgets for the relocation of the properties within ROW of the Project area.
  - (2) To bear the necessary expenses for the registration to the Contractors Registration Board (CRB) for Contractor(s).
  - (3) To provide a camp site for the Project.
- 4-3. The Tanzanian side confirmed that it would take all necessary actions for completing EIA procedures before arrival of the next JICA mission.
- 4-4. Based on the basic engineering design of facilities presented by the Team, the Tanzanian side confirmed that it would commence with making a Resettlement Action Plan (RAP) immediately.



**Components of the Draft Report**

1	The Project section	Road between Masasi and Mangaka, approximately 55.1km
2	Number of lanes	2 Lanes
3	Carriageway width	3.25m x 2
4	Shoulder width	1.5m x 2
5	Pavement design load	TLC3
6	Specifications of carriageway pavement	
a	Surface Course	DBST (Double Bituminous Surface Treatment)
b	Base Course	15cm
c	Subbase Course	20cm
7	Specifications of shoulder pavement	
a	Surface Course	SBST (Single Bituminous Surface Treatment)
8	Structural objects	
a	Pipe Culvert	60 places
b	Box Culvert	11 places
c	Bridge	3 places (Length of each bridge is 30m)
9	Total length of ditch	19,300m
10	Pavement Marking	center and both sides of the road, approximately 55.1km
11	Guard rails and guard posts	around the major structures (see 8b and 8c)
12	Kilometer post	each 5 km alternatingly
13	Bus stop	14 places (18m x 4m+approach section)

(3) Outline explanation of the study outputs

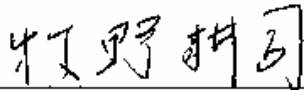
**Minutes of Discussions  
on the Basic Design Study on  
the Project for Upgrading Masasi – Mangaka Road  
in the United Republic of Tanzania  
(Explanation on the Draft Final Report)**

In December 2006, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Draft Explanation Team on the Project for Upgrading Masasi – Mangaka Road (hereinafter referred to as "the Project") to the United Republic of Tanzania (hereinafter referred to as "Tanzania") and through series of discussions, field survey, and technical examination of the results in Japan, JICA prepared a draft of the final report of the study.

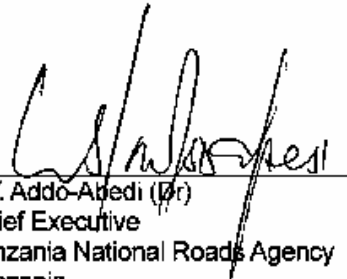
In order to explain and consult the Government of Tanzania on the components of the draft report, JICA sent to Tanzania the Draft Final Report Explanation Team (hereinafter referred to as "the Team"), headed by Mr. Koji Makino, Deputy Resident Representative, JICA Tanzania Office.

As a result of discussions, both sides have confirmed the main items described in the attached sheets.

Dar es Salaam, March 15, 2007

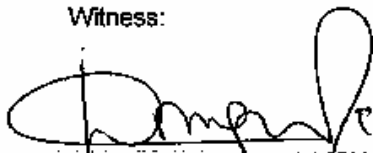


Koji Makino  
Leader  
Draft Report Explanation Team  
JICA

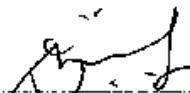


F.Y. Addo-Abedi (Dr)  
Chief Executive  
Tanzania National Roads Agency  
Tanzania

Witness:



Ngosha Said Magonya  
Commissioner for External Finance  
Ministry of Finance  
Tanzania



Leopold J. K. M. Mujungi  
Director for Trunk Roads  
Ministry of Infrastructure Development  
Tanzania

## ATTACHMENT

### 1. Components of the Draft Report

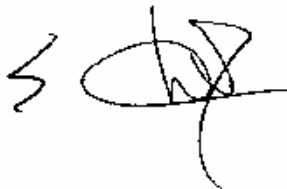
The Tanzanian side agreed and accepted in principle the components of the Draft Final Report explained by the Team (See Annex 1).

### 2. Schedule of the Study

JICA will complete the Final Report in accordance with the confirmed items and send it to the Tanzanian side around April 2007.

### 3. Other Relevant Issues

- 3-1. The Tanzanian side confirmed that the following undertakings should be taken by the Tanzanian side at its cost.
- (1) To accelerate all the necessary procedures for the Project such as the custom clearance, tax exemption, and etc.
  - (2) To secure camp site for the Project , borrow pit, disposal area, quarry site, etc. for the construction.
  - (3) To relocate the infrastructure(public utility such as telephone line, water pipe, electric distribution line) along the Masasi - Mangaka Road
  - (4) To relocate the houses within ROW of Masasi – Mangaka Road
  - (5) To carry out necessary maintenance for the Masasi – Mangaka Road after the completion of the construction
- 3-2. The Tanzanian side confirmed that the registration fees for both Engineers Registration Board(ERB) and Contractors Registration Board(CRB) shall be covered by Tanzanian Government.
- 3-3. Both sides confirmed that the EIA procedures are on the way of final approval (see Annex 2) and that the Tanzanian side shall complete the EIA procedures by the end of March 2007 and submit the copy of the certificate to JICA Tanzania Office by the end of March 2007.
- 3-4. The Tanzanian side shall complete a Resettlement Action Plan (RAP), if applicable, as soon as possible, at least by the middle of September 2007.



### Components of the Draft Final Report

1	The Project section	Road between Masasi and Mangaka, 55.1km
2	Number of lanes	2 Lanes
3	Carriageway width	3.25m x 2
4	Shoulder width	1.5m x 2
5	Pavement design load	TLC3
6	Specifications of carriageway pavement	
a	Surface Course	DBST (Double Bituminous Surface Treatment)
b	Base Course	15cm
c	Subbase Course	20cm
7	Specifications of shoulder pavement	
a	Surface Course	SBST (Single Bituminous Surface Treatment)
8	Structural objects	
a	Pipe Culvert	60 places
b	Box Culvert	11 places
c	Bridge	3 places (Length of each bridge is 30m)
9	Total length of ditch	19,300m
10	Pavement Marking	center and both sides of the road, 55.1 km
11	Guard rails and guard posts	around the major structures (see 8b and 8c)
12	Kilometer post	each 5 km alternatingly
13	Bus stop	14 places (18m x 4m+approach section)



# NATIONAL ENVIRONMENT MANAGEMENT COUNCIL (NEMC)

BARAZA LA TAIFA LA HEDHI NA USIMAMIZI WA MAZINGIRA

Tel. No. Direct line: 255 (022) 2134603  
Tel: 255 (022) 2127817  
Mobile: 0741 - 608930  
Fax: 255 (022) 2111570  
E-mail address: nems@nemc2.org

<b>TANROADS</b>	
TANZANIA NATIONAL ROADS AGENCY	
RECEIVED BY:	
RECEIVED ON:	25 JAN 2007
REGISTRATION NO:	
ENCLOSURES:	
ORIGINAL TO/COPIES ACTION BY:	
COPY TO:	

Tenzel House (3rd floor),  
Sokolne Drive,  
P.O. Box 83154,  
DAR ES SALAAM,  
TANZANIA.

In reply please quote:

Ref: NEMC/329/1/Vol III/34

Date: 23.01.2007

Chief Executive,  
TANROADS,  
P.O. Box 11364,  
Dar-es-Salaam.

## RE: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED MTWARA - MBAMBABAY ROAD.

Kindly refer to the above captioned heading.

We acknowledge receipt of your letter with reference TRD/D/GEN/P.63/15 dated December 29, 2006 which requested the National Environment Management Council (NEMC) to provide the current status of the Environmental Impact Assessment (EIA) of the above mentioned project.

The Technical Review Committee (TRC) discussed the EIA report on the proposed Mtwara - Mbamba Bay road on 19<sup>th</sup> December, 2003. The TAC comments were sent to NDC vide our letter referenced NEMC/329/1/Vol III of January 24, 2004. NDC was required to submit to NEMC 15 copies of the final/revised EIA report, 3 copies of the Feasibility Study, 5 copies of the contractors Environmental Management Plan and 2 copies of the Detailed Design.

Unfortunately, there has been a long period of silence between NDC and us on this project. In addition, we have realized that there has also been miscommunication between us on this subject. We have now sorted out this matter with officers from your office and agreed that:

1. Now that we have received a copy of the EIS from TANROADS, we will expedite completion of the review process and initiate an approval process.

All correspondence should be addressed to the Director - General

2. Once approved, the EIA for the entire road (Mtwara - Mbamba bay) will be used for the Masasi - Mangaka road section.
3. Review of the EIA indicated that there are no adverse environmental and social impacts that are associated with the above proposed project that can not be mitigated. Thus, as the approval process may take time, NEMC has no objection on the processing of the Japanese grant for upgrading of the Masasi - Mangaka road section.

We look forward to your cooperation in concluding this matter.

Yours sincerely



Eng. B.T. Baya  
**ACTING DIRECTOR GENERAL**

CC Permanent Secretary,  
Vice President's Office  
P.O. Box 5380,  
Dar-es-Salaam.

Permanent Secretary,  
Ministry of Infrastructure,  
P.O. Box 9423,  
Dar-es-Salaam.





**5. Project Preliminary Plan (Basic Design)**

1. Project Name
Project for Upgrading Masasi-Mangaka Road in the United Republic of Tanzania
2. Background of the Request (need and status if the cooperation)
<p>Concerning road development plans in Tanzania, in the Poverty Reduction Strategy Paper (formulated in October 2000), which is regarded as the national development plan for the country, high priority is given to improvement of access to cities and rural villages, repair of trunk and local roads, and maintenance of already repaired trunk and local roads, in order to improve the level of services available for transporting goods and people.</p> <p>Regarding road development, the 10-Year Road Sector Development Plan (2001~2011) was compiled in 2001. This aims to promote development and maintenance of national trunk roads and provincial roads divided according to nine road corridors, and it aims to link all provinces by trunk roads and provincial roads. Through doing this it is anticipated that stable supply of agricultural products to consumer centers will be secured and the economic growth of rural areas will be promoted. The Project road between Masasi and Mangaka is regarded as an important trunk road forming part of the southern development corridor (Mtwara Corridor), which traverses the southern part of the country, and it is anticipated that the Project road will also function as an international route of physical distribution.</p> <p>The Project target area in the south of Tanzania has historically been an underdeveloped area, however, it is blessed with agricultural production resources, mineral resources and tourism resources and has a lot of potential for economic development. Concerning the main industry, agriculture accounts for 70~75% of local production, and many households are engaged in farming. The major crop is cashew nuts, with this area accounting for 50% of national production and having a reputation for good quality; however, due to the inadequate development of the access road network, half of the cashew crop cannot be shipped, so development of the road network is urgently required.</p> <p>The dirt road over the Project route, which forms part of an important access road network in the area, is only 3~5 m width, which is too narrow to allow safe two-way traffic. Moreover, it suffers from impassability caused by rain erosion, while rutting of the road surface leads to contact between vehicles and falls by pedestrians and bicycles. Against such a background, the Project has the objective of securing the safe and smooth flow of traffic along the target route through rehabilitating the section between Masasi and Mangaka.</p>
3. Outline of the Overall Project Plan
*Underlined parts: outputs, activities and inputs directly related to the grant aid
<p>(1) Goal of the overall Project plan (scope and scale of the benefits)</p> <p>To secure smooth and safe traffic on National Highway 6 over the section between Masasi</p>

and Mangaka.

Benefiting population: residents of Mtwara Province – approximately 1,130,000

(2) Outputs of the overall Project plan

The target road will be improved.

(3) Main activities of the Project overall plan

Conduct road improvements on 55.1 km of road over 3 years between 2007~2010

(4) Inputs

1) Japanese side (the Project): Grant Aid worth 2.409 billion yen

2) Tanzanian side

Cost of relocating obstacles in line with road construction

Cost of relocating houses in the ROW in line with road construction

Cost of land acquisition in line with realignment, and cost of and borrowing land for securing a temporary construction yard

Maintenance cost following road construction

Construction operator registration cost in line with the Project

(5) Implementation setup

Supervisory agency: Ministry of Infrastructure Development (MoID)

Implementing agency: Tanzania National Roads Agency (TANROADS)

#### 4. Contents of the Grant Aid Project

(1) Site

Between Masasi and Mangaka section (55.1 km), on the National Route 6,

(2) Outline

Target road length 55.1 km, traversal drainage pipes; 60 points, box culverts: 11 points, bridge replacement: 3 points and construction of incidental facilities

(3) Items to be borne by the Tanzania

1) Securing of construction site land

2) Relocation of houses in the ROW

3) Relocation of obstacles

4) Necessary procedures for construction

(4) Estimated Project cost

Estimated Project cost 2.45 billion yen (grant aid 2.409 billion yen, local side burden 41 million yen)

(5) Works period

41 months including the tender period (schedule)

<p>(6) Consideration to poverty, gender, environment and society  Monitor conditions regarding the relocation of houses in line with the road construction by the local side.</p>
<p>5. External Factor Risks (items regarding achievement of the Project overall plan goals)</p>
<p>(1) Natural disasters exceeding expectations, such as flooding and earthquakes, will not occur.</p>
<p>6. Utilization of Lessons Learned from Similar Projects in the Past</p>
<p>None in particular</p>
<p>7. Proposals Concerning Post Evaluation of the Project Overall Plan</p>
<p>(1) Indicators expressing achievement of the Project overall plan goals  Shortening of travel times over the target section  Reduction in the number of days of traffic stoppages caused by flooding or water damage</p> <p>(2) Other output indicators  None in particular</p> <p>(3) Evaluation timing  2012 onwards (1 year after completion of the facilities)</p>

## 6. List of Reference Materials/Acquired Materials

Table A-8 List of Collected Materials

No.	Description	Type	Original / Copy	Issued by	Year
1	Drive record January 2006 Dar es Salaam - Mtwara	Report	Copy	JICA Tanzania Office	2006
2	Detailed engineering design of bridges on package 2 and TAN-ZAM highway volume 4: Drawings (STA 036+140 section Masasi-Lindi Border Bridge MTW-2-10040, MWENA Bridge)	Data	Copy	MOW	1993
3	ACT SUPPLEMENT, Employment and labour relations act, Labour Institutions 2004. The united republic of Tanzania	Document	Original	GOT	2004
4	Tariff book of harbor dues and charges Tanzania Harbor Authority	Document	Original	Tanzania Port Authority	1999
5	Tanzania Traveler s Map. 1 :200mill.	Map	Original	MACMILLAN EDUCATION	1999
6	Road Map of East Africa. 1:200mill.	Map	Original	Text book centre Ltd.	1998
7	Tanzania Budget Review 2006, "Commentary" "Tax changes" "The Economy", by PRCEWATER HOUSE COOPRETS	Document	Original	PRCEWATER HOUSE COOPRETS	2006
8	Contract agreement for upgrading of TARAKEA-KAMWANGA Road. Priced BOQ/ Tanroads and China Sichuan International co-operation Co. Ltd	Data	Copy	TANROADS	2004
9	Works Contract Dossier for Project No.8.: NZEGA-ISAKA(VIA TINDE)ROAD UPGRADIND PROJECT, Priced BOQ/Tanroads and Grinaker-LTA Ltd JET park road, jet Park (South Africa)	Data	Copy	TANROADS	2003
10	Contract for KAGOMA-LUSAHUNGA ROAD UPGRADIND PROJECT between The Tanzania national roads and China state construction engineering corporation. Priced BOQ	Data	Copy	TANROADS	2006
11	MWANZA/SHINYANGA BORDER-TINDE ROAD UPGRADIND PROJECT Administrative order No.1. Bill of Quantities including new rates. by Louis Berger SAS	Data	Copy	TANROADS	2005
12	" Contractor ", Newsletter of the Contractors Registration Board(CRB), Tanzania, April-June 2006	Document	Original	CRB	2006
13	"CONSTRUCTION business" Vol.8 No.5 Feb 2006 - TANZANIA TRUNK ROAD NETWORK by National Construction Council (NCC)	Document	Original	NCC	2006
14	"CONSTRUCTION business" Vol.8 No.6 April/May 2006 -Water & Culture, -Timber Supply Tanzania, -News briefs etc. by National Construction Council (NCC)	Document	Original	NCC	2006
15	The project for Improvement of bridges on trunk road PHASE II FINAL REPORT 1.Bridge No.1 Mikindani, 2.Bridge No.2 Mbuo, 3.Bridge No.4 Mkwaya. by Oriental Consultants and CPC JV	Data	Copy	Oriental · CPC/JV	1999

## **7. Other Materials/Information**

7-1 Technical Memorandum with TANROADS

7-2 Results of the Survey of Natural Conditions (Soil Condition)

7-3 Results of the Survey of natural Conditions (Geology)

7-4 Basic Design Drawings

7-1 Technical Memorandum with TANROADS

## TANROADS

TANZANIA NATIONAL ROADS AGENCY

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25 August 2006

Ref. No: TRD/D/GEN/P, 63/9

M/s Construction Project Consultants, Inc. Japan (CPC)  
YSK Bldg., 3-23-1 Takadanobaba, Shinjuku-ku  
Tokyo 169-0075  
Japan

Fax: +81-3-5337-4092 (Attention: Mr. Hideaki Morita)

**RE: MASASI – MANGAKA ROAD PROJECT**

**Sub: Confirmation of the Technical Note**

Reference is made to your letter dated 17<sup>th</sup> August 2006 with which you submitted a Technical Note that indicates the key design values to be used for the Basic Design of the above project.

We have reviewed the Technical Note and confirm that the values conform to the standards which are currently in use. You are therefore allowed to use the values for the design of the project road.



B. H. P. Nyiti  
for: CHIEF EXECUTIVE

17-Aug-2006

## Memorandum

**Subject: Technical note of Design Value to be used for the Basic Design Study on the Project**

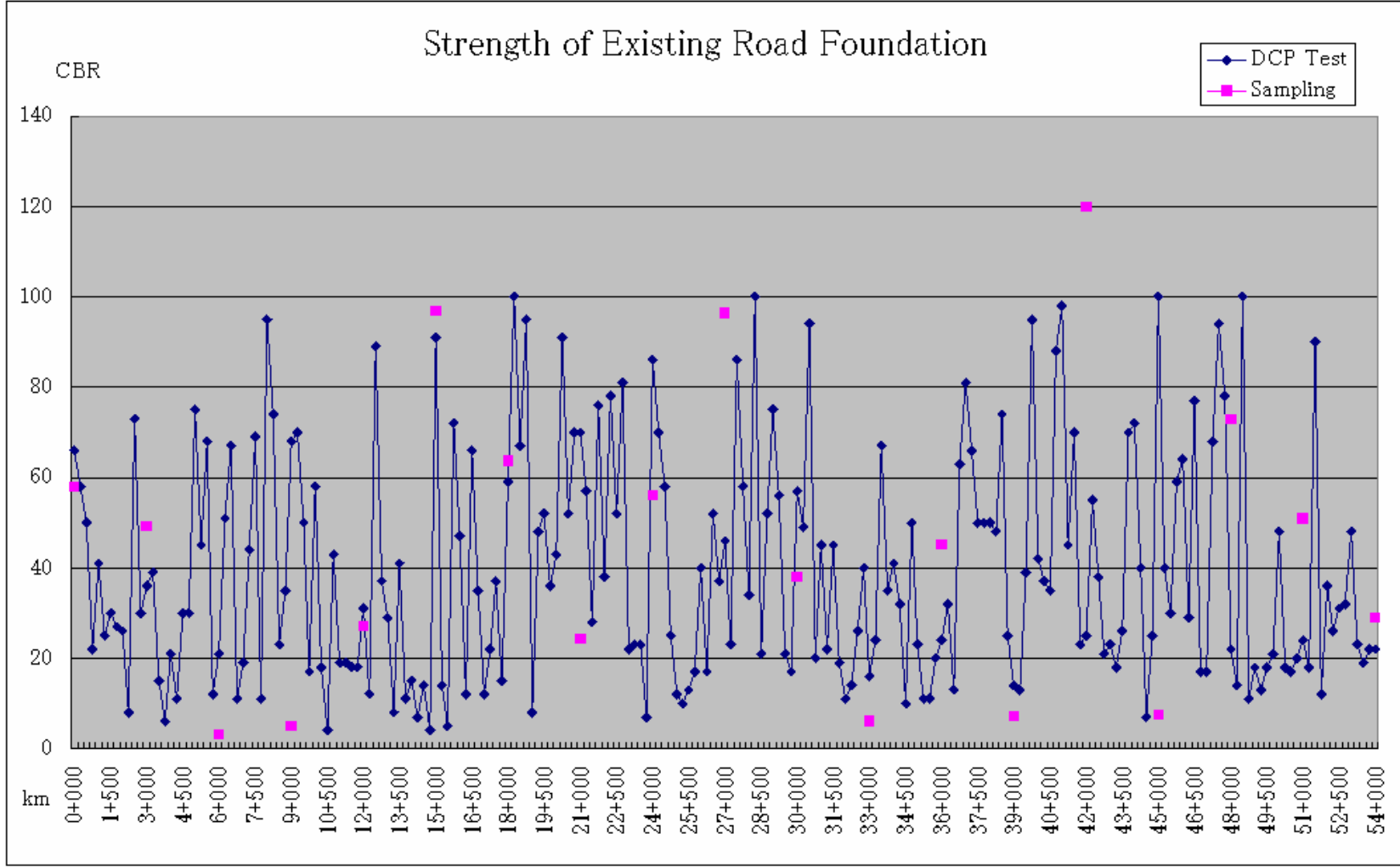
The JICA Study Team will propose the following principal standard for the design of captioned project.

Description		Units	Value		
			Flat Section	Rolling	Mountainous
Design Speed		Km/hr	100 (80)	80 (65)	60 (40)
No. of Lanes		No.	2		
Right of Way Width		m	45		
Carrageway Width		m	6.5		
Shoulder width		m	1.5		
Cross Fall on Carrageway		%	2.5		
Cross Fall on Shoulder		%	4.0		
Minimum Radius of Horizontal Curve		m	380	230	125
Maximum Gradient		%	3 (8)	5 (10)	8 (10)
Maximum Superelevation		%	8	8	8
Minimum Sight Distance		m	205 (157)	140 (113)	85 (74)
Fill Slope	Granular soil	Angle	1:1.5~2.0 (depend on soil type)		
Cut Slope	Hard Rock	Angle	1:0.5		
	Decomposed Rock	Angle	1:0.75		
	Other than Rock	Angle	1:1.0~1.5 (depend on soil type)		
Pavement Design Load		-	TLC-3		
Structure Live Load		-	Class B Load of Japan Road Association (This is more than HA, HB load on the British Standard which applied as Tanzania Standard)		
Seismic		Kh	0		

Note : ( ) = Minimum value

H. MORITA

Chief Consultant of JICA Study Team





7-3 Results of the Survey of natural Conditions (Geology)

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GEOTECHNICAL ENGINEERING DEPARTMENT															
DRILLING LOG							Sheet 1 of 2								
Drill and Casing Type	Size	Metres	Project: GEOTECHNICAL INVESTIGATION ON BRIDGES ALONG MASASI - MANGAKA ROAD												
DRILLING BUCKET	138mm	8.80	Location: MSANGUSANGU BRIDGE 32.4KM 'On river bed'												
STEEL CASING	150mm	5.80	Borehole No.: BH 03				Elevation: 273.568m								
Coordinates	453968.055 E 8797507.781 N		Depth to water Table: Nil				Date: 12-08-2006								
			Driller: S. Karju				Logged by: B. Mwerera								
MATERIAL DESCRIPTION	Reduced level (m)	Legend	Depth (m)	Stratum Thickness (m)	SAMPLE			PENETRATION				SPT N - Value	Undrained $C_u$ (kN/m <sup>2</sup> )	shear strength $\phi$ (Deg)	
					Depth (m)	Type	No.	15	7.5	7.5	7.5				7.5
Top soil, loose, brown, dry, medium to coarse SAND				0.50	0.00 - 0.50	○	B1								
Loose, dark grey, moist, fine sandy SILT	272.6		1.00	2.00	1.50 - 1.95	●	S1	4	2	3	2	2	9		
Dark grey, granite boulder thickness 0.2m with sand	271.4		2.00	0.30	2.30 - 2.60	○	B2								
Firm/dense, yellowish grey, moist, medium to coarse sandy CLAY/clayey SAND	270.6		3.00	1.30	3.00 - 3.45	●	S2	12	8	12	12	12	44		
Very dense, greenish grey, moist, fine laterite sandy SILT, boulder encountered, high number of blows	269.6		4.00	1.60	4.30 - 4.95	●	S3	20	50/7cm				>50		
Rock encountered	268.6		5.00	3.00											
	267.6		6.00												
	266.6		7.00												
	265.6		8.00												
	264.6		9.00												
	263.6		10.00												
WATER LEVEL OBSERVATION															
Date	Time	WL (m)	Casing	BET											
				APPROXIMATE STRATUM CHANGE						WATER TABLE					
				● DISTURBED SAMPLE						N NO. OF BLOWS FOR 300mm PENETRATION					
				■ U4 SAMPLE											
				○ BULK SAMPLE											
				w WATER SAMPLE											

DRILLING LOG

Boring method: Rotary core drilling	Location: MSANGUSANGU 32.9Km	Project: GEOTECHNICAL INVESTIGATION ON BRIDGES ALONG MASAKI MANGAKA ROAD
Boring diameter: 76 mm	Orientation: VERTICAL	Ground level: Nil
Casing diameter: 86mm (to m); mm (to m) (Outer diameter)	Boring equipment: Danda 3000 Rotary rig core barrel: diamond bits;	Driller: S. Kanyo Date: 22/08/2006

Samples and in situ test		Core run	Recovered (m)	TCR %	RQD %	Fracture Index	Description of strata	Reduced level, m	Legend
Depth, m	Type								
5.60	Core	1.50	1.08	72%	67%	10	Greyish, fine grained, fractured, fresh Kyanite Schist rock.	267.968	
4.60		1.50	1.26	84%	77%	4		266.968	
3.60	Core	1.50	1.26	84%	77%	4	Greyish, fine grained, fractured, fresh Kyanite Schist rock.	265.968	
2.60		1.50	1.26	84%	77%	4		264.968	
1.60	END								
0.60									

Remarks: at least 90% water recovery greyish in colour

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**GEOTECHNICAL ENGINEERING DEPARTMENT**

**DRILLING LOG**

Sheet 1 of 2

<b>Drill and Casing Type</b>	Size	Metres	<b>Project:</b> GEOTECHNICAL INVESTIGATION ON BRIDGES ALONG MASASI - MANGAKA ROAD
DRILLING BUCKET	138mm	8.50	<b>Location:</b> MBANGALA BRIDGE 36.2Km 'On river bed'
STEEL CASING	150mm	7.50	<b>Borehole No.:</b> BH 02
<b>Coordinates</b>	450922.571 E 8795764.075 N		<b>Elevation:</b> 247.939m <b>Date:</b> 12 - 08 - 2006 <b>Logged by:</b> B. Mwerero
			<b>Depth to water table:</b> 2.15m
			<b>Driller:</b> S. Kanju

MATERIAL DESCRIPTION	Reduced level (m)	Legend	Depth (m)	Stratum thickness (m)	SAMPLE			PENETRATION					SPT N - Value	Undrained $C_u$ (kN/m <sup>2</sup> )	Shear strength $\phi$ (Deg)
					Depth (m)	Type	No.	15	7.5	7.5	7.5	7.5			
Top soil, dark grey, dry, silty CLAY	245.9		1.00	1.20	0.00 - 0.50	○	B1								
Loose to very loose, greyish brown, moist, medium to coarse silty SAND with occasional lumps of clay and gravel	245.9		2.00	2.80	1.20 - 1.50	○	B2								
			↓		1.50 - 1.95	●	S1	3	1	2	2	7			
	244.9		3.00		2.50 - 3.00	○	B3								
			↓		3.00 - 3.45	●	S2	2			1	1	2		
Very stiff/ very dense, brownish grey, moist, medium to coarse sandy CLAY in matrix of laterite sand	243.9		4.00	0.70	4.50 - 4.95	■	U1								
	242.8		5.00		4.65 - 4.70	○	B4								
Very dense, reddish brown, moist, medium to coarse laterite silty gravelly SAND			↓	2.80	4.70 - 5.15	●	S3	50/11.5cm				>50			
	241.9		6.00		6.00 - 6.45	■	S4	50/8cm				>50			
	240.8		7.00		7.50 - 7.95	●	S5	50/1cm				>50	No recovery		
Rock encountered	239.9		8.00	1.00											
	238.9		9.00												
	237.9		10.00												

**WATER LEVEL OBSERVATION**

Date	Time	WL (m)	Casing
13/8/2006	07:50am	2.15	7.50m
14/8/2006	07:30am	1.93	7.50m
18/8/2006	08:00am	2.43	7.50m

- APPROXIMATE STRATUM CHANGE  
 ● DISTURBED SAMPLE  
 ■ U4 SAMPLE  
 ○ BULK SAMPLE  
 W WATER SAMPLE

- ↓ WATER TABLE  
 N NO. OF BLOWS FOR 300mm PENETRATION

DRILLING LOG

Boring method: Rotary core drilling	Location: MBANGALA 46.25m	Project: GEOTECHNICAL INVESTIGATION ON BRIDGES ALONG MASASI-MANGAKA ROAD
Boring diameter: 76 mm	Orientation: VERTICAL	Ground level: N3
Casing diameter: 86mm (to m); mm (to m) (Outer diameter)	Driller: S. Kapi	Date: 13/08/2006
Boring equipment: Dando 3000 Rotary rig. core barrel, diamond bits		

Samples and in situ test		Core no	Recovered (m)	FCR %	RQD %	Fracture Index	Description of strata	Recharge level, m	Legend
Depth, m	Type								
7.50	Core	1.00	0.85	85%	60%	10	Greyish, fine grained, fractured, fresh Kyanite-Schist rock	140.439	
8.50							END	139.459	
9.50									
10.50									
11.20									

Remarks: at least 90% water recovery greyish in colour



**INTER - CONSULT LTD.**  
**GEOTECHNICAL ENGINEERING DEPARTMENT**

**DRILLING LOG**

Sheet 1 of 2

<b>Drill and Casing Type</b>	Size	Metres	<b>Project:</b> GEOTECHNICAL INVESTIGATION ON BRIDGES ALONG MASASI - MANGAKA ROAD		
DRILLING BUCKET	138mm	15.00	<b>Location:</b> MASTALELE BRIDGE 36.9km <sup>3</sup> On river bed		
STEEL CASING	150mm	4.50	<b>Borehole No.:</b> BH.01	<b>Elevation:</b> 249.747m	
<b>Coordinates</b>	450354.327 E 8795692.040 N		<b>Depth to water table:</b> 0.20m		<b>Date:</b> 08 - 08 - 2006
			<b>Driller:</b> S. Kamu	<b>Logged by:</b> B. Mwerero	

MATERIAL DESCRIPTION	Reduced level (m)	Legenda	Depth (m)	Stratum thickness (m)	SAMPLE			PENETRATION					SPT N - Value	Undrained C <sub>u</sub> (kN/m <sup>2</sup> )	shear strength Ø (Deg)	
					Depth (m)	Type	No.	15	7.5	7.5	7.5	7.5				
Top soil, Loose, brown, coarse SAND. Water found at 0.20m	248.7		1.00	1.00	0.00 - 1.00	○	B1									
Firm, yellowish grey, moist, medium sandy CLAY	247.7		2.00	1.25	1.00 - 1.50	○	B2									
					1.50 - 1.95	■	U1							47		
Medium dense, brown, moist, fine silty SAND	246.7		3.00	0.20	1.95 - 2.40	●	S1	4	2	4	5	5	16			
					3.00 - 3.45	●	S2	3	2	3	5	9	15			
Firm/ medium dense, grey mottled reddish, moist, sandy CLAY With occasional layers of clayey SAND and gravel.	245.7		6.00	8.00	4.50 - 4.95	■	U2						64			
	244.7				4.95 - 5.40	●	S3	5	6	7	10	10	33			
	243.7				6.00 - 6.45	●	S4	8	5	5	4	5	19			
	242.7				7.00 - 7.50	○	B3									
	241.7				7.50 - 7.95	■	S5	5	4	3	4	5	16			
	240.7				9.00 - 9.45	■	U3							52		
239.7	10.00				9.45 - 9.90	●	S6	6	4	4	5	5	18			

WATER LEVEL OBSERVATION			
Date	Time	WL (m)	Casing
08/08/2006	07:40am	2.28	4.50m
10/08/2006	07:40am	0.31	4.50m

<b>KEY</b>	- - - - - APPROXIMATE STRATUM CHANGE ■ DISTURBED SAMPLE ■ U1 SAMPLE ○ BULK SAMPLE W WATER SAMPLE	↓ WATER TABLE  N NO. OF BLOWS FOR 300mm PENETRATION
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GEOTECHNICAL ENGINEERING DEPARTMENT

**DRILLING LOG**

Sheet 2 of 2

<b>Drill and Casing Type</b>	Size	Metres	<b>Project:</b> GEOTECHNICAL INVESTIGATION ON BRIDGES ALONG MASASI - MANGAKA ROAD	
DRILLING BUCKET	138mm	15.00	<b>Location:</b> MASDALELE BRIDGE 36.9Km On river bed	
STEEL CASING	150mm	4.50	<b>Borehole No.1:</b> BH 01	<b>Elevation:</b> 249.747m
<b>Coordinates</b>	450354.327 E 8795692.040 N		<b>Depth to water table:</b> 0.20m	<b>Date:</b> 06-08-2006
			<b>Driller:</b> S. Kanju	<b>Logged by:</b> B. Mwerero

MATERIAL DESCRIPTION	Reduced level(m)	Legeno	Depth (m)	Stratum thickness(m)	SAMPLE			PENETRATION					SPT N - Value	Undrained $C_u$ (kN/m <sup>2</sup> )	shear strength $\phi$ (Deg)	
					Depth (m)	Type	No.	15	7.5	7.5	7.5	7.5				
								15	7.5	7.5	7.5	7.5				
Medium to very dense, yellowish brown, moist, fine to medium silty SAND with occasional pebbles. At 15m laterite silty SAND with occasional laterite gravel and pebble.	238.7		11.00		10.50 - 10.95	●	57	5	3	4	5	5	17			
	237.7		12.00	5.00	12.00 - 12.45	●	58	7	5	4	4	3	18			
	236.7		13.00		13.50 - 13.95	●	59	10	6	7	8	9	30			
	235.7		14.00													
	234.7		15.00		15.00 - 15.45	●	510	60/7cm					150			
								End drilling								
			16.00													
			17.00													
			18.00													
			19.00													
			20.00													

WATER LEVEL OBSERVATION			
Date	Time	WL (m)	Casing
03/08/2006	07:40am	2.78	4.50m
10/08/2006	07:40am	0.81	4.50m

**KEY:**

- APPROXIMATE STRATUM CHANGE
- DISTURBED SAMPLE
- UN SAMPLE
- ◇ BULK SAMPLE
- W WATER SAMPLE
- ⬇ WATER TABLE
- N NO. OF BLOWS FOR 300mm PENETRATION