

**NATIONAL ROAD ADMINISTRATION
REPUBLIC OF MOZAMBIQUE**

**THE PREPARATORY STUDY
ON
ROAD IMPROVEMENT PLAN
IN NACALA DEVELOPMENT CORRIDOR
(N13: CUAMBA-MANDIMBA-LICHINGA)
IN
THE REPUBLIC OF MOZAMBIQUE**

**FINAL REPORT
2 of 3
MAIN TEXT**

Volume 1

**Part I Overall Approach & Work Procedure
Part II General Appreciations**

February 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

**Eight - Japan Engineering Consultants Inc.
Oriental Consultants Co., Ltd.**

The following foreign exchange rate is applied in the study

1 US dollar = 28.00Mtn = 91.36 JP Yen, or 1 MTn = 3.26 JP Yen (October 2009)

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PREFACE

In response to the request from the Government of the Republic of Mozambique, the Government of Japan decided to conduct the Preparatory Survey on Road Improvement Plan in Nacala Development Corridor (N13: Cuamba-Mandimba-Lichinga) and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA dispatched a Study Team headed by Mr. Hisashi MUTO of Eight-Japan Engineering Consultants Inc. and consist of Eight-Japan Engineering Consultants Inc. and Oriental Consultants Co., Ltd. to Mozambique, between March 2009 and December 2009.

The Study Team held discussions with the officials concerned of the Government of Mozambique and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

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

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Mozambique for their close cooperation extended to the study.

February 2010,

Kiyofumi KONISHI
Director General
Economic Infrastructure Department
Japan International Cooperation Agency

Mr. Kiyofumi KONISHI
Director General
Economic Infrastructure Department
Japan International Cooperation Agency

February 2010

Dear Sir,

LETTER OF TRANSMITTAL

We are pleased to submit to you the Final Report of the Preparatory Survey on Road Improvement Plan in Nacala Development Corridor (N13: Cuamba-Mandimba-Lichinga) in the Republic of Mozambique.

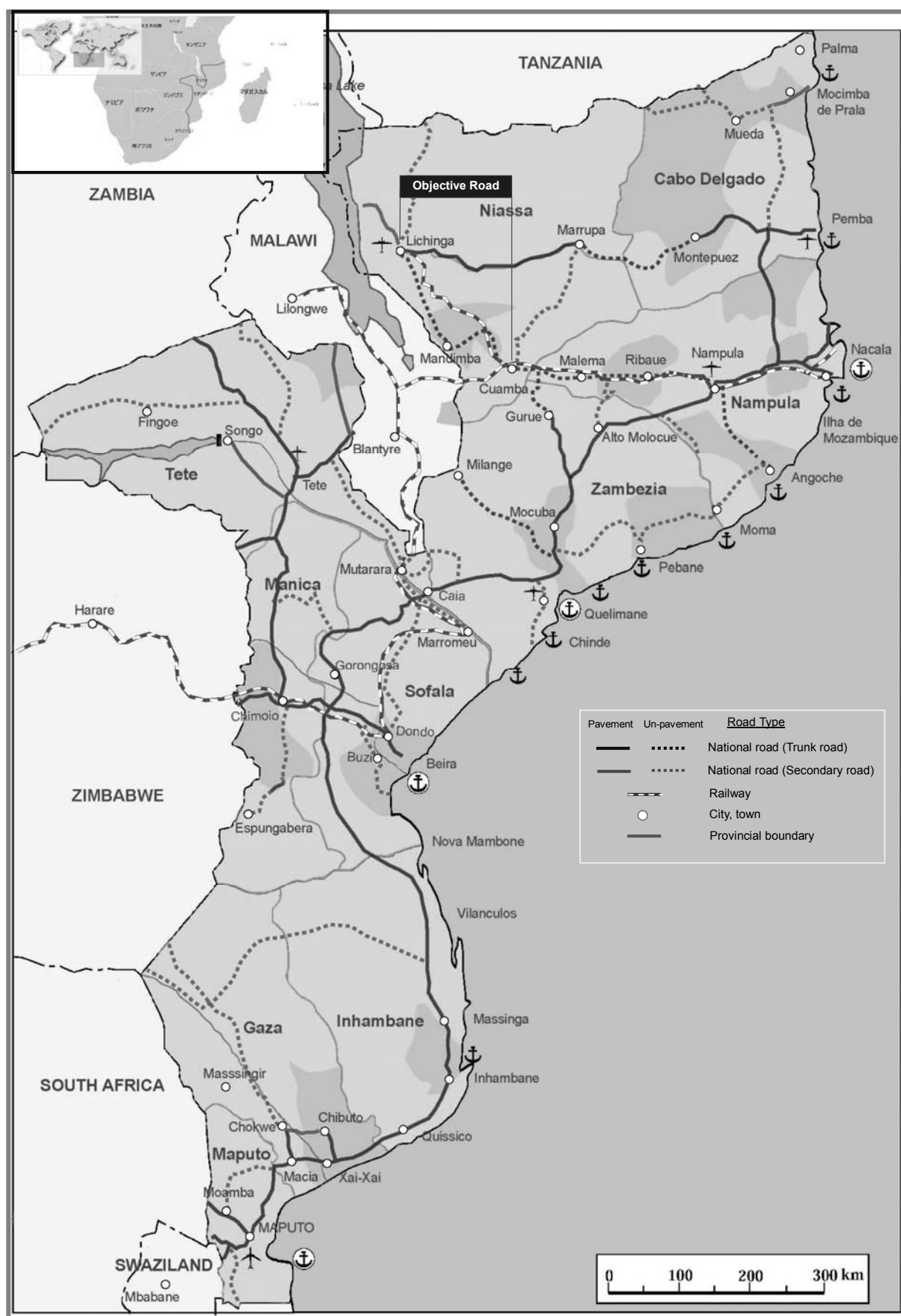
This study was conducted by Eight-Japan Engineering Consultants Inc. and Oriental Consultants Co., Ltd. under a contract to JICA, during the period from March 2009 to February 2010.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, Ministry of Foreign Affairs of Japan, National Road Administration, JICA Mozambique Office and Embassy of Japan in Mozambique for their cooperation assistance throughout the Study.

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

Very truly yours,

Hisashi MUTO
Team Leader,
The Preparatory Survey on Road Improvement Plan in Nacala
Development Corridor
The Consortium of Eight-Japan Engineering Consultants Inc.
and Oriental Consultants Co., Ltd.



Project Location Map

Project Outline

1. Country	Republic of Mozambique
2. Name of Study	The Preparatory Survey on Road Improvement Plan in Nacala Development Corridor (N13: Cuamba-Mandimba-Lichinga) in the Republic of Mozambique
3. Counterpart Agency	National Road Administration (ANE), Ministry of Public Works and Housing(MOPWH)
4. Objectives of the Study	(1) The objectives of the Study are to determine the most technically feasible and economically viable, environmentally acceptable and socially optimal option of upgrading the existing Cuamba – Lichinga road to an all-weather road for easier transit. (2) Formulation and recommendation of the “Regional Development Program” intended for Niassa Province is also the objective of the Study.

1. The Study Area

- The Study Road, with a total length of approximately 302km including the Mandimba-Malawi Border road, traverses four districts having high agricultural potential, namely Cuamba, Mandimba, Ngauma and Lichinga in Niassa Province.
- The Cuamba-Mandimba-Malawi Border road is an important component within the Nacala Development Corridor, since it connects Niassa and Nampula Provinces, and in addition it serves to link landlocked Zambia and Malawi to the Mozambican coast.

2. Scope of the Study

- (1) Economic Feasibility Study
 - 1) Economic Analysis, 2) Traffic Analysis, 3) Economic Evaluation, 4) Risk Analysis
- (2) Preliminary Engineering Design
 - 1) Site Measurement (Natural Condition Survey), 2) Visual Site Survey, 3) Preliminary Design, 4) Cost Estimate
- (3) One Stop Border Post (OSBP)
- (4) Assistance for Execution of EIA by GOM (ANE)
- (5) Regional Development Program

3. Narrative Description

Feasibility Study

The Study Road passes through many small villages. The road can be broadly divided into three terrains (0 – 148km: Flat terrain, 148 – 240km: Rolling terrain, 240 – 302km: Rolling with some mountainous terrain), and it undulates from a starting altitude of 560MASL reaching up to nearly 1,400MASL at Lichinga. The existing horizontal alignment and vertical alignment generally follow the watershed crest and the natural ground, respectively. The existing road is in fair to poor condition during the dry season and becomes impassable during the rainy season due to interaction between poor drainage and erodible soils. In addition the Study Road width varies between 5m and more than 10m and is generally lower than the surrounding ground.

As a result of the traffic demand analysis, future traffic volumes for both sections (Cuamba-Mandimba and Mandimba-Lichinga) in 2023 were estimated at about 1,481AADT and 1,732AADT, respectively. From the viewpoint of terrain, traffic safety, construction cost, social impacts, traffic management and operation, a design speed of 100km/hr was recommended for the section of Cuamba - Mandimba. Similarly, a design speed of 80km/hr was recommend for the section of Mandimba - Lichinga. And furthermore, the selection of the suitable pavement composition was evaluated based on the initial cost and its financial viability using the EIRR indicator. As a result of the analysis, a DBST surface on a granular base and cemented sub-base was selected as the most economically viable pavement composition. This composition was shown to have the lowest initial cost and the highest EIRR.

Regional Development Program

Niassa Province has the potential for various kinds of development. However, bad access conditions have hindered economic development in the province. Furthermore, huge areas, scattered population and low population density have made it difficult to deliver basic social services to the people. The Study Team formulated a regional development program so that the road improvements of Cuamba-Mandimba and Mandimba-Lichinga could generate synergistic effects on regional development. For the southern part of Niassa Province, such development measures included the support to smallholding farmers’ commercialization and agro-processing industries, and infrastructure development for improving logistic functions in the towns of Cuamba and Mandimba. For the middle to northern part of the province, high priority was given to the support of smallholding farmers’ commercialization, wood processing industries and tourism, as well as to improvement of social infrastructure and services.

4. Conclusion and Recommendations

- (1) To authorize the regional development program proposed by the Study in conjunction with the road implementation plan.
- (2) To advance the bilateral discussion for OSBP and to establish a policy relevant to the following issues:
 - Types of operational system for OSBP scheme
 - Layout and facility size
 - Implementation program such as "Two-step upgrading," proposed by the Study
- (3) To adopt the COI concept for minimization of social impacts such as resettlement.
- (4) To start the detailed design for Cuamba - Mandimba Road (154km) as soon as possible.
- (5) To execute a severe site survey (Topographic, Geological and Soil) for Mandimba - Lichinga Road.

5. Report Structure

Name of Report	Number of Volume	Main Contents of the Report		Language		
				Eng.	Por.	Jap.
1. Summary	-	-	-	✓	✓	✓
2. Main Text	Volume-1	Part I	Overall Approach & Work Procedure	✓	✓	
		Part II	General Appreciations			
	Volume-2 Cuamba-Mandimba Section	Part III	Preliminary Road Engineering Design			
		Part IV	Economic Feasibility Study			
		Part V	Cross Border Facilities			
	Volume-2 Mandimba-Lichinga Section	Part III	Preliminary Road Engineering Design			
		Part IV	Economic Feasibility Study			
	Volume-3	Part VI	Environmental and Social Considerations			
3. Drawings	Volume-4	Part VII	Regional Development Program			
	Cuamba-Mandimba Section	-	-	✓	✓	
	Mandimba-Lichinga Section	-	-			

Executive Summary

Part I Overall Approach & Work Procedure

Mozambique is located on the south-eastern coast of Africa and covers an area of 799,380 sq. km. It is bounded on the north by Tanzania; on the west by Malawi, Zambia, Zimbabwe, Swaziland and the Republic of South Africa (RSA); and on the entire eastern boundary by the Mozambican channel of the Indian Ocean. Mozambique's 17-year civil war, which lasted until 1992, ruined much of the country and destroyed key road infrastructure.

The Government of the Republic of Mozambique (hereafter referred to as the "GOM") assumed that the limited access to roads and other socio-economic services is a cause of the country's poverty and gave priority to improving infrastructures in areas with high potential for agricultural production, etc. in the Action Plan for the Reduction of Absolute Poverty (PARPA II: 2006 – 2009).

A main goal of the Road Sector Strategy 2007-2011 (RSS) is to serve the efficient road network to the prioritized economic areas such as agricultural areas, tourist sites and areas of industrial or natural-resource development that have the greatest potential to contribute to economic growth and PARPA II.

Given the above-mentioned situation, the GOM requested the Government of Japan (hereafter referred to as the "GOJ") to conduct a feasibility study (F/S) for the Upgrading of the Nampula - Cuamba Road. In response to this request from the GOM, the GOJ conducted "The Study on Upgrading of Nampula - Cuamba Road" from 2006 to 2007. In Nampula – Cuamba section, the detail design has been put forward for construction by the counter fund of GOJ.

The Study Road (N13: Cuamba – Mandimba – Lichinga), as part of the two Mozambican corridors (Nacala N13/N1 and Lichinga-Pemba N14/N1 corridors), provides a strategic link to the Malawi Border at Mandimba with the ports of Nacala and Pemba, in Nampula and Cabo Delgado Provinces respectively. Although the Study Road has much potential for stimulating development and reducing poverty throughout the entire northern area of Mozambique by enabling efficient connection, the section concerned is the only unpaved section.

Accordingly, the Japan International Cooperation Agency (hereafter referred to as "JICA"), the official agency responsible for the technical cooperation of the GOJ, undertook the Study including regional development program of Niassa Province along the Study Road in close cooperation with the concerned authorities of Mozambique.

The objectives of the Study are to determine the most technically feasible and economically viable, environmentally acceptable and socially optimal option of upgrading the existing Cuamba – Lichinga road to an all-weather road for easier transit. The Study also determines the impact of providing an all-weather road on poverty reduction and environment.

And establishment of the "Regional Development Program" intended for Niassa Province is also the objective of the Study. This program aims to extend the improvement effect to the wide area in conjunction with the road improvement (Nacala N13/N1 and Lichinga-Pemba N14/N1 corridors).

Part II General Appreciations

1. Government/Sectoral Policy

National policy and planning in Mozambique all have poverty reduction as a key objective. The Mozambique Government has been combating absolute poverty under the Poverty Reduction Strategy Paper (PARPA: 2001-2005) and PARPA II (2006-2009). The target of PARPA II is to reduce the incidence of absolute poverty from 54% in 2003 to 45% in 2009.

And Mozambique's transport sector is governed by the following road sector policies and strategies:

- Road Sector Strategy 2007-2011 (RSS)
- Integrated Road Sector Program 2009-2011 (PRISE)
- Semi Annual Work Plan and Budget (SAWPB)

2. Responsible Institutions for the Sector

Mozambique's road network is currently managed by the National Road Administration (ANE), which reports to the Ministry of Public Works and Housing. The Road Fund is responsible for managing the funds for the sector.

3. Traffic Modal Split

In Mozambique, the roads occupy a large share of both freight (58.2%) and passenger transport (96.1%) among all modes, particularly for passenger transport which is almost totally reliant on the road network. On the other hand, at 27.9%., contribution of the railway mode is relatively high for freight transport. Marine transportation (8.3%) also contributes towards transportation of freight. The air mode only shares a low ratio for both goods and passenger transport due to lower transport capacity.

4. Road Classification System and Conditions

Mozambique has classified roads which consist of national roads (primary and secondary) and regional roads (tertiary and vicinal roads). These roads are administrated by ANE. Urban roads and unclassified roads fall under the jurisdiction of the municipal councils and the district administrations respectively.

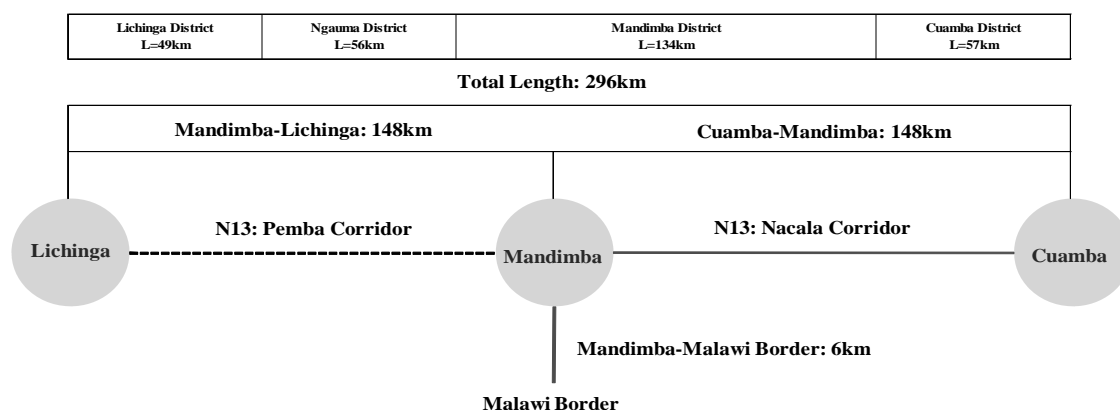
The current Mozambique classified road network is estimated at around 30,000km of which less than 20% is paved. Of the paved roads, the majority are estimated to be in good to fair condition (88%), however only 57% of the unpaved roads are estimated to be fully travelable. A key element of the RSS and of the Strategic Maintenance Plan (SMP) is the introduction of a Paved Road Management Programme (PRMP), which will be managed separately from the rest of the road network. SMP takes care of the 30,000km of classified roads and an additional 3,000km of urban roads.

[Cuamba-Mandimba Section]

Part III Preliminary Engineering Design

1. General Observations

The Study Road can be broadly divided into two sections (Cuamba-Mandimba Section and Mandimba-Malawi Border Section) and the road length of each section is indicated in the following figure.



Outline of the Study Road

2. Natural Condition Survey for the Study Road

The aim of the natural condition survey is to confirm the existing natural conditions for the Study Road with a view to making a road design. Natural condition survey is composed of the following three works.

1) Topographic Survey (Road alignment survey, Aerial survey, Bridge survey, Benchmark setting), 2) Geological Survey, 3) Soil & Material Survey

3. Hydrology and Hydrological Analysis

Following table shows the results of the flood level calculation by the HEC-Ras, which is based on the calculation for non-uniform flow.

Bridge	Return Period	Discharge (m ³ /s)	Calculated Flood Level (m)	Results of Field Survey (m)
Muambessi	50-Year	312.0	618.50	616.9
	100-Year	390.9	619.28	
Lussangassi	50 Year	589.9	639.42	637.5
	100 Year	731.4	639.92	
Ngolua	50-Year	246.4	704.16	706.2
	100-Year	307.9	704.85	
Ngame II	50 Year	243.7	708.61	709.2
	100 Year	301.7	709.15	

4. Applicable Design Standards

The application of a proper design standard will ensure that the following objectives are achieved:

- Ensure safety, a high standard service level and comfort for road users by the provision of adequate sight distance and roadway space,
- Ensure that the roadway is designed economically
- Ensure uniformity in the design
- Ensure safety of the structures (bridges and culverts).

For the design studies of the Nampula-Nacala Road and Nampula-Cuamba Road which are a part of Nacala Corridor, the Study Team proposed to use the Southern Africa Transport and Communications Commission (SATCC) design standards, as these were commonly used for other projects in the region.

5. Preliminary Engineering Design

Through discussions with ANE and the results of field surveys by the Study Team, the concept of the Project was confirmed as follows:

- To create an efficient primary road connection securing smooth traffic flow throughout the year corresponding to the future traffic demand
- To create a safe primary road connection by reducing the risk of accidents and the rate of injuries to pedestrians by motorized vehicles

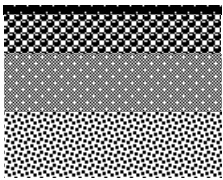
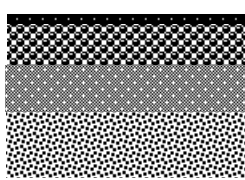
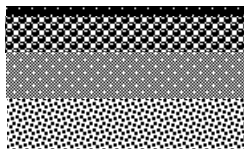



(1) Recommendable Alignment

The following table shows the improvement magnitude and effect of the recommended alignment. In regard to the section between Cuamba and Malawi Border, it was clarified by two indices (horizontal curvature and rise plus fall) that the existing alignments both horizontal and vertical almost meet criteria for a design speed of 100km/h. This means that improvement to the recommended alignment will basically be carried out on the existing road.

		Existing	Plan
Length (km)		153.8km	152.9km
Terrain		Flat	Flat
Design Speed		-	100km/h
Geometry	Horizontal Curvature deg/km	22.4 (1.00)	21.2 (0.95)
	Rise + Fall m/km	9.8 (1.00)	9.8 (1.00)
	No. of Rises + Falls no./km	4.5	3.3
No. of Level Crossings		8	2

(2) Suitable Pavement Compositions

A mechanistic analysis using ELSYM5 was conducted according to the design CBR. The results of the analysis are as shown in following table.

S2 (3-4)	S3 (5-7)	S4 (8-14)
		
<p>  : G4 Crushed or Natural Gravel Base Soaked CBR>80%@98% mod. AASHTO density  : C4 Cemented stabilized Sub-base 0.75-1.5Mpa@100% mod. AASHTO density  : G7 Selected Layer Soaked CBR>15%@93% mod. AASHTO density Poisson's ratio & Elastic coefficient (Elastic coefficient = (10 x CBR)Mpa) G4: 0.35, Phase-I: 400Mpa, Phase-II: 400Mpa, Phase-III: 300Mpa C4: 0.25, Phase-I: 1500Mpa, Phase-II: 600Mpa, Phase-III: 300Mpa G7: 0.35, Phase-I: 150Mpa, Phase-II: 150Mpa, Phase-III: 150Mpa </p>		

(3) Bridge Design

By the discussion with ANE, bridge inner width has been set as 9.2m for two-lane bridges. Those are summarized in following table.

General		Existing bridge			New bridge			
No.	name	width	length	existing	lane	width	length	from existing Br.
(Cuamba)								
1	Muambessi	4.8	14.3	demolish	2-lane	9.2	17	same position
2	Lussangassi	3.2	28.0	demolish	2-lane	9.2	34	down stream 8m
3	Ngolua	4.7	14.0	demolish	2-lane	9.2	17	same position
4	Ngame-II	4.9	28.0	demolish	2-lane	9.2	34	same position
(Mandimba)								

6. Construction Planning

The construction plan was proposed for improvement of Cuamba – Mandimba road on N13 including construction method, procurement of material and equipment, and construction schedule according to site condition, structural scale and work quantities.

7. Project Implementation Plan

Project implementation plan was proposed based on some constraints affecting the schedule as below:

- Selection of consultant for D/D will require four to five months procedure and preparation of D/D with tender documents will require minimum five months.
- Preparation of environmental impact assessment and RAP will require about eight to nine months and will be submitted to AfDB and JICA 120 days prior to the submission of the appraisal report and loan agreement of the Project, respectively.

- Tendering for construction contractor will require minimum nine to ten months procedure including pre-qualification, tender announcement, tender preparation limited to 90 days and tender evaluation and approval by ANE and lending agencies
- Construction work and supervision service will require about three years (33 months)

8. Project Cost Estimate

Basically unit construction cost of “Upgrading of Nampula – Cuamba Road” (hereinafter referred as “NCR”) is utilized for the Estimate due to high similarities between the two projects as follows.

- Site location: The Project road is the extension of NCR beyond Cuamba in northern region.
- Time of estimate: Engineering estimate of NCR was finalized at its detailed design stage in April 2009.

The results of the Estimate are summarized in the following table.

Description	Final (USD)
	DBST
1000 General	21,773,229
2000 Drainage	6,205,937
3000 EW & granular layers	47,887,098
4000 AC & seals	13,525,335
5000 Ancillary	2,501,784
6000 Structures	6,051,036
7000 Test & QC	17,250
8000 Others	1,573,090
Total (Bill A: Road)	99,534,760
Bill B: Day works	855,999
Bill C: Social issues	935,627
Bill D: Environmental	248,837
Total (Bill A to D)	101,575,223
Contingencies (10%)	10,157,522
IVA (6.8%)	7,597,827
Total construction cost	119,330,572
Engineering cost (5%)	5,586,637
IVA (6.8%)	379,891
Total project cost	125,297,100
Compensation cost	156,103
Project cost per km	820,492

9. Road Maintenance Systems

ANE’s ten provincial delegations are responsible for the implementation of all maintenance works on classified roads. The Directorate of Maintenance has a crucial role in ensuring that the delegations in provinces are fully aware of and complying with the technical and operational guidelines for implementation of the annual maintenance plan; and that roads of all types (primary, secondary, tertiary, vicinal, paved, unpaved) are being maintained and provided .

Part IV Economic Feasibility Study

1. Existing Traffic Flow Patterns

The Study Team conducted the following surveys and research to recognize the characteristics of traffic flow patterns for each section.

- Previous traffic volume data in ANE
- Traffic volume and roadside OD survey in May and August, 2009 at three locations in Cuamba, Mandimba and Lichinga on the Study Road
- OD survey at four borders between Mozambique, Malawi and Zambia
- Interview survey of stakeholders both in Mozambique and Malawi

This section is used for passenger movement from Lichinga and other districts in Niassa to connect railway or Nampula province. Regarding goods transportation, some consumer goods are dispatched from Cuamba to Lichinga. On the other hand, most consumer goods for Cuamba city come from the Nampula side mainly by railway.

2. Methodology of Traffic Demand Forecast

The Study Team applied the socio-economic framework based on the development strategy in Niassa (PEP), and the concepts of forecast methodology as three different types of traffic;

Passenger traffic volume is estimated by “Gravity Model” with the variable index of potential population and road section impedance, developed by the actual number of passengers for each O-D trip.

Regional traffic volume is considered by dividing traffic as attraction and generation for each zone. Trip attraction is estimated by the consumption of daily goods, and trip generation is based on the agro-products from Niassa Province.

International traffic volume is thought to be generated after the road network is improved. It is estimated by the Malawi trade and railway capacity, and applies the corridor choice model, named logit model.

3. Results of Traffic Demand Forecast

Accumulating the results of each component, future traffic volume for both sections will be summarized. For the section of Cuamba – Mandimba, future traffic volume in AADT is estimated at about 457AADT in 2014, 1,481AADT in 2023 and 5,027AADT in 2033 in the “with” case.

The section of Cuamba - Mandimba is characterized by the numbers of trailers that will be diverted from Beira corridor and railway. It is evidenced that this section will be composed of a part of international corridor.

Compared with the previous feasibility study between Nampula and Cuamba, this estimated traffic volume is almost the same level of volume as for the previous section.

4. Economic Analysis

Economic analysis is conducted on the following assumptions:

<i>Analysis Tool</i>	: HDM-4 (RED, Comprehensive for reference)
<i>Project life</i>	: 20 years after the opening of the project road (2014)
<i>Pricing date</i>	: as of October 2009
<i>Social discount rate</i>	: 12%
<i>Conversion Factor</i>	: Construction work (0.84), Maintenance work (0.75)
<i>Exchange rate</i>	: US\$1.00 = 28.00 Meticaís (MT)

Results of analysis are tabulated as follows:

Sensitivity Analysis

Case	Assumptions	EIRR
Base	Upgrade to paved road with DBST with Lichinga-Mandinba intervention	19.5%
1	Decrease in traffic volume of -20%	16.6%
2	Increase in investment costs of +20%	16.9%
3	Combination of above as the worst case	14.3%

The Project scores an average level as an upgrade-to-paved intervention and its economic viability is acceptable, with an EIRR of over 12% of the opportunity cost among alternatives. Based on this result, the Project is evaluated as one of the prioritized projects to be implemented in the nation. The particular importance of this primary road and of bringing it to all-weather travelable condition is well established. The Study Team concludes that the road upgrading project is economically feasible in terms of the national economy of Mozambique.

Part V Cross Border Facilities

1. Baseline Study and Fact Findings for Upgrading Border Facilities:

Upgrading of facilities at Mandimba-Chiponde border post was assessed in terms of its needs and requirements in conformity with baseline study and facts found upon the following issues.

- Current Conditions of Borders at Mozambique-Malawi
 - Cross Border Traffic
 - Control System and Facility
- Characteristics of Mandimba-Chiponde Border
 - Geographical and Commercial Features
 - Interactions and Border Communities
 - Strategic Importance on Regional Corridor Development
 - Site Conditions and Facilities
- Strategy for Upgrading Border Control and Facility
 - SADC Regional Strategy
 - Mozambique-Malawi Bilateral Strategy

2. Implementation Approach for Upgrading Border Facilities:

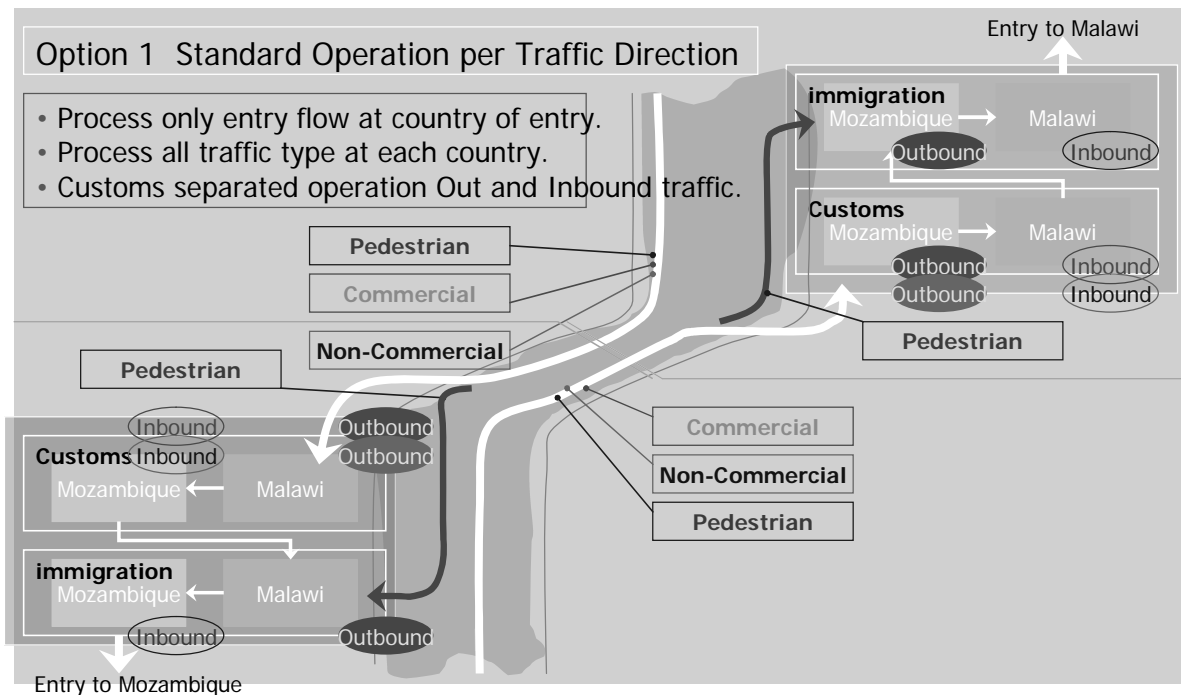
Implementation approach was formulated with the following proposals:

- Phased introduction for OSBP shall be employed,
- Existing facility shall be practically adapted and utilized under the environment of OSBP operation,
- Phased introduction shall be examined in line with: i) magnitude of future demands of cross border traffic and year forecasted, ii) time schedule of the bilateral discussion and the agreement, and iii) time schedule to introduce OSBP environment to other borders.

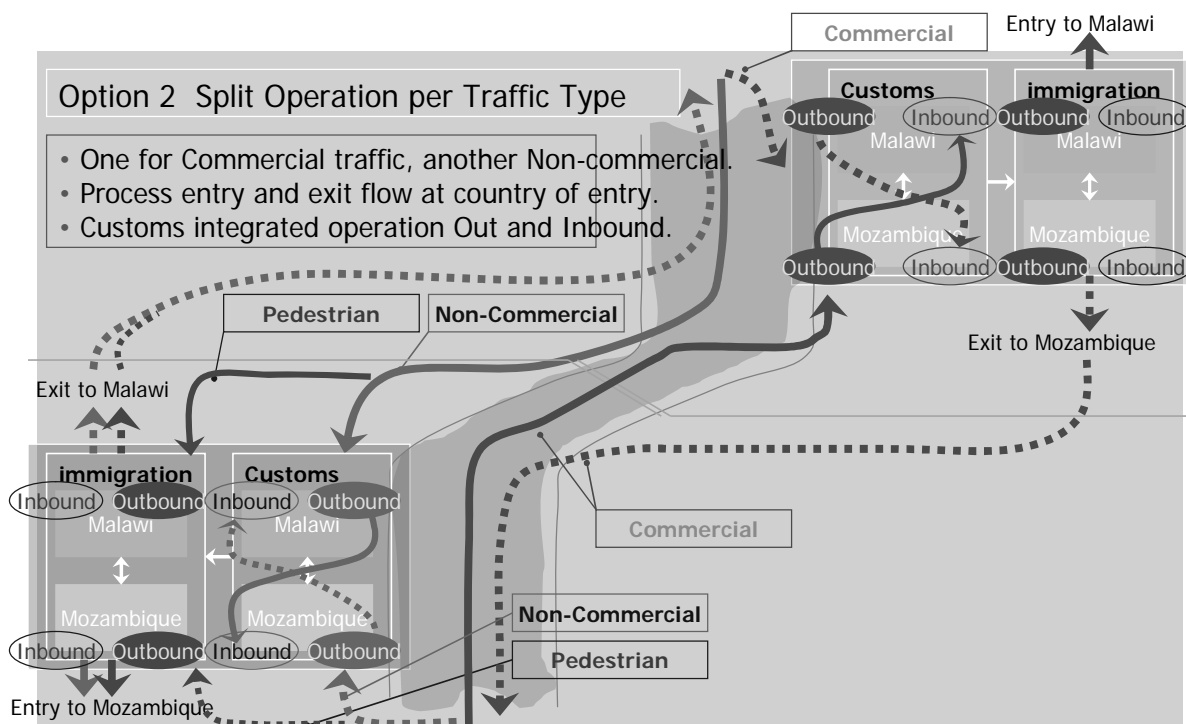
3. Implementation Policy for Upgrading Border Facilities:

“Two-step upgrading” as competitive scenario and **“Juxtaposed facility model”** were technically selected for the phased introduction of OSBP. And facility planning was preliminarily formulated estimating provisional conditions such as border control procedures and performance benchmarks (target time release, total processing time, unit workforce etc.) to be applied for OSBP operation.

Two types of operational options for OSBP scheme were proposed and preliminary layout and facility size were proposed for two target years according to “Two-step upgrading,” that is, 2014 as the first step and 2024 as the second step introduction:



Option 1: Split Operation per Traffic Direction



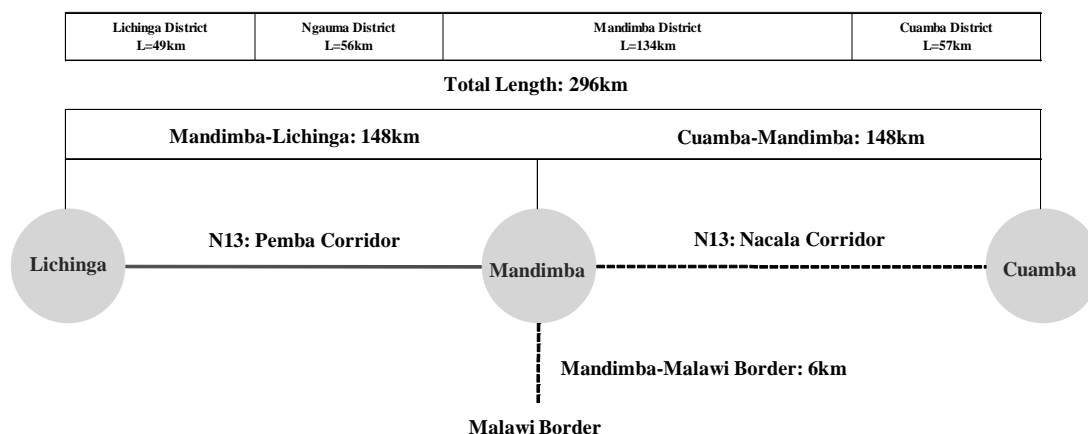
Option2: Split Operation per Traffic Type

[Mandimba-Lichinga Section]

Part III Preliminary Engineering Design

1. General Observations

As shown in Figure 1.1.1, the Study Road, with a total length of approximately 148km, traverses three districts having high agricultural potential, namely Mandimba, Ngauma and Lichinga in Niassa Province. The Mandimba-Lichinga road is part of the Pemba Corridor.



Outline of the Study Road

2. Natural Condition Survey for the Study Road

The aim of the natural condition survey is to confirm the existing natural conditions for the Study Road with a view to making a road design. Natural condition survey is composed of the following three components:

- 1) Topographic survey (Aerial survey, Bridge survey, Benchmark setting),
- 2) Geological survey, and
- 3) Soil & material survey.

3. Hydrology and Hydrological Analysis

Following table shows the results of the flood level calculation by the HEC-Ras, which is based on the calculation for non-uniform flow.

Bridge	Return Period	Discharge (m ³ /s)	Calculated Flood Level (m)	Results of Field Survey (m)
Ngame I	50-Year	225.6	731.10	732.9
	100-Year	278.9	731.68	
Lilasse	50 Year	277.3	892.76	893.2
	100 Year	342.7	893.01	
Ninde	50-Year	256.6	902.47	902.9
	100-Year	316.9	902.75	
Luculumesi	50 Year	716.2	992.98	990.0
	100 Year	885.0	993.63	
Lutembue	50-Year	310.9	1045.64	1043.9
	100-Year	384.7	1046.01	
Luambala	50 Year	463.2	1107.61	1105.5
	100 Year	576.5	1108.09	

4. Applicable Design Standards

The application of a proper design standard will ensure that the following objectives are achieved:

- Ensure safety, a high standard service level and comfort for road users by the provision of adequate sight distance and roadway space,
- Ensure that the roadway is designed economically
- Ensure uniformity in the design
- Ensure safety of the structures (bridges and culverts).

The Study Team proposed to use the Southern Africa Transport and Communications Commission (SATCC) design standards, as these were commonly used for other projects in the region. The Lichinga- Montepuez Road is also subject to the SATCC design standards.

5. Preliminary Engineering Design

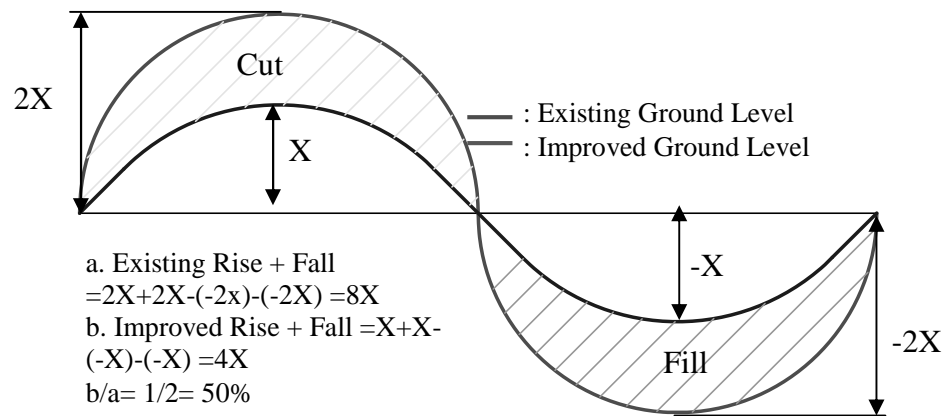
Through discussions with ANE and the results of field surveys by the Study Team, the concept of the Project was confirmed as follows:

- To create an efficient primary road connection securing smooth traffic flow throughout the year corresponding to the future traffic demand
- To create a safe primary road connection by reducing the risk of accidents and the rate of injuries to pedestrians by motorized vehicles

(1) Recommendable Alignment

The following table shows the improvement magnitude and effect of the recommended alignment. In regard to the section between Mandimba and Lichinga, although the horizontal alignment almost meets criteria for a design speed of 80km/h, the vertical alignment should be improved more than 50% for meeting a design speed of 80km/h as shown in following figure. This means that this section should be improved on large scale.

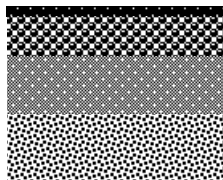
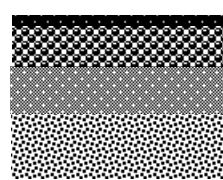
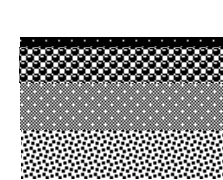



			Existing	Plan
Length (km)			148.1km	148.6km
Terrain			Rolling and mountainous	Rolling and mountainous
Design Speed			-	80km/h
Geometry	Horizontal Curvature	deg/km	164.1 (1.00)	174.8 (1.07)
	Rise + Fall	m/km	55.8 (1.00)	24.2 (0.43)
	No. of Rises + Falls	no./km	3.1	2.8



Improvement Image of the Vertical Alignment

(2) Suitable Pavement Compositions

A mechanistic analysis using ELSYM5 was conducted according to the design CBR. The results of the analysis are as shown in following table.

S2 (3-4)	S3 (5-7)	S4 (8-14)
		
<p> : G4 Crushed or Natural Gravel Base Soaked CBR>80%@98% mod. AASHTO density</p> <p> : C4 Cemented stabilized Sub-base 0.75-1.5Mpa@100% mod. AASHTO density</p> <p> : G7 Selected Layer Soaked CBR>15%@93% mod. AASHTO density</p> <p>Poisson's ratio & Elastic coefficient (Elastic coefficient = (10 x CBR)Mpa)</p> <p>G4: 0.35, Phase-I: 400Mpa, Phase-II: 400Mpa, Phase-III: 300Mpa</p> <p>C4: 0.25, Phase-I: 1500Mpa, Phase-II: 600Mpa, Phase-III: 300Mpa</p> <p>G7: 0.35, Phase-I: 150Mpa, Phase-II: 150Mpa, Phase-III: 150Mpa</p>		

(3) Bridge Design

By the discussion with ANE, bridge inner width has been set as 9.2m for two-lane bridges. Those are summarized in following table.

General		Existing bridge			New bridge			
No.	name	width	length	existing	lane	width	length	from existing Br.
(Mandimba)								
5	Ngame-I	4.2	28.0	demolish	2-lane	9.2	30	same position
6	Lilasse	4.0	10.0	demolish	2-lane	9.2	17	same position
7	Ninde	4.1	31.0	demolish	2-lane	9.2	34	down stream 8m
8	Luculumesi	4.4	22.0	demolish	2-lane	9.2	34	down stream 8m
9	Lutembue	4.1	34.0	demolish	2-lane	9.2	34	down stream 8m
10	Luambala	4.2	22.0	demolish	2-lane	9.2	30	up stream 8m
(Lichinga)								

6. Construction Planning

The construction plan was proposed for improvement of Mandimba - Lichinga road on N13 including construction method, procurement of material and equipment, and construction schedule according to site condition, structural scale and work quantities.

7. Project Implementation Plan

Project implementation plan was proposed based on some constraints affecting the schedule as shown below:

- Selection of consultant for D/D will require four months procedure and preparation of D/D and tender documents will require minimum six months.
- Preparation of environmental impact assessment and RAP will require about eight to nine months and will be submitted to a donor 120 days prior to the submission of the appraisal report and loan agreement of the Project.
- Tendering for construction contractor will require minimum nine to ten months procedure including pre-qualification, tender announcement, tender preparation of 90 days limitation and tender evaluation and approval by ANE and lending agencies
- Construction work and supervision service will require about three years (33 months)

The GOM/ANE is willing to make a request to apply for this Project as NEPAD project or component of the Cuanma-Mandimba Road Project. NEPAD project has to contribute to enhancing regional economic integration as a multinational project. However, the function of the Lichinga-Mandimba Road is not international trunk road linking other countries but rather essential road for regional development of Niassa Province.

For the reasons mentioned above, the possibility of applying this Project as NEPAD project will not be high. In that case, the GOM/ANE should consider a phased improvement in line with the existing road conditions and regional development program.

8. Project Cost Estimate

Basically unit construction cost of “Upgrading of Nampula – Cuamba Road” (hereinafter referred as “NCR”) is utilized for the Estimate due to high similarities between the two projects as follows.

- Site location: The Project Road is the extension of NCR beyond Cuamba in northern region.
- Time of estimate: Engineering estimate of NCR was finalized at its detailed design stage in April 2009.

The results of the Estimate are summarized in following tables.

Description	Final (USD)
	DBST
1000 General	28,083,346
2000 Drainage	11,519,383
3000 EW & granular layers	66,843,578
4000 AC & seals	14,259,205
5000 Ancillary	3,578,272
6000 Structures	5,797,170
7000 Test & QC	17,250
8000 Others	1,997,534
Total (Bill A: Road)	132,095,738
Bill B: Day works	1,136,023
Bill C: Social issues	1,241,700
Bill D: Environmental	330,239
Total (Bill A to D)	134,803,700
Contingencies (10%)	13,480,370
IVA (6.8%)	10,083,317
Total construction cost	158,367,387
Engineering cost (5%)	7,414,204
IVA (6.8%)	504,166
Total project cost	166,285,757
Compensation cost	199,391
Project cost per km	1,121,868

9. Road Maintenance Systems

ANE's ten provincial delegations are responsible for the implementation of all maintenance works on classified roads. The Directorate of Maintenance has a crucial role in ensuring that the delegations in provinces are fully aware of and complying with the technical and operational guidelines for implementation of the annual maintenance plan; and that roads of all types (primary, secondary, tertiary, vicinal, paved, unpaved) are being maintained and provided .

Part IV Traffic Demand Forecast and Economic Analysis

1. Existing Traffic Flow Patterns

The Study Team conducted the following surveys and research to recognize the characteristics of traffic flow patterns for each section:

- Previous traffic volume data in ANE
- Traffic volume and roadside OD survey in May and August, 2009 at three locations in Cuamba, Mandimba and Lichinga on the Study Road
- OD survey at four borders between Mozambique, Malawi and Zambia
- Interview survey with stakeholders in both Mozambique and Malawi

This section is the only route for delivering consumer goods to Lichinga, which is the provincial capital of Niassa, which is the base for distributing to the northern part. This section can be said to be the lifeline for the northern area. The majority of social and official movement is along the OD-pair between Lichinga and Cuamba.

2. Methodology of Traffic Demand Forecast

The Study Team applied the socio-economic framework based on the development strategy in Niassa (PEP), and the concepts of forecast methodology as three different types of traffic:

Passenger traffic volume is estimated by “Gravity Model” with the variable index of potential population and road section impedance, developed by the actual number of passengers for each O-D trip.

Regional traffic volume is considered by dividing traffic as attraction and generation for each zone. Trip attraction is estimated by the consumption of daily goods, and trip generation is based on the agro-products from Niassa province.

International traffic volume is thought to be generated after the road network is improved. It is estimated by the Malawi trade and railway capacity, and applies the corridor choice model, named logit model.

3. Results of Traffic Demand Forecast

Accumulating the results of each component, future traffic volume for both sections will be summarized. For the section of Mandimba – Lichinga, future traffic volume in AADT is estimated at about 467AADT in 2014, 1,732AADT in 2023 and 6,417AADT in 2033 in the “with” case.

The future AADT of section between Lichinga – Mandimba is more than Mandimba – Cuamba. It is because social communication will be more active by minibuses and passenger cars to the connection of provincial capital in Lichinga.

Compared with the previous feasibility study between Nampula and Cuamba, this estimated traffic volume is almost the same level of volume as for the previous section.

4. Economic Analysis

Economic analysis was conducted on the following assumptions:

<i>Analysis Tool</i>	: HDM-4 (RED, Comprehensive for reference)
<i>Project life</i>	: 20 years after the opening of the project road (2016)
<i>Pricing date</i>	: As of October 2009
<i>Social discount rate</i>	: 12%
<i>Conversion Factor</i>	: Construction work (0.84), Maintenance work (0.75)
<i>Exchange rate</i>	: US\$1.00 = 28.00 Meticaís (MT)

Results of analysis are tabulated as follows:

Sensitivity Analysis

Case	Assumptions	EIRR
Base	Upgrade to paved road with DBST (revised cost)	18.1%
1	Decrease in traffic volume of -20%	15.4%
2	Increase in investment costs of +20%	15.6%
3	Combination of above as the worst case	13.6%

The Project scores an average level as an upgrade-to-paved intervention and its economic viability is acceptable, with an EIRR of over 12% of the opportunity cost among alternatives. Based on this result, the Project is evaluated as one of the prioritized projects to be implemented in the nation. The particular importance of this primary road and of bringing it to all-weather travelable condition is well established. The Study Team concludes that the road upgrading project is economically feasible in terms of the national economy of Mozambique.

Part VI Environmental and Social Considerations

1. Environmental Law and Relevant Guidelines

The Government of Mozambique has issued laws relevant to the environment. According to the EIA Law, all project proponents must obtain environmental certification from the approval organization which is the Ministry of Environmental Coordination (hereinafter referred to as “MICOA”). This environmental law prescribes that rural road rehabilitation projects are classified as “category A” projects, which require an EIA basically. With regard to Malawi side, the Part V in Environmental Management Act 1996 says, “A4.5 construction new road / widening of existing road of highway / rural road” requires EIA process. On the other hand, construction of immigration facilities is not prescribed in the mandatory list for EIA.

The environmental and social consideration survey based on the JBIC and JICA guidelines indicated that it seems serious environmental impacts are not expected, so far, however some key issues such as resettlement, elephant migration corridor and infectious disease items were picked up, and some mitigation measures were recommended from the Study Team.

2. Environmental Recommendations

The Study Team recommends the following:

[Implementation of Mitigation Measure against Key Issues]

- With regard to African elephant migration routes in the Study Area, signboards should be set up to warn drivers and inhabitants and environmental education should be conducted for construction workers and inhabitants by the proponent.
- In terms of resettlement, adequate law-based process under land law, RPF and other relevant guidelines shall be conducted. Especially, sufficient discussion for negotiation of price determination shall be carried out with stakeholders because the GOM does not have a prescribed compensation price list for structures and assets at the moment.

[Implementation of Adequate EIA]

- ToR for EIA which will be prepared by ANE should consider relevant guidelines such as GOM, JBIC, JICA and AfDB.
- The Study Report shall be referred and incorporated into the EIA report which will be prepared by ANE, especially analysis of elephants and quantitative pollution forecast in air quality and noise pollution

[Implementation of Required Environmental Process during Construction]

- Appropriate law-based processes shall be adopted for development of quarries and borrow pits during construction. Generally, development of new quarry site shall take environmental certificate from Provincial MICOA.

Part VII Regional Development Program

1. Present Situation and Development Potential of Niassa Province

Niassa Province has inherent development potential in agriculture, forestry, mining and tourism. However, poor access conditions have hindered economic development in the province. Furthermore, its territorial size, scattered population and low population density have made it difficult to deliver basic social services to the people.

The majority of provincial population is rural and the majority of rural population is smallholding farmers (smallholders). They grow a variety of food crops including maize, cassava and beans. Poor access conditions increase transport costs. It is difficult for smallholders to transport their agricultural produce by car and sell them at market places. As a result, smallholders have to wait for middlemen to come to their villages or they need to bring produce to nearby buying places by bicycle or on foot. Moreover, in order to satisfy cash needs, they have to sell part of food crops for their own family consumption.

Some smallholders grow cash crops, such as tobacco and cotton. On the other hand, in recent years, in the southern part of Niassa Province, where access conditions are relatively good because of its railway linkage, some smallholders grow sesame for export in the activities of agricultural associations. However, these kinds of cash cropping are still limited in number and to certain areas.

Agriculture is a major and important economic sector, which provides food and cash for the majority of people in the province. In Niassa Province, there is much room for improvement of agriculture in technical production and commercialization. Furthermore, agro-processing industries are expected highly not only to increase the demand for local agricultural produce, but also to increase non-agricultural employment.

In the northern part of Niassa Province, since 2005, industrial tree plantations have been increasingly developed by foreign investments. Harvesting of trees will start at those plantations around 2013. Those harvested wood and/or locally processed wood products would be exported to other regions. In the short term, they rely on road transport from Lichinga to Cuamba to get railway at Cuamba. In the mid and long terms, it is expected that the railway line between Cuamba and Lichinga could be rehabilitated so as to transport unprocessed wood or processed wood products to Cuamba and further to Nampula or to Nacala, sometime to Malawi.

In Niassa Province, Niassa Lake in the north-western area and Niassa Reserve in the north-eastern area have tourism potential. Lichinga, provincial town of Niassa, has beautiful streetscape due to Portuguese colonial legacy. Lichinga has development potential to be a base for tourist accommodation. Such tourism potential including tourist resorts, water sports, ecotourism and game hunting has been hardly exploited yet.

It has been known that the north-western area of the province has mineral resources including coal. However, high transport costs have hindered exploration and development of mineral resources.

2. Regional Development Measures for Promoting Synergy Effect of Trunk Road Improvement and Regional Development

- (1) Corridor along Cuamba-Mandimba Trunk Road: Southern Part of Niassa Province

Smallholder Agriculture and Agro-Processing Industries

The upgrading and pavement project of Cuamba-Mandimba Road could reduce transport costs, as well as improve road access along the corridor. As a result, regional potential to commercialize smallholder agriculture and to expand their production would be enhanced. However, such road upgrading alone cannot realize the enhanced regional potential and achieve smallholder commercialization and production expansion. Therefore, it is necessary to assist in strengthening their agriculture associations and securing market channels for their produce.

The upgrading and integration of Cuamba-Mandimba Road with already upgraded Nampula-Cuamba Road would substantially reduce long-distance transport costs by truck so as to reduce goods prices imported from other regions.

It is considered that such smallholder commercialization and agricultural production expansion would increase business potential of agro-processing industries along the corridor. However, such road upgrading alone is not enough to exploit improved opportunities in agro-processing industries. It is essential to assist in not only feasibility studies but also business development services, for providing information and support to private sectors. Such measures would help private sectors to actually invest in the field of agro-processing.

Urban Economy and Logistics Function

The integrated upgrading of trunk roads of Nacala Development Corridor would vitalize regional economy along the corridor. This could promote geographical expansion of commercial catchments Nampula Town and Nacala Town, resulting in upgraded commercial agglomeration.

Similarly the inland towns, such as Cuamba Town and Mandimba Town, would expand their commercial catchments and increase demands for transport and logistics sectors.

In addition to the upgrading of Nampula-Cuamba-Mandimba Road, development of bypass roads, logistics centers and loading-unloading facilities between roads and railways would be necessary for making regional transport more effective and efficient by taking advantage of upgraded trunk roads and rehabilitated railway of Nacala Development Corridor.

- (2) Periphery of Nacala Development Corridor: Central and Northern Parts of Niassa Province

Smallholder Commercialization and Production Improvement

Commercialization of smallholders in the periphery of Nacala Development Corridor would be encouraged by the road improvement between Nampula, Cuamba and Mandimba. Due to the reduced long-distance transport costs, the farmers would be able to sell their agricultural products at higher prices. As the economic activities in Nacala Development Corridor are vitalized with the trunk road improvement, populations of Cuamba Town and Mandimba Town would

increase. As a result, the amount of agricultural products to be dealt with by the middlemen would increase. Currently the support to the smallholder commercialization by organizing agricultural associations and by making linkage with marketing companies is provided in a limited number of villages in the southern part of the province. In order to make full use of the enhanced opportunities for smallholder commercialization, such support should be expanded to the central and northern parts. In addition, agricultural technical support should be introduced to improve their production.

Tourism Development

If the road between Nampula, Cuamba and Mandimba is improved, tourists visiting southern part of the Province from Malawi or Nampula by bus or car would increase. It is expected that Lichinga would be developed as a comfortable tourist base to provide accommodation to tourists, traveling along the route via Cuamba and Mandimba. Measures should be taken to improve the quality of tourism services in hotels, restaurants and car rentals, as well as to provide tourist information in Lichinga Town. Furthermore, efforts should be made to attract tourists to make trips from Lichinga to nearby tourist spots such as Niassa Lake and nature conservation areas.

In order to fully develop tourism in Niassa Province to such an extent that more international and domestic tourists would visit Niassa Lake and/or Niassa Reserve as popular tourist destinations, good access conditions should be ensured with improved Mandimba-Lichinga Road. In combination with the road improvement, it is necessary to make Lichinga Town an attractive tourist center, by providing small tourist-oriented facilities, such as tourist information centers, museums and sign boards. It is also necessary to start developing the capacity of local tourist industries by providing training programs. More tourist accommodations and attractions should be developed at Niassa Lake and Niassa Reserve. For facilitating tourism development at the provincial level and for promoting tourism in Niassa Province, it is also recommended to establish a local tourism board involving government and private sectors.

Development of Wood Processing Industry

Improvement of Mandimba-Lichinga Road is essential for promoting industrial development, such as wood-processing industries, in the central and northern part of Niassa Province. The road improvement would largely contribute to cost reduction of long-distance truck transport and furthermore to price reduction of imported goods, such as spare parts and fuels. This could lead to enhancement of basic conditions for attracting industries.

For actual promotion of wood-processing industries, business development services should be provided for foreign investors and companies. Furthermore, it is also necessary to develop small and medium scale enterprises (SMEs) of wood-processing for local employment generation.

Mineral Resources Development

The improvement of Lichinga-Mandimba Road is essential to realize mineral resources development in the north-western area of the province. Together with the road improvement, geological surveys and research is important to provide information on mineral resources availability to promote private investment in mineral exploration and furthermore in mineral exploitation. In the long term, rehabilitation of Lichinga-Cuamba Railway Line is highly expected for

transporting exploited mineral resources through Cuamba, Nampula and Nacala.

Improvement of Social Services

In addition to the above-mentioned economic development measures, the improvement of social services, such as water, education and health, as well as the improvement of local roads are very important for the regional development in the central and northern parts of Niassa Province. In the decentralization policy of Mozambique, budgets for the development are allocated to district governments, and they are supposed to play central roles in planning and implementation for local development. However, their capacity is limited. In order to improve social infrastructure and services, assistance programs for capacity development of district governments are necessary.

The Preparatory Survey on Road Improvement Plan in Nacala Development Corridor (N13: Cuamba-Mandimba-Lichinga) in the Republic of Mozambique

Final Report

Table of Contents

Main Text

Volume 1

Part I Overall Approach & Work Procedure

Part II General Appreciations

Project Location Map

Project Outline

Summary of Project

Table of Contents

List of Figures

List of Tables

Abbreviation

Part I Overall Approach & Work Procedure	1
Chapter 1 Background and Study Objectives	1
1.1 Background	1
1.2 Study Area and Road	1
1.3 Study Objectives	2
Chapter 2 Scope of the Study	3
2.1 General	3
2.2 Study Description	3
2.3 Scope of the Study	3
Chapter 3 Work Procedure	6
3.1 Study Approach	6
3.2 Appreciation of Issues	6
3.3 Study Flowchart	6
3.4 Study Organization	8
3.5 Report Submission	8
Part II General Appreciations	10
Chapter 1 Features of the Sector	10
1.1 Government/Sectoral Policy	10
1.2 Features of the Sector	10
1.3 Responsible Institutions for the Sector	15
Chapter 2 Transport Sector and Related Parameters	18
2.1 Traffic Modal Split	18
2.2 Road Classification System and Conditions	19
Chapter 3 Macro-Economic Backgrounds	24
3.1 Demography	24
3.2 GDP and Macro-Economic Background	25

List of Figures

Part I Overall Approach & Work Procedure

Figure 3.3.1	Study Flow	7
Figure 3.4.1	Organization Chart for the Study	8

Part II General Appreciations

Figure 1.3.1	ANE's Organization Chart.....	16
Figure 3.1.1	Population of Niassa Province	25
Figure 3.2.1	Macro Economic Indicators	26
Figure 3.2.2	GDP Forecast (bil.MT)	26
Figure 3.2.3	GDP (bil.US\$).....	27
Figure 3.2.4	GDP/capita (US\$)	27
Figure 3.2.5	Population (mil.)	28
Figure 3.2.6	Inflation Ratio	28

List of Tables

Part I Overall Approach & Work Procedure

Table 3.5.1	List of Reports for Submittal	9
-------------	-------------------------------------	---

Part II General Appreciations

Table 1.2.1	Budget Plan for the PRISE 2009-2011 (Unit: Mil. Mt).....	12
Table 1.2.2	Budget Plan for 2010 (Unit: Mil. Mt).....	13
Table 1.2.3	Summary PRISE Sources and Uses of Funds : 2 nd Semester 2009	13
Table 1.2.4	Budget Plan for the Annual Road Maintenance in 2009.....	15
Table 1.3.1	Responsible Institutions for the Road Sector.....	17
Table 2.1.1	Traffic Modal Split in Mozambique	18
Table 2.1.2	Transport and Communications in Niassa	19
Table 2.2.1	New Road Classification System.....	20
Table 2.2.2	Road Network in Mozambique (km)	21
Table 2.2.3	Summary Road Conditions	21
Table 2.2.4	Outlook of Roads in Niassa	22
Table 2.2.5	Growth of Registered Vehicles	22
Table 2.2.6	Number of Traffic Accidents	23
Table 2.2.7	Deaths per 10,000 Motor Vehicle	23
Table 3.2.1	Structure of GDP in Niassa	29

Abbreviation

AADT	Annual Average Daily Traffic	FDD	Full Due Diligence
ACE	Competent Authority of Road Sector	FIP	Preliminary Information File
ACV	Aggregate Crushed Value	GAT	Cross Cutting Issues Unit (Environmental Unit in ANE)
ADT	Average Daily Traffic		
AfDB	African Development Bank	GAS	Director of Assessor and Supervision Cabinet
ANE	National Road Administration		
AU	Africa Union	GDP	Gross Domestic Product
BOO	Build Own Operate	GED	Cabinet for Development and Strategic Study
BOT	Build Operate Transfer		
BOOT	Build Own Operate and Transfer	GOJ	Government of Japan
CBR	California Bearing Ration	GOM	Government of the Republic of Mozambique
CDN	Northern Development Corridor		
CFM	Mozambique Railway Authority	GPS	Global Positioning System
CLUSA	Cooperative League of the U.S.A.	H.W.L	High Water Level
COI	Corridor of Impact	HDM-4	Highway Design and Maintenance Standards Model
COMESA	Common Market for Eastern and Southern Africa	HIV/AIDS	Human Immunodeficiency Virus /Acquires Immune Deficiency Syndrome
DA	Directorate of Administration		
DCP	Dynamic Cone Penetration		
DIMAN	Directorate of Maintenance of ANE	ICB	International Competitive Bidding
DIPRO	Directorate of Project of ANE	IDA	International Development Association
DNEP	National Directorate of Roads and Bridges	IND	National De-mining Institute
DPANE	Provincial Delegation of ANE	INE	National Statistics Institute
DPOPH	Provincial Directorate of Public Works and Housing	IRI	International Roughness Index
		IRR	Internal Rate of Return
DTI	Department of Trade and Industry	IUCN	International Union for the Conservation of Nature and Natural Resources
EAC	East African Community		
EIA	Environmental Impact Assessment		
EIRR	Economic Internal Rate of Return	JBIC	Japan Bank for International Cooperation
ESCS	Environmental and Social Consideration Survey	JICA	Japan International Cooperation Agency
EU	European Union		

MASL	Meter Above Sea Level	SADC	Southern African Development Community
MCA	Multi Criteria Analysis		
MCC	Millennium Challenge Corporation	SATCC	the Southern Africa Transport and Communications Commission
MICOA	Ministry for Coordination of Environmental Affairs	SAWPB	Semi Annual Workplan and Budget
MOAF	Ministry of Agriculture & Fisheries	SEA	Strategic Environmental Assessment
MODP	Ministry of Development & Planning	SDI	Spatial Development Initiatives
MOIC	Ministry of Industry & Commerce	SISTAF	Ministries of Finance and Planning and Development in the Government's financial management system
MOPWH	Ministry of Public Works and Housing		
MOTC	Ministry of Transport & Communication		
MTEF	Medium Term Expenditure Framework	SIDA	Swedish International Development Cooperation Agency
NCB	National Competitive Bidding	SMEs	Medium-scale National Entrepreneurs
NEPAD	New Partnership for Africa's Development	SMP	Strategic Maintenance Plan
NGO	Non-Governmental Organization	SPT	Standard Penetration Test
NPV	Net Present Value	STD	Sexually Transmitted Disease
OSBP	One Stop Border Post	SWOT	Strength, Opportunity, Weakness and Threat
OD	Origin and Destination		
PAC	Environmental Accompanying Plans	TMH	Technical Measures for Highways
PAP	Project Affected Person(s)	TRH	Technical Recommendations for Highways
PARPA	The Action Plan for the Reduction of Absolute Poverty	TOR	Terms of Reference
PEP	Provincial Strategic Plan	VEF	Vehicle Equivalent Factor
PES	Economic and Social Plan	VOC	Vehicle Operation Cost
PGA	Environmental Administration Plan	WB	The World Bank
PPP	Public-Private Partnership		
PRISE	Road Sector Integrate Program		
RAP	Resettlement Action Plan		
RECs	Regional Economic Communities		
RED	Roads Economic Decision Model		
RF	Road Fund		
RMF	Regional Maximum Flood		
ROW	Right of Way		
RPF	Resettlement Policy Framework		
RSS	Roads Sector Strategy 2007-2011		

PART I

OVERALL APPROACH & WORK PROCEDURE

Part I Overall Approach & Work Procedure

Chapter 1 Background and Study Objectives

1.1 Background

Mozambique is located on the south-eastern coast of Africa and covers an area of 799,380 sq. km. It is bounded on the north by Tanzania; on the west by Malawi, Zambia, Zimbabwe, Swaziland and the Republic of South Africa (RSA); and the entire eastern boundary by the Mozambican channel of the Indian Ocean.

Mozambique's 17-year civil war, which lasted until 1992, ruined much of the country and destroyed key road infrastructure.

The Government of the Republic of Mozambique (hereafter referred to as the "GOM") assumed that the limited access to roads and other socio-economic services is a cause of the country's poverty and gave priority to improve infrastructures in areas with high potential for agricultural production, etc in the Action Plan for the Reduction of Absolute Poverty (PARPA II: 2006 – 2009).

A main goal of the Road Sector Strategy 2007-2011 (RSS) is to serve the efficient road network to the prioritized economic areas that have the greatest potential to contribute to economic growth and PARPA II such as agricultural areas, tourist sites and areas of industrial or natural-resource development.

Given the above-mentioned situation, the GOM requested the Government of Japan (hereafter referred to as the "GOJ") to conduct a feasibility study (F/S) for the Upgrading of the Nampula - Cuamba Road. In response to this request from the GOM, the GOJ conducted "The Study on Upgrading of Nampula - Cuamba Road" from 2006 to 2007. In Nampula – Cuamba section, the detail design has been put forward for construction by the counter fund of GOM.

The Study Road (N13: Cuamba – Mandimba – Lichinga), as part of the two Mozambican corridors (Nacala N13/N1 and Lichinga-Pemba N14/N1 corridors), provides a strategic link to the Malawi Border at Mandimba with the ports of Nacala and Pemba, in Nampula and Cabo Delgado Provinces respectively. Although the Study Road has much potential for stimulating development and reducing poverty throughout the entire northern area of Mozambique by enabling efficient connection, the section concerned is the only unpaved section.

Accordingly, the Japan International Cooperation Agency (hereafter referred to as "JICA"), the official agency responsible for the technical cooperation of the GOJ, undertook the Study including regional development program of Niassa Province along the Study Road in close cooperation with the concerned authorities of Mozambique.

1.2 Study Area and Road

The Study Road is 302 km long (Cuamba-Mandimba:148km, Mandimba-Lichinga:148km, Mandimba-Malawi Border:6km) and is located in Niassa

Province of Mozambique. The road passes through the rural district of Mandimba, to the Malawi border. The route, as part of the two Mozambican corridors (Nacala N13/N1 and Lichinga-Pemba N14/N1 corridors) provides a strategic link to the Malawi Border at Mandimba with the ports of Nacala and Pemba, in Nampula and Cabo Delgado Provinces respectively. Also, the route is a strategic link from the different parts of the country to Niassa Lake which is fast developing as an important tourism destination. Much of the study area for this section lies in rolling to hilly terrain. The rainfall in this area ranges from 900 to 1000 mm. The area is suitable for most forms of agricultural production.

The entire Study Road is basically a two-wheel rudimentary track of earth/gravel type. The road level between Cuamba to Lichinga is lower than the surrounding natural ground level and does not conform to geometric standards. The presence of red and black clayey soils makes the road impassable during the wet season. In general, the road exhibits severe and extensive potholes, ruts and corrugations causing discomfort to users and making driving dangerous.

1.3 Study Objectives

- (1) The objectives of the study are to determine the most technically feasible and economically viable, environmentally acceptable and socially optimal option of upgrading the existing Cuamba – Lichinga road to an all-weather road for easier transit. The study also determines the impact of providing an all-weather road on poverty reduction and environment.
- (2) Establishment of the “Regional Development Program” intended for Niassa Province is also the objective of the study. This program aims to extend the improvement effect to the wide area in conjunction with the road improvement (Nacala N13/N1 and Lichinga-Pemba N14/N1 corridors).

Chapter 2 Scope of the Study

2.1 General

The Consultant shall perform all necessary planning, engineering, economic, financial, social and environmental analysis, field investigations, and related works to attain the objectives of the Study under cooperation of ANE.

Note that the Environment Impact Assessment (EIA) is responsible of the GOM. JICA assist ANE for execution of the EIA.

2.2 Study Description

The Study includes conducting the economic feasibility study, preliminary engineering design, assistance for environmental impact assessment and establishment of regional development program for Cuamba - Lichinga road over 302km.

2.3 Scope of the Study

2.3.1 Economic Feasibility Study

(1) Economic Analysis

The Consultant shall carry out economic analysis for the Study area based on the following data;

- Population levels and anticipated growth
- Existing and anticipated production levels for different sectors such as agriculture, industry, mining, etc
- National/regional income levels

(2) Traffic Analysis

The Consultant shall determine the type and volume of the existing traffic by existing historical data, traffic counts and origin and destination survey. In addition to the general survey, other field investigations such as interview to the major transport company shall be undertaken by the Consultant.

The Consultant shall identify, describe and quantify existing and potential traffic generating factors in the Study areas.

(3) Economic Evaluation

The Consultant shall carry out economic evaluation of the Project. For this, the economic costs of construction of the design standard being evaluated shall be compared with the relevant level of economic user benefits arising from implementation of the Project at the different design levels.

(4) Risk Analysis

The Consultant shall conduct risk analysis based on the standards of African Development Bank (AfDB), JICA, etc.

2.3.2 Preliminary Engineering Design

(1) Site Measurement (Natural Condition Survey)

The Consultant shall conduct following site measurements for the preliminary engineering design of the different options:

- Topographic survey
- Aerial survey
- Boring survey including other relevant laboratory tests that are required
- Material survey including other relevant laboratory tests that are required
- Axle load survey

(2) Visual Site Survey

The Consultant shall conduct following visual site surveys for the preliminary engineering design of the different options:

- Land use survey
- Hydrological/hydraulic survey
- Alignment, pavement and structure such as bridge evaluation for improvements to acceptable standards and preliminary design
- Collection of other physical and engineering data which are necessary to justify the technical feasibility of the proposed roads

(3) Preliminary Design

Based on the traffic studies, environmental impact assessment studies by ANE, economic analysis and geo-technical tests, the Consultant shall develop possible preliminary design standards for the different options. The merits and drawbacks of each option should determine the final standard to be adopted for the chosen alternative. It shall be necessary for the Consultant to provide comparative data of construction and maintenance costs for the different design standards to support the final design adopted for the road.

(4) Cost Estimate

Based on the above preliminary design results, the Consultant shall provide preliminary quantity and cost estimate. This estimate shall be based on locally derived unit prices appropriate for the previously estimated quantities. The estimate shall give details of foreign and local costs by main work items including taxes and duties levied.

(5) One Stop Border Post (OSBP)

The Consultant shall assess the appropriateness of the OSBP for Mandimba from

the viewpoints of efficiency, immediacy and so on. For this purpose, the Consultant shall conduct the following site measurements:

- Traffic volume survey
- Time required for customs clearance
- Collection of other physical data which are necessary to justify the technical feasibility of the proposed OSBP

2.3.3 Assistance for Execution of EIA by GOM (ANE)

The Consultant shall assist ANE for execution of the EIA for the Study Road, because procedure and contents of the EIA shall comply with the EIA guidelines of both AfDB and JICA. For this purpose, the Consultant shall provide the following activities to ANE:

- Assistance for preparation of the TOR for EIA
- Process management
- Simple site survey with local environmental consultant hired by ANE
- Holding of stakeholder meetings for formulation of consensus from local people

2.3.4 Regional Development Program

The Consultant shall establish the “Regional Development Program” intended for Niassa Province based on the “PEP Niassa 2017” which cuts across economic, social, organization, health, and industry (agriculture, industry and commerce) to extend the road improvement effect to the wide area. This program shall propose to Niassa Province.

Chapter 3 Work Procedure

3.1 Study Approach

The Study is executed in accordance with the scope of the Study described in the previous chapter. The major focus of the Study is to conduct the preliminary design, its feasibility study and to study the regional development program in and around the objective road. Below, the basic issues and approach of the Study are described.

3.2 Appreciation of Issues

- (1) In the pre-feasibility study in 2007 by Millennium Challenge Corporation (MCC), the Study Road (Cuamba–Mandimba–Lichinga) was identified as a low investment efficiency project.
- (2) The improvement plan of the Study Road shall be carried out effectively and in consideration of an economical design standard, functional design at the intersections of railways, and the social environment of the surrounding population.
- (3) In case the Study Road is improved and upgraded, the Study Road will attract additional traffic from other roads, corridors such as Beira and from other transportation modes. Therefore, future traffic demand for the Study Road shall be adequately forecasted in consideration with related road network and railway.
- (4) The existing road is narrow carriageway with gravel/earthen road, passing through highly erodible sections. The road level is lower than the surrounding natural ground level and does not conform to geometric standards. In most sections, there is considerable loss of surfacing material. In addition, the presence of red and black clayey soils makes the road impassable during the wet season. The rivers are crossed by low-level bridge structures, which are overtopped during the rainy season and the road remains closed to traffic for long periods.
- (5) A regional development program, which shall serve as the basis for road improvement, shall be implemented taking into consideration economic and environmental impacts on inhabitants.

3.3 Study Flowchart

As for the work of the Study, it is divided into work missions in Mozambique and work in Japan, respectively. The workflow of the Study is shown in Fig. 3.3.1.

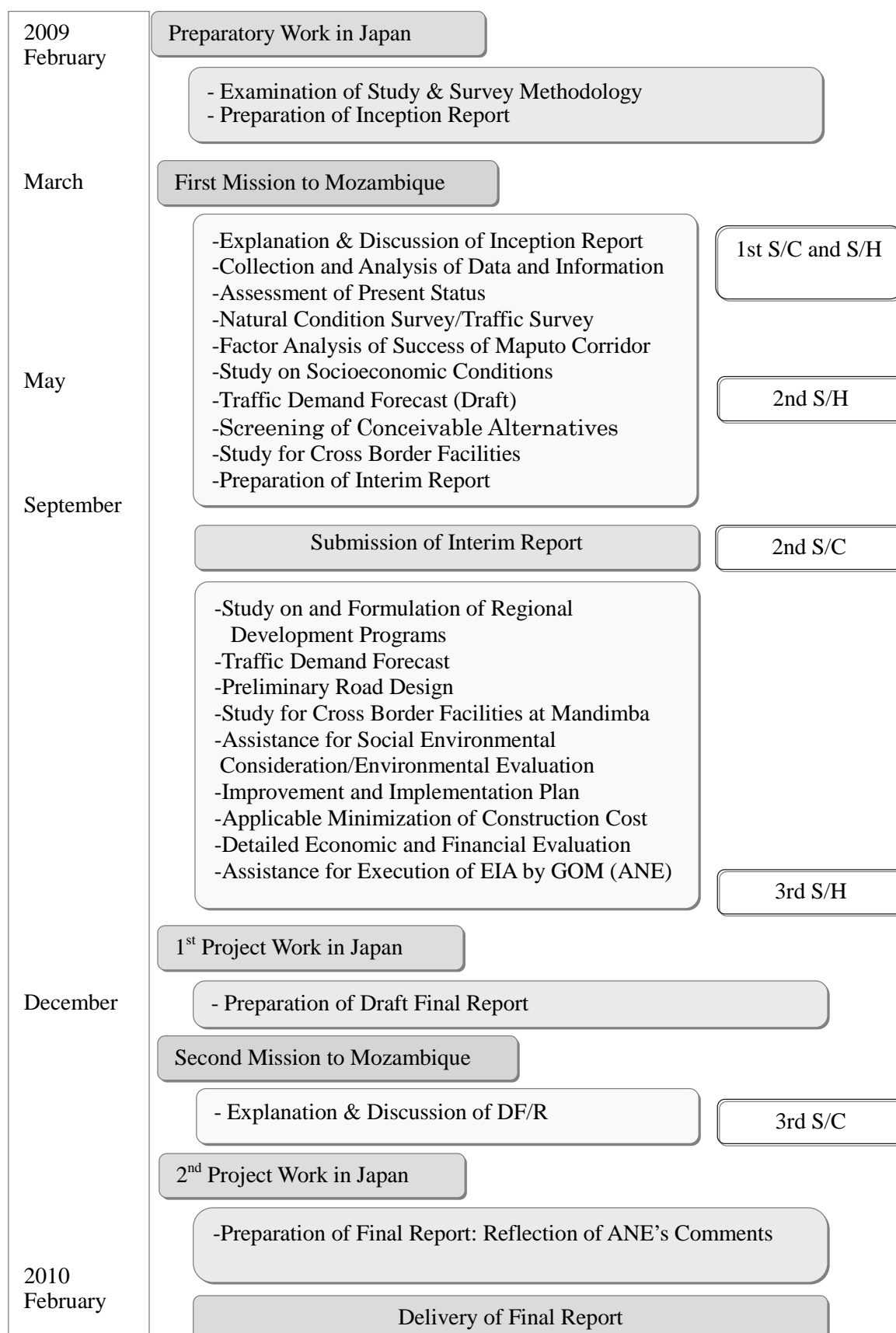
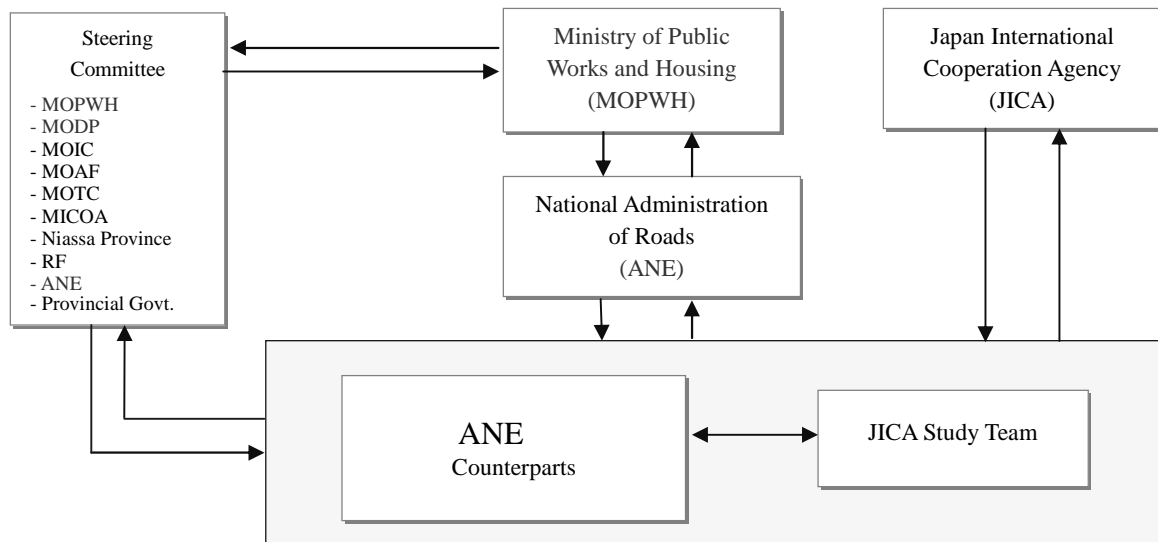


Figure 3.3.1 Study Flow

3.4 Study Organization

The Study shall be carried out by the National Administration of Roads (ANE) under the Ministry of Public Works and Housing (MOPWH) together with the Study Team. The relationship among these institutions is as shown in Figure 3.4.1.



MOPWH: Ministry of Public Works & Housing
MODP: Ministry of Development & Planning
MOIC: Ministry of Industry & Commerce
MOAF: Ministry of Agriculture & Fisheries
MOTC: Ministry of Transport & Communication
MICOA: Minister for Coordination of Environmental Affairs
RF: Road Fund
ANE: National Administration of Roads

Figure 3.4.1 Organization Chart for the Study

ANE, as the agency responsible for national roads and bridges, shall act as the counterpart agency to the Study Team, and also as a coordinating body in relation to other government/non-government organizations concerned for the smooth implementation of the Study.

A Steering Committee shall be set up in order to conduct the Study efficiently and effectively.

3.5 Report Submission

The Study Team prepares and submits the reports listed in Table 3.5.1 both in the Portuguese and English languages to the Government of Mozambique.

Table 3.5.1 List of Reports for Submittal

No.	Report	Date of Submission	Language	No. of Copies
1	Inception Report (IC/R)	Mid April 2007	Portuguese	15
			English	10
2	Interim Report (IT/R)	Mid September 2009	Portuguese	15
			English	10
3	Draft Final Report (DF/R)	Mid December 2009	Portuguese	15
			English	10
4	Final Report (F/R)	Mid February 2010	Portuguese	15
			English	10
			CD	1 set

PART II

GENERAL APPRECIATIONS

Part II General Appreciations

Chapter 1 Features of the Sector

1.1 Government/Sectoral Policy

National policy and planning in Mozambique all have poverty reduction as a key objective. The Mozambique Government has been combating absolute poverty under the Poverty Reduction Strategy Paper (PARPA: 2001-2005) and PARPA II (2006-2009). The target of PARPA II is to reduce the incidence of absolute poverty from 54 percent in 2003 to 45 percent in 2009.

In addition, PARPA II has leaned to greater integration of the national economy and an increase in productivity. In particular, PARPA II pays more attention to district-based development, creation of an enabling environment for the productive sector, improvement of the financial system, measures to help small and medium-size companies and the development of both the internal revenue collection system and the methods of allocating budgeted funds. Although PARPA II calls for an increase in internal revenues in real terms, it still expects to continue to rely on the contribution of foreign donors to finance about 49 percent of the state budget every year during the period.

For these purposes, PARPA II formulated three pillars, comprising good governance, investment in human capital and economic development.

The improvement of the transportation system is part of the third pillar of economic development through improved connections between cities and provinces. The rehabilitation and maintenance of roads and bridges will be also continued in order to improve mobility and reduce vehicle operating costs (VOCs).

1.2 Features of the Sector

1.2.1 General

The Road Sector Strategy 2007-2011 (RSS) presents the main elements of the Government of Mozambique's (GOM's) strategy for developing and managing the classified road network. The RSS adds a level of detail to the GOM's Road Sector Policy to establish the main principles, approaches, and activities.

The RSS takes into account a medium to long term perspective, however it includes 5-year horizon investment plan, reviewed and revised for implementation on a 3-year basis which in turn is adjusted annually, considering needs and budget constraints.

The road sector national objectives, as stated in the RSS, aim at achieving the following objectives through the improvement of the road network:

- Ensuring the social and economic mobility necessary for promoting growth, and
- Fostering regional development by providing secure road links to all areas of

the country.

The RSS also prioritizes roads providing access to Mozambican ports and to international border crossings, thereby contributing to investment in international transportation services. Prior road networks in this category include:

- Beira Corridor (N6), linking Mozambique to Zimbabwe
- Tete Corridor (N7), linking Mozambique to Malawi
- Nacala (N13) and Montepuez (N14) Corridors, linking the north of Mozambique to Malawi
- Ngomane and Metangula corridors, linking the north of Mozambique to Tanzania
- Quelimane Corridor, linking Quelimane port to southern Malawi

As mentioned above, the Nacala corridor forms part of the priority road links, offering a short route to Nacala port for Malawi and Zambia.

Improving the secondary and tertiary road network is also a main target of the RSS. It is expected to provide economic opportunities to rural populations. Since these roads have low traffic volumes, their rehabilitation can be justified using low-cost labour-intensive construction and maintenance methods. Such methods have proved very effective under the previous Feeder Roads Programme and have the added advantage of generating employment opportunities to the rural poor. Furthermore, the upgrading of a coherent regional road network would promote decentralized decision-making through improved mobility.

The specific objective of the Integrated Road Sector Program (PRISE) is to establish an action plan for the road sector under RSS. Under PRISE, sector planning, finance, implementation, monitoring and evaluation are fully integrated.

The programme is developed to be in line with the priorities and objectives of the Government of Mozambique Road Sector Policy, PARPA, Medium Term Expenditure Framework (MTEF), and RSS. PRISE enables the GOM to guide the road sector and monitor its performance to ensure that it supports the Government's main objectives of poverty reduction and balanced economic development. It will also facilitate managing sector expenditures and intersectoral balance by bringing all activities on-budget.

PRISE is reviewed and revised every six months by the Semi Annual Work Plan and Budget (SAWPB).

1.2.2 Road Investment Plan under the PRISE

The current investment plan for the road sector is formulated based on PRISE 2009 - 2011. The PRISE 2009 - 2011, adopts a sector wide approach for the first time as it aims to embrace current thinking in the application of external assistance to the country. In line with the recommendations of the Paris Declaration on Aid Effectiveness, the PRISE represents a comprehensive program of activities for the road sector and promotes the harmonization of

external financing. It represents an ambitious program of road and bridge rehabilitation and upgrade while securing sufficient funds for maintaining the network. Guided by the Road Sector Strategy 2007 – 2011 the PRISE will continue the process of strengthening capacity in the provinces to manage the classified network and also the capacity of the National Road Administration, ANE to plan and implement the important steps in the development of the road network as a whole.

For this purpose, the following work plan briefly describes the activities to be undertaken, implemented, or procured during the above-mentioned period.

Table 1.2.1 Budget Plan for the PRISE 2009-2011 (Unit: Mil. Mt)

Code	Description	2009	2010	2011
10000	Operating Costs and Administration	528	544	560
20000	Capacity Building and Studies	154	131	164
21000	Technical Assistance	58	76	68
22000	Consultancies and Studies	72	31	72
23000	Training	14	14	14
24000	Private Sector Support	10	10	10
30000	Maintenance of Roads and Bridges	2,811	3,569	3,893
31000	Urban Roads Maintenance	188	202	217
32000	District Roads Maintenance	126	141	158
33000	Provincial Consultants	207	214	220
34000	Emergency Works	214	230	248
35000	Unpaved Road Maintenance	986	1,084	1,193
36000	Paved Road Maintenance	1,090	1,697	1,857
36100	Paved Road Routine Maintenance	408	420	433
36200	Paved Road Periodic Maintenance	652	1,250	1,400
36300	Engineering Services for Paved Periodic Maintenance	30	27	24
40000	Construction and Rehabilitation of Bridges	1,807	1,158	1,150
41000	Construction of Bridges	1,338	650	618
42000	Rehabilitation of Bridges	469	493	517
43000	Preparation of Bridge Projects	-	15	15
50000	Road Rehabilitation and Upgrading	3,697	4,625	5,135
51000	Rehabilitation and Upgrading of Regional Roads	614	950	1,350
52000	Rehabilitation and Upgrading of National Roads	3,042	3,600	3,708
53000	Preparation of Designs for Road Rehabilitation and Upgrade	41	75	77
60000	Road Safety	102	176	185
61000	Road Safety	40	62	66
62000	Axle Load Control	62	114	119
	Grand Total	9,099	10,202	11,088

*As of July 2009

Source: Road Fund

The budget codes that have been used coincide with those used by the Ministries of Finance and Planning and Development in the Government's financial

management system SISTAF.

1.2.3 Semi Annual Work Plan and Budget (SAWPB)

As mentioned above, the PRISE is reviewed and revised every six months by the Semi-Annual Work Plan and Budget (SAWPB). The work plan in Table 1.2.3 is provided in the “Semi-Annual Work Plan and Budget Q3 – Q4 2009” as 2nd semester plan for the PRISE. According to SAWPB, execution of the budget for paved road maintenance (code: 36000) and Rehabilitation and Upgrading of National Roads (code: 52000) is low compared to the budget plan for the 1st semester.

In addition, draft budget plan for the next fiscal year for the road sector was informed from ANE. According to the budget plan, in 2010 for road sector, approximately 60% of the budget plan depends on donor funds and local bank finance.

Table 1.2.2 Budget Plan for 2010 (Unit: Mil. Mt)

	Total	GOM	Donor	Others
Total	12,989	5,556	6,204	1,229
%	100	42	49	10

Source: Semi-Annual Work Plan and Budget Q3 – Q4 2009

Table 1.2.3 Summary PRISE Sources and Uses of Funds: 2nd Semester 2009 (Unit: mil MT)

Code	Description	Plan 2009 by PRISE	Uses				Sources								2010	
			1st Semester		2nd Semester		GOM		RF/SBS		Pooled Fund		DPs Earmarked		Plan by PRISE	Budget Demand
			Plan	Result	Time 3	Time 4	Time 3	Time 4	Time 3	Time 4	Time 3	Time 4	Time 3	Time 4		
10000	Operating Costs and Administration	528.0	276.7	260.8	137.5	138.1					2.8	136.0	135.3	1.5	544.0	589.9
11000	Staff Expenses		102.5	99.8	61.8	61.8						61.8	61.8			
12000	Operating Expenses		106.0	115.7	46.0	46.0						46.0	46.0			
13000	Infrastructure		36.4	7.7	18.2	18.2						18.2	18.2			
14000	Equipment		31.8	37.6	11.5	12.1					2.8	10.0	9.3	1.5		
20000	Capacity Building and Studies	154.0	56.4	45.9	52.8	52.5			2.7	2.7	11.5	11.5	38.3	38.3	131.0	215.0
21000	Technical Assistance	58.0	20.2	6.7	19.3	18.9								19.3	18.9	86.8
22000	Consultancies and Studies	72.0	22.4	31.5	24.6	24.7			2.7	2.7	7.3	7.3	14.6	14.7	31.0	96.6
23000	Training	14.0	8.6	7.7	6.4	6.4					4.2	4.2	2.2	2.2	12.0	27.0
24000	Private Sector Support	10.0	5.1	0.0	2.5	2.5							2.5	2.5	10.0	4.6
30000	Maintenance of Roads and Bridges	2811.0	1229.6	854.0	840.5	773.9			405.3	433.1	435.2	341.0			3569.0	3858.5
31000	Urban Roads Maintenance	188.0	93.8	91.0	46.9	46.9			46.9	46.9					202.0	219.5
32000	District Roads Maintenance	126.0	63.1	48.0	31.5	31.5			31.5	31.5					141.0	166.8
33000	Provincial Consultants	207.0	103.7	87.0	51.9	51.9			51.9	51.9					214.0	269.7
34000	Emergency Works	214.0	78.6	86.0	100.8	34.2			100.8	18.6		15.6			230.0	214.6
35000	Unpaved Road Maintenance	986.0	394.3	366.0	295.1	295.1			118.1	118.1	295.1	177.1			1084.0	1058.5
36000	Paved Road Maintenance	1090.0	496.2	176.0	314.3	314.3			174.2	166.1	140.1	148.3			1697.0	1929.4
40000	Construction and Rehabilitation of Bridges	1807.0	952.8	929.0	458.3	404.1	222.0	238.2					236.2	165.9	1158.0	820.2
41000	Construction of Bridges	1338.0	699.7	405.0	357.0	281.2	120.7	115.3					236.2	165.9	630.0	284.6
42000	Rehabilitation of Bridges	469.0	253.1	504.0	101.3	122.9	101.3	122.9							493.0	535.6
43000	Preparation of Bridge Projects		0.0	20.0	0.0	0.0									15.0	
50000	Road Rehabilitation and Upgrading	3697.0	1354.5	971.4	1189.3	1088.7	396.6	326.4					792.7	762.3	4625.0	7247.3
51000	Rehabilitation and Upgrading of Regional Roads	614.0	291.8	259.7	213.8	245.9	16.0	16.0					197.8	230.0	930.0	1422.1
52000	Rehabilitation and Upgrading of National Roads	3042.0	1062.7	711.7	955.0	822.3	375.6	305.4					579.4	516.8	3600.0	5735.2
53000	Preparation of Designs for Road Rehabilitation and Upgrade	41.0	0.0	0.0	20.5	20.5	5.0	5.0					15.5	15.5	75.0	90.0
60000	Road Safety	102.0	33.2	18.4	33.9	35.0					28.4	28.7	5.5	6.3	176.0	257.8
61000	Road Safety	40.0	14.5	18.4	12.0	13.1					6.5	6.8	5.5	6.3	62.0	191.0
62000	Axle Load Control	602.0	18.7	0.0	21.9	21.9					21.9	21.9			114.0	66.8
	Grand Total	9099.0	3903.1	3079.5	2712.3	2492.3	618.6	564.6	408.0	438.6	611.1	516.5	1074.5	972.8	10202.0	12988.7

Funding sources are indicated as follows:

- RF/SBS: funded by Road Fund revenues from road user charges and supplemented by DP contributions to sector budget support. Payments made out of specified accounts.
- PF: Pooled Fund, financed by IDA and Road Fund revenues from road user charges; payments made only through specified pooled fund accounts at Bank of Mozambique.
- GOM: funded by the Government of Mozambique investment budget through transfers from the Ministry of Finance to the Road Fund.
- DPs Earmarked: Donor Funds

1.2.4 Road Maintenance Programme

The Annual Programme of Activities of the Directorate of Maintenance has been established by the Directorate of Maintenance of the National Road Administration (ANE) under the plan and the budget based on the PRISE and the SAWPB.

In this programme, the following activities are defined as categories for road maintenance:

- Paved road maintenance: routine maintenance on critical sections, periodic maintenance and engineering services for paving.
- Unpaved road maintenance: routine maintenance, periodic maintenance and rehabilitation of regional road and unclassified road.
- Road safety: installation of road signs on paved roads, installation of reflectors, and rehabilitation of weighbridge, in addition, auditing of road safety.

Table 1.2.4 Budget Plan for the Annual Road Maintenance in 2009

Category	Activity	Distance (km)	Value (x10 ³ Mt)	Intervention Class
Paved Road Maintenance	Routine road maintenance	5,017	422,458	Provincial
	Repairing on critical section	833	553,656	Central
	Engineering Project	806	30	Central
Unpaved Road Maintenance	Routine maintenance	13,870	652,130	Provincial
	Periodic maintenance	308	54,458	Provincial
	Rehabilitation of Regional Roads	337	205,646	Provincial and Central
	- Rehabilitation of Regional Roads (Provincial Level-Road Fund)	139	78,934	
	- Reabilitação de Estradas Regionais (Central Level)			
	- Project of Kfw	163	88,965	
	- Project of NORAD	35	37,748	
	Regional roads and unclassified roads Upgrading	2,209	451,355	Provincial and Central
	- Regional roads and unclassified roads Upgrading (Provincial Level – Road Fund)	1,566	238,370	
	- Regional road upgrading (Central Level)			
	- Pilot project supported by (ASDI)	65	126,847	
	- Unclassified roads upgrading (DANIDA)	578	86,139	
Road Safety	Road signs on paved roads	731	83,172	Central

Source: ANE/DIMAN

1.3 Responsible Institutions for the Sector

1.3.1 Institutions

Major reforms of the road sector have been implemented in two phases since 1999. There has been a separation of the executive and management functions, which had been closely interrelated in the past. The National Road

Administration, governed by the Road Board, has been created. The establishment of the Road Fund as a separate autonomous body under the World Bank's Road Management Initiative has enabled dedicated funding for road maintenance to be collected by the Government in a sustainable manner.

Mozambique's road network is currently managed by the National Road Administration (ANE), which reports to the Ministry of Public Works and Housing. The Road Fund is responsible for managing the funds for the sector.

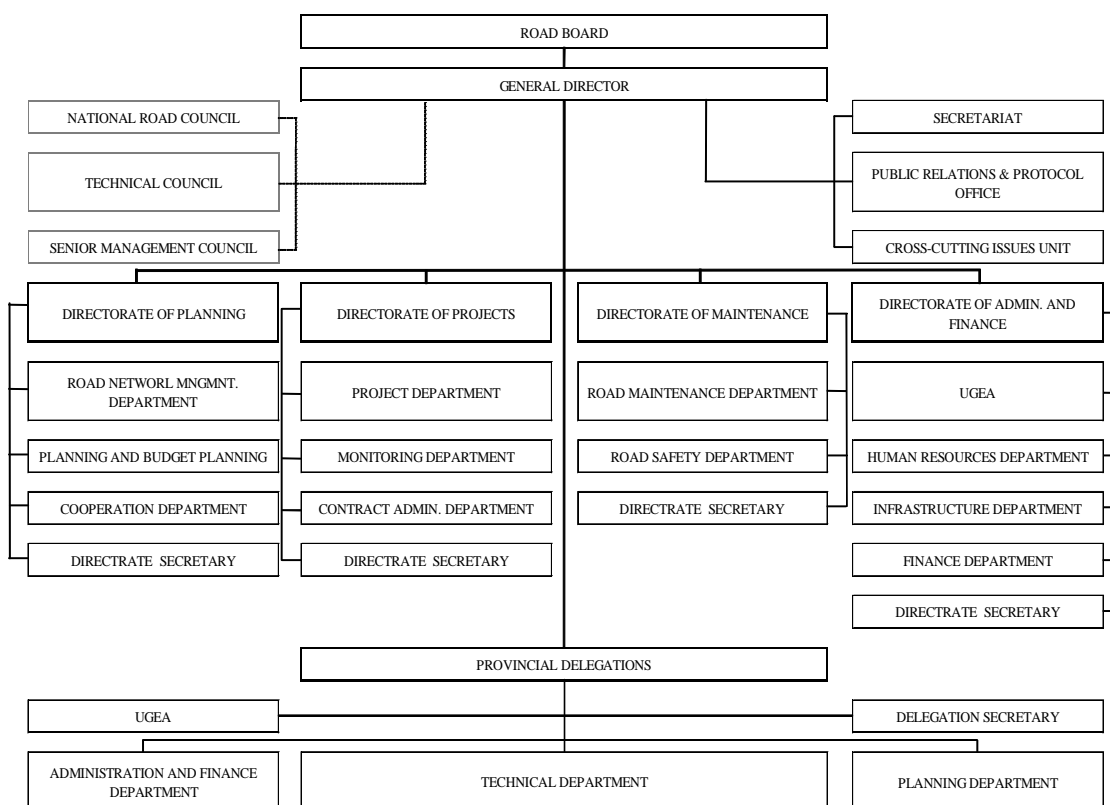


Figure 1.3.1 ANE's Organization Chart

1.3.2 Responsibility and Capacity for Implementation

The Directorate of Project (DIPRO) of the National Road Administration (ANE) is responsible for road implementation. ANE's Directorate of Projects has lengthy experience of managing road implementation projects such as feasibility study and design preparation for projects. Staff from ANE's Cross Cutting Issues Unit (GAT) have also managed the preparation of Environmental Impact Assessment, resettlement programme and social-economic impact monitoring for projects.

1.3.3 Responsibility and Capacity for Maintenance

Periodic and routine maintenance of primary, secondary and tertiary roads is under direct responsibility of the Directorate of Maintenance (DIMAN) and Provincial Delegation (DPANE) of the National Road Administration (ANE). Periodic and routine maintenance of urban roads is the responsibility of the municipalities with technical support by ANE's DIMAN.

The institutional responsibilities for the various classes of roads and type of road works are presented in Table 1.3.1.

Table1.3.1 Responsible Institutions for the Road Sector

Road class	Rehabilitation /Upgrading	Periodic Maintenance	Routine Maintenance
Primary	ANE / DIPRO	ANE / DIMAN	ANE / DIMAN/DPANE
Secondary	ANE / DIPRO	ANE / DIMAN	ANE / DIMAN/DPANE
Tertiary	ANE/DPANE	ANE/DPANE	ANE/DPANE
Urban	Municipal Authorities	Municipal Authorities	Municipal Authorities
District (vicinal)	ANE/DPANE District	ANE/DPANE District	ANE/DPANE District
Non-classified	District Beneficiaries	District Beneficiaries	District Beneficiaries

Chapter 2 Transport Sector and Related Parameters

2.1 Traffic Modal Split

2.1.1 Entire Country

Table 2.1.1 shows the traffic modal split for both goods and passenger transportation in Mozambique. In general, the road mode occupies a large share of both freight (58.2%) and passenger transport (96.1%) among all modes, particularly for passenger transport which is almost totally reliant on the road network. On the other hand, at 27.9%, contribution of the railway mode is relatively high for the freight transport. Marine transportation (8.3%) also contributes towards transportation of freight. The air mode only shares a low ratio for both goods and passenger transport due to lower transport capacity.

Table 2.1.1 Traffic Modal Split in Mozambique

Transportation		Road	Railway	Sea	Air	Pipeline
Goods (million TKM)	2004	950.7 (42.3%)	760.6 (33.8%)	279.1 (12.4%)	9.3 (0.4%)	248.3 (11.0%)
	2005	1,048.8 (46.8%)	762.8 (34.1%)	295.6 (13.2%)	7.4 (0.3%)	125.4 (5.6%)
	2006	1238.3 (53.8%)	775.1 (33.7%)	178.8 (7.8%)	6.0 (0.3%)	102.1 (4.4%)
	2007	1534.5 (58.2%)	736.3 (27.9%)	217.8 (8.3%)	8.1 (0.3%)	137.9 (5.2%)
Passengers (million PKM)	2004	20,906.2 (97.2%)	106.0 (0.5%)	29.8 (0.1%)	467.5 (2.2%)	-
	2005	23,909.7 (97.2%)	172.2 (0.7%)	18.5 (0.1%)	504.5 (2.1%)	-
	2006	26486.8 (96.3%)	342.3 (1.2%)	9.0 (0.0%)	662.3 (2.4%)	-
	2007	28769.6 (96.1%)	319.6 (1.1%)	9.4 (0.0%)	845.8 (2.8%)	-

Source: Statistical Yearbook

2.1.2 Niassa Province

In the national context, the province of Niassa is of the more deprived in infrastructural terms. Location of the province of Niassa is quite remote in relation to the main production and consumption centers of the country, particularly due to the poor interconnection of the access roads and transport system, which results in the precarious integration of the province in the national market. On the other hand, being a border province, it enjoys a relief program in the context of regional integration of Southern Africa.

The rail system of Niassa links to Nampula, namely, to Nacala Port through Cuamba, and to another direction, showing a poor drift line for Malawi. Nacala corridor is integrated by the above Nacala-Cuamba-Entrelagos line for 610 km and by the Lichinga line for 262 km. Earlier, the entire line was totally operational, but at present, the Cuamba-Lichinga line is not in good condition, providing a constraint to the development of the province.

Niassa province has a single airport with regular carriers, i.e. Lichinga airport which was categorized as an international airport equipped with immigration and

customs facilities in 2005, although it still requires rehabilitation and expansion of runway.

Table 2.1.2 Transport and Communications in Niassa

Mode	2006	2007	2008	Growth (%),08/07
Cargo(TKM)	5,299	8,594	11,371	32.3
Railway	1,711	4,784	6,390	33.6
Road	1,682	2,485	2,513	1.1
Sea	1,449	708	799	12.9
Air	457	617	1,669	170.5
Passenger(PKM)	695,957	559,827	861,530	53.9
Railway	N/A	N/A	N/A	N/A
Road	654,000	470,474	773,798	64.5
Sea	22,055	52,164	61,442	17.8
Air	19,902	37,189	26,290	-29.3

Source: DPTC Niassa, 2008

2.2 Road Classification System and Conditions

2.2.1 Road Classification System

The classification system of roads, which account for high ratios of both goods and passenger transport, is summarized in Table 2.2.1. The classified roads consist of national roads (primary and secondary) and regional roads (tertiary and vicinal roads). These roads are administrated by ANE. Urban roads and unclassified roads fall under the jurisdiction of the municipal councils and the district administrations respectively.

Table 2.2.1 New Road Classification System

Categorization	Designation	Functional Definition	Numbering
National Roads	Primary Roads	Form the national trunk road network and link: <ul style="list-style-type: none"> • Provincial capitals • Provincial capitals and other cities • Provincial capitals and main ports • Provincial capitals and important border posts 	(a): N1 to N100 (b): N101 to N199
	Secondary Roads	Form the secondary network complementing the trunk road network and link: <ul style="list-style-type: none"> • Primary roads • Provincial capitals and sea or river ports • Primary roads and economic poles of high importance • Primary roads and (other) border posts 	N200 to N399
Regional Roads	Tertiary Roads	Tertiary roads link: <ul style="list-style-type: none"> • Secondary roads with primary roads or with other secondary roads • District centres • District centres and administrative posts • District centres and economic poles of high importance 	R400 to R799
	Vicinal Roads	Vicinal roads link: <ul style="list-style-type: none"> • Tertiary roads • Administrative posts • Administrative posts and other population centres 	R800 onwards

(a): Roads that constitute major routes

(b): Other primary roads

Source: Final Report on the Reclassification of the Mozambique Road Network, 2003

2.2.2 Road Conditions

(1) Road Conditions in Mozambique

The current Mozambique classified road network is estimated at around 30,000 km of which less than 20% are paved. Of the paved roads, the majority were estimated to be in good to fair condition (88%), however only 57% of the unpaved roads were estimated to be fully travelable. A key element of the RSS and of the Strategic Maintenance Plan (SMP) is the introduction of a Paved Road Management Programme (PRMP), which will be managed separately from the rest of the road network. SMP takes care of the 30,000 km of the classified roads and an additional 3,000 km of urban road.

Table 2.2.2 Road Network in Mozambique (km)

Classification	Unpaved	Paved	Total
Primary	1,407 (4.8%)	4,459 (15.2%)	5,866 (20.0%)
Secondary	3,983 (13.6%)	809 (2.8%)	4,792 (16.3%)
Tertiary	11,645 (39.7%)	516 (1.8%)	12,161 (41.4%)
Vicinal	6,500 (22.1%)	30 (0.1%)	6,530 (22.3%)
Subtotal Classified	23,535 (80.2%)	5,814 (19.8%)	29,348 (100.0%)
Urban	2,500	500	3,000
Grand Total	26,035	6,314	32,348

Source: RSS 2007-11 Final Report (2006), P19

Table 2.2.3 Summary Road Conditions

Surface	Good	Fair	Poor	Total
Paved	65%	23%	12%	100%
Unpaved	17%	35%	48%	100%
- Fully Travelable	15%	28%	14%	57%
- Semi-Travelable	2%	6%	22%	30%
- Impassable	0%	1%	12%	13%

Source: RSS 2007-11 Final Report (2006), P3

* Fully travelable: road is open to "normal" traffic all year without closure.

Semi-travelable: road is closed to "normal" traffic intermittently during rainy season.

Impassable: road is closed to "normal" traffic during most of the year.

(2) Road Conditions in Niassa Province

As shown in the tables below, the road network of Niassa is formed by the total length of 7,690 km, composed of the primary road (870 km), secondary (1,420 km), tertiary (1,208 km), and no classified (local, 4,570 km). National roads are N 14 linking Lichinga and Pemba, N 13 linking Lichinga and Nampula, N 360 tying Cuamba and Marrupa and N 361 that ties Lichinga and Metangula. Most of the roads of Niassa, namely the tertiary ones, are of gravel earth surface. They are usually in travelable condition between April and December. Of the 7,690 km of the road network of Niassa, 4,000 km is in good travelable (52%) condition, 2,072 km in normal (27%) condition, 1,576 in bad condition (20%) and the remaining ones 1% are impassable. In spite of the progresses reached in the last few years, particularly in the southern part of the province, many roads of normal and bad condition are impassable in the rainy period due to the precarious condition of the respective bridges on the roads.

Table 2.2.4 Outlook of Roads in Niassa

Class	Total Length (km)	Good	Normal	Bad	Impassable
Primary	870	870	-	-	-
Secondary	1,042	573	62	407	-
Tertiary	1,208	750	111	305	42
Local	4,570	1,807	1,899	864	-
Total	7,690	4,000	2,072	1,576	42
Percentage		52%	27%	20%	1%

Source: DPOPH Niassa, 2007

2.2.3 Vehicle Ownership

In 2007, Mozambique has an estimated 208,546 vehicles, of which the South Region accounts for a large share (76.5%), followed by the Central Region which accounts for about 14.7%. The South Region also shows the highest average annual increase over the period 1998 – 2007 (almost 15%). In the North region, although the average annual increase is approximately 3%, Niassa Province exceeds Mozambique's average (11.2%).

Table 2.2.5 Growth of Registered Vehicles

Unit: Number of vehicles

Year	North Region			Central Region	South Region	Mozambique
	Niassa	Cabo Delgado	Nampula			
1998	757	2,925	10,104	20,719	45,821	80,326
1999	1,001	2,711	10,509	23,080	62,791	100,092
2000	1,198	2,822	10,722	24,115	68,871	107,728
2001	1,196	2,856	10,707	24,701	74,816	114,276
2002	1,201	2,950	10,875	25,983	85,174	126,183
2003	1,434	2,986	11,002	27,122	91,742	134,286
2004	1,510	3,093	11,348	27,888	107,882	151,721
2005	1,653	3,189	11,931	28,764	125,064	170,601
2006	1,786	3,324	12,326	29,517	145,789	192,742
2007	2,050	3,407	12,904	30,669	159,516	208,546
Average Annual Trend (1998-2007)	3.2%			4.5%	14.9%	11.2%
	11.7%	1.7%	2.8%			

Source: Statistical Yearbook 2005-2007

2.2.4 Traffic Accidents

In Mozambique, traffic accidents are serious social issues and have even been debated in Congress. The number of deaths shows the high average (approximately 9.0%) and increasing annual rate over the period 2005 – 2008. Additionally, the deaths per 10,000 motor vehicles in Mozambique are high level compared to other countries.

The main causes of the accidents are analyzed as follows:

- Speeding

- Unreasonable overtaking
- Drink-driving
- Careless crossing by pedestrians
- Poor maintenance of vehicles
- Inadequate transport safety such as excess cargo

Table 2.2.6 Number of Traffic Accidents

	Number of				
	Accidents	Deaths	Seriously-injured	Slightly-injured	Damage Accidents
2005	5,636	1,183	3,327	4,087	4,653
2006	5,122	1,295	3,179	3,516	4,227
2007	5,411	1,502	3,473	3,592	4,677
2008	5,438	1,531	3,508	3,799	4,967

Source: PRM/INAV, 2009

Table 2.2.7 Deaths per 10,000 Motor Vehicle

Mozambique	South Africa	Swaziland	India	U.S.A	Japan
72.2*	16.8	43.8	2.3	1.8	0.62

*Year 2007

Source: Study Team

Chapter 3 Macro-Economic Backgrounds

3.1 Demography

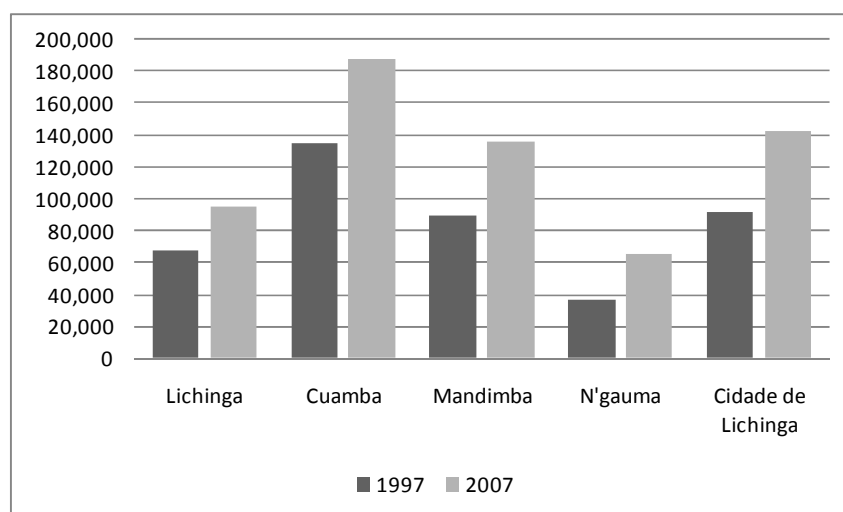
The basic statistics for any transport analysis are population, because the demand for transport is a function of the demand for goods and services by the people living in the project area. Statistics on the population to be served by the project road were obtained from the 2007 preliminary census and the projections from the Institute of National Statistics (INE.)

The total population was counted at 20,530,714 in the 2007 census, with a population growth rate of 2%. The population density is 2.16 inhabitants per km² and 60 % live in rural areas. The population of the four Northern provinces (Niassa, Nampula, Cabo Delgado and Zambezia), at around 10 million persons, is about 50% of Mozambique's total population of 20 million. The majority (74%) of the population in the four Northern provinces lives in Zambezia and Nampula, which account for nearly 40% of Mozambique's total population.

Similar to other provinces of the country, the population of Niassa Province is distributed unequally. The urban areas and the locations along the principal accessible have concentration of population, while the interior zones have less concentration of people. According to the 2007 population census, 23% of Niassa's population resides in urban areas and 77% in rural areas. The project area of direct influence contains 54% of the population of Niassa.

Population is concentrated at each end of the project road in Lichinga and Cuamba of Niassa province which has a low population density compared to the country as a whole (10.0 hab/ km² versus 21.6 hab/ km² for Mozambique), and the population in the intermediate areas is rather low. Districts of Mandimba (31.1 hab./km²), Lichinga (23.4 hab./km²) and N'gauma (27.0 hab./km²) are densely populated. Most of the people living in this region are previous inhabitants who returned to the area after the peace accords. The rates of population growth also vary considerably between the districts. The highest rates are Mechanhelas followed by N'gauma, with over 6%.

A major portion of the population in Niassa practices Islam (61.4%), followed by Catholic Christians (23.5%) and small pockets of practitioners of other indeterminate Christian religions (6.2%) and Protestants/Evangelists (3.7%).



Source: INE

Figure 3.1.1 Population of Niassa Province

In general, the population of Niassa is predominately young, with 47.1% less than 15 years old. The population older than 65 corresponds to merely 2.5%. In the rural areas of Niassa Province, most of the labor force is involved in agriculture (87.9%). Even in urban areas, 64.5% of the population works in agriculture.

3.2 GDP and Macro-Economic Background

The IMF Country Report in February 2009 stipulates that Mozambique is meeting the macroeconomic objectives of its medium-term development strategy, and is also expected to meet the program targets for end-December 2008, except for the one on reserve money, for which the government proposes a modification to accommodate the impact of higher import prices on inflation. The external environment has presented Mozambique with major challenges. Higher fuel and food import prices in mid-year increased inflation and exposed social vulnerabilities.

To mitigate the social impact, the government introduced additional measures in June, which were financed by cuts in non-priority expenditures and additional aid. Output in 2008 has also been adversely affected by disruptions to energy supply, mainly to the aluminium industry, Mozambique's primary exporter.

Mozambique is vulnerable to the global financial crisis and economic slowdown. Lower import prices will help to reduce inflation and likely benefit the trade balance. However, lower export volumes and reduced private capital inflows are expected to reduce economic growth.

The turbulence could also spread to the financial system despite its limited integration into global financial markets. The government's policy response will need to be carefully tailored to the specific nature of the shock and its impact on domestic demand.

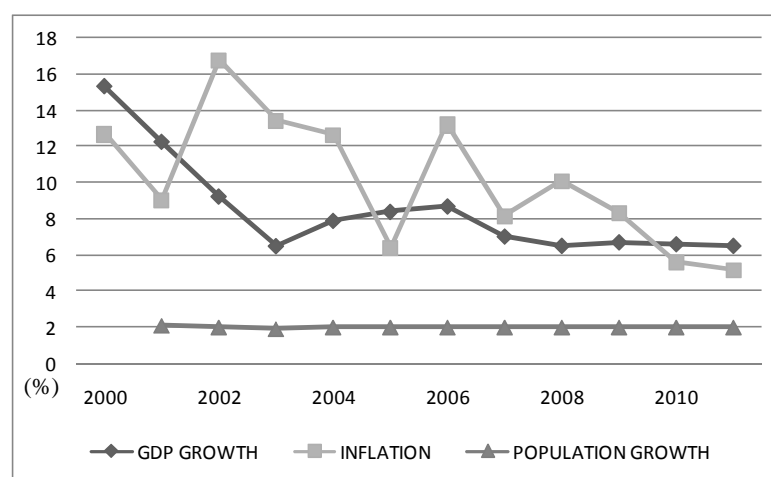
Economic prospects remain strong, but have weakened. Projections for real GDP growth, have been reduced for both 2008 and 2009. However, as international prices decline, inflation should return to single digits in 2009 and beyond.

The government remains committed to prudent fiscal and monetary policies. The fiscal program for 2009 targets a domestic debt repayment of about 0.1 percent of GDP, providing space for a continued significant expansion of private sector credit within an appropriate monetary policy. External reserve import coverage at the end of 2009 will remain comfortable at about 4.5 months of imports.

The government is maintaining the momentum of structural reform. The government is focusing on strengthening policy operations, giving special attention to the tax system and public financial management. The Bank of Mozambique is working to improve policy formulation and implementation and to deepen financial markets. The government is also focusing on reforms to support private sector development, management of the country's natural resources, and public sector governance.

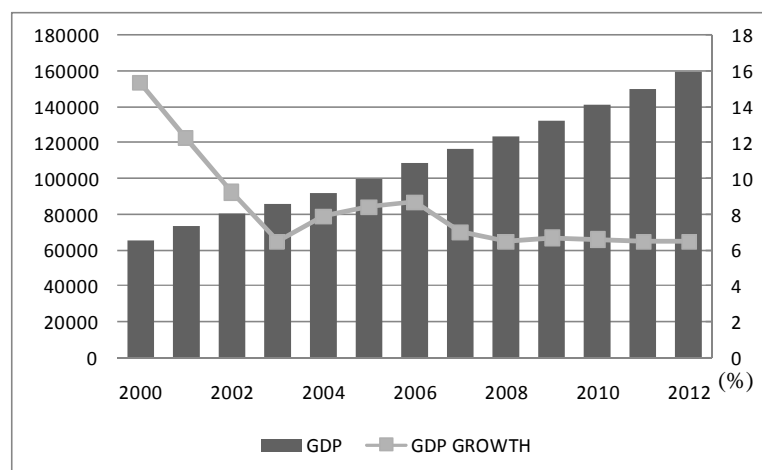
The joint IMF-World Bank debt sustainability analysis indicates that the risk of external debt distress remains low. However, total public debt, including domestic debt, could rapidly become unsustainable if a large primary deficit persists, or if output growth slows significantly and permanently.

The following graphs show the macro-economic indicators of the country.



Source: INE

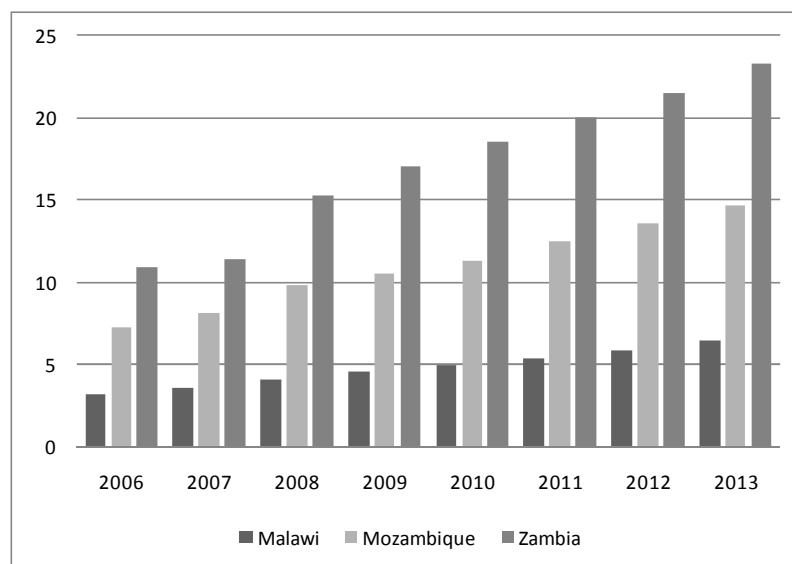
Figure 3.2.1 Macro Economic Indicators



Source: INE

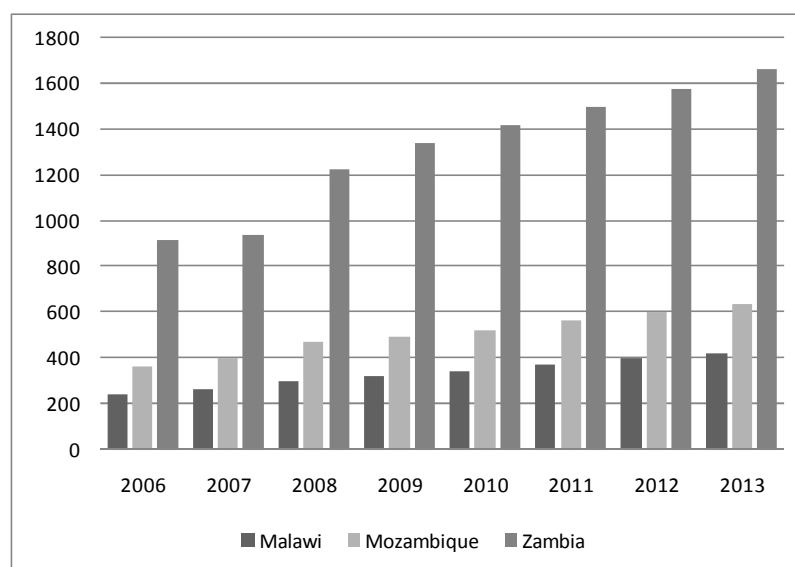
Figure 3.2.2 GDP Forecast (bil.MT)

The concept of the Nacala Development Corridor (NDC) has been derived jointly by the governments of Malawi and Mozambique in order to exploit the significantly under-utilized natural resources present in the two countries. More recently the Zambian Government has indicated its desire to join the initiative, and as such the Eastern, Northern and even parts of the Central Province of Zambia should be regarded as part of the NDC in that they constitute an important hinterland to the NDC. In this connection, macro-economic indicators for those three countries are shown hereunder.



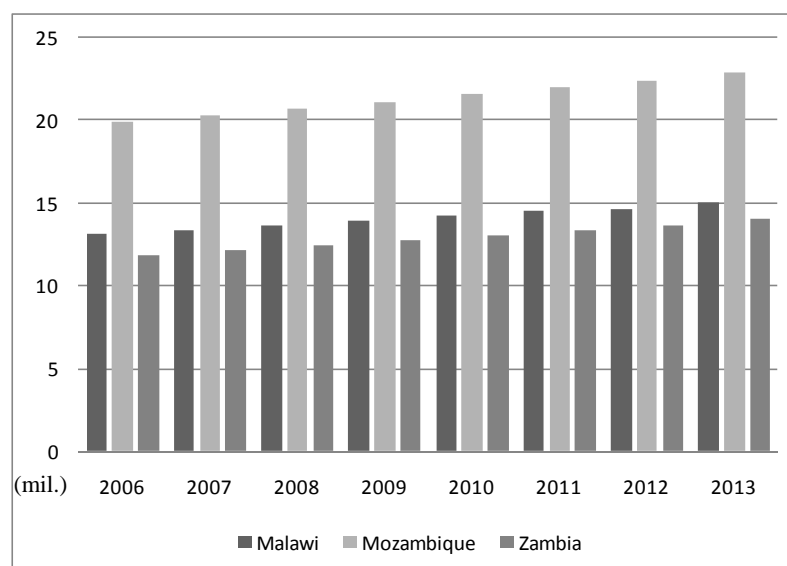
Source: INE

Figure 3.2.3 GDP (bil.US\$)



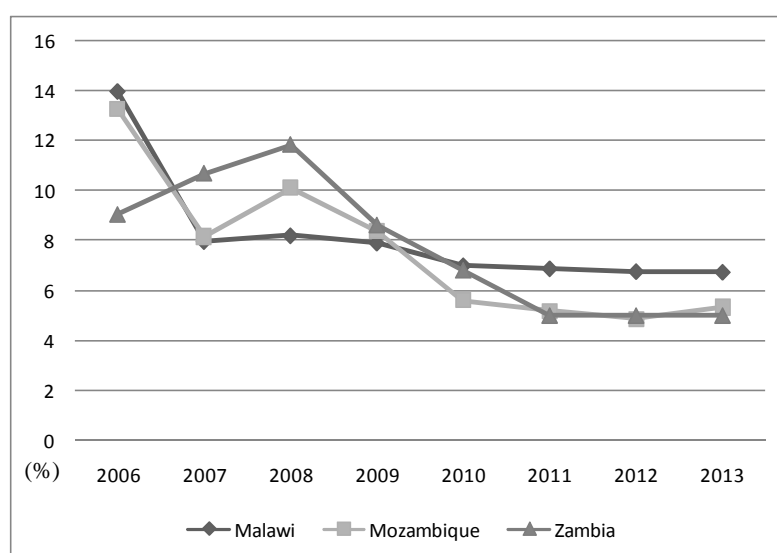
Source: INE

Figure 3.2.4 GDP/capita (US\$)



Source: INE

Figure 3.2.5 Population (mil.)



Source: INE

Figure 3.2.6 Inflation Ratio

The present structure of the economy in the four Northern Provinces is made up of agriculture, tourism, forestry production and fishing. As for agriculture production, cassava and maize are the predominant crops produced in each of the four Northern Provinces followed by beans, and sorghum, rice and millet. Export-oriented cash crop production is led by tobacco in Niassa and groundnuts in Cabo Delgado, Nampula, and Zambezia Provinces. Livestock production in the Northern Provinces includes three types of cattle, pigs and chickens. Production of chickens and livestock poultry is led mainly by Zambezia and Nampula provinces.

Niassa's economy is predominated by agriculture which contributes, on average, 36% of the GDP, constituting the main source of employment and subsistence. Farmers practice on merely 2.4% of the 12.3 million hectares of arable land existing in the province. Combined, agriculture, forestry and livestock contribute more than 80% of Niassa's GDP. Other important sectors of activities are energy, communications, and mineral mining.

The economy of Niassa Province has been growing rapidly. Since 1996, the annual real average growth rate for Niassa's GDP was 10.6%, bigger than 8.2% for the entire Northern region of the country. In this period, Niassa's GDP per capita also grew fast reaching an annual average of 7.4%, which was above the national average 5.8%. In 2006, Niassa's GDP was about \$180 million or about 2.5% of the national GDP, similar to 2.6% in 1997. At the level of the northern region of the country, Niassa's economy share went up from 12% in 1996 to 15%. As of 2006, Niassa's economy gained impetus from fast growth in agriculture, livestock and forestry (19.3%), fishing (29.8%) and mineral resources (25%) and construction (2.11%). Consequently, it grew by 13.3% against 1996, more than 8% for the national economy.

Most agricultural production is destined for self-consumption while the surplus is sold to pay school costs for children and health care expenses and buy basic goods such as sugar, soap, salt, clothing, matches, edible oil, and other items indispensable to people's daily life. Besides agriculture, the people of Niassa also do other activities such as hunting, raising goats and chickens, small businesses, and fishing on a small scale,

Table 3.2.1 Structure of GDP in Niassa

Sector	GDP Value (1,000 MT at Constant prices in 2005)		Structure (%)		Growth rate (%)
	2005	2006	2005	2006	
Agriculture, livestock and forestry	3,766,902.0	4,492,646.4	83.04	87.41	19.27
Fishing	4,515.0	5,861.3	0.10	0.11	29.82
Mineral mining	268,000.0	335,000.0	5.91	6.52	25.00
Energy and fuels	467,982.1	279,317.4	10.32	5.43	-40.31
Construction materials	509.0	1,339.0	0.01	0.03	163.06
Construction	596.7	609.3	0.01	0.01	2.11
Transportation and communication	27,528.4	25,207.5	0.61	0.49	-8.43
Total	4,536,033.2	5,139,980.9	100.0	100.0	13.31

Source: PEP Niassa 2017

