National Roads Administration
The Republic of Mozambique

PREPARATORY SURVEY
ON
THE PROJECT FOR CONSTRUCTION OF BRIDGES
ON
N380 IN CABO DELGADO PROVINCE

PREPARATORY STUDY

July 2016

JAPAN INTERNATIONAL COOPERATION AGENCY

CHODAI CO., LTD.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the Preparatory Survey and entrust the survey to CHODAI Co., Ltd.

The survey team held a series of discussions with the officials concerned of the Government of Mozambique, and conducted a field investigation. As a result of further studies in Japan, the present report was finalized.

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

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

July, 2016

Akira NAKAMURA
Director General,
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SUMMARY

(1) Overview of the Recipient Country

The Republic of Mozambique (hereinafter “Mozambique”) is located in the southern part of Africa and is surrounded by Tanzania, Malawi, Zambia, Zimbabwe, Swaziland and South Africa. Moreover, Madagascar and the Comoros are located across the Mozambique Channel.

Mozambique has a total land area of approximately 799,000 km^2, which is about twice the size of Japan. The country extends from north to south and has an approximately 2,500km long coastline facing the Indian Ocean. The costal area and its hinterland make up 44% of the total land area, while the plateau in the west (200-600 m above sea level) occupies 29% and a highland (about 1,000 m above sea level) 27% of the total.

The total population in Mozambique is 24,580,000. The country has a GNI per capita of 470 USD, and the rate of economic growth was 7.0% in 2011. Economic growth has been increasing by 7-8% per year thanks to innovations in infrastructure and strong foreign investment.

(2) Background of the Requested Japanese Assistance

The northern part of Mozambique has abundant natural resources and much potential for agricultural development, but infrastructure development is lagging behind due to the effects of the civil war. In particular, only 21% of the roads in the country are paved, and the Mozambique government has therefore started to make new investments and carry out road maintenance which it ranks as an important issue.

The Mozambique government prioritizes especially the five northern provinces (Cabo Delgado, Tete, Nampula, Zambezia and Niassa), also known as the "Nacala corridor area," and has requested Japan to provide general support for them.

Cabo Delgado Province has both the Mtwara corridor in the north, which is linked to Tanzania and Malawi, and the Nacala corridor in the south, which is the most important area for Japanese assistance. National Highway No. 380 (hereinafter “N380”) is an important road which links both corridors to the road network, and also an important national highway which provides smooth access to development projects in the Rovuma basin.

The ratio of bridges in need of reconstruction to the number of existing bridges in Cabo Delgado Province is high, especially since some bridges were washed away by flooding in March 2014. The bridges on N380 are temporary Bailey bridges and thus have problems with safety, durability and capacity. They are now disturbing traffic flow and have become a serious bottleneck for traffic.

Against this background, the Mozambique government has requested the Japanese government for grant aid for the replacement of 8 bridges and expects the projects to be implemented immediately.

(3) Summary of the Survey Findings and Project Contents

The Japanese government decided to conduct the Preparatory Survey on the Project for Construction of Bridges on N380 in Cabo Delgado Province, and JICA dispatched a Preparatory Survey Team to Mozambique between February and March 2015. The Team then prepared a Summary Report based on the field survey and subsequent studies carried out in Japan. JICA dispatched the Team to Mozambique to present the Summary Report in May 2016, and based on the discussions held, the Mozambican side and the Japanese side confirmed and agreed on the contents of the design and the obligations of the Mozambique government for this Project. The Minutes of Discussion were signed by both sides in May 2016.

As part of the field study, various surveys were carried out on issues regarding the construction of the requested bridges, covering areas such as traffic, topography, geology, meteorology, hydrology, environment, social and economic issues, procurement and construction costs, etc. Based on the results of these surveys, it was decided to extend the lengths of Messalo I Bridge, Messalo III Bridge and Mapuede Bridge from their respective original lengths. The Catipusse, Muagamura, Muera I, Muera II and Mungoe bridges were excluded from the bridges scheduled for reconstruction since they exceeded the limits of the available grant aid.

An outline of the bridges and approach roads is shown in the table below.

No.	Bridge name	Bridge length (m)	Superstructure	Substructure	Foundation piles	Revised approach roads (m)
1	Messalo I	175	PCT girders	Abutments (inverted T-type), piers (wall type)	Concrete piles	545
2	Messalo III	140	ditto	ditto	ditto	520
3	Mapuede	35	ditto	Inverted T-type abutments	ditto	445

(4) Project Period and Estimated Project Cost

The planned overall project period is 40 months and consists of 10.0 months for the detailed design work and 30.0 months for construction. The project cost is estimated to be 92 million metical.

(5) Project Evaluation

1) Appropriateness

As a grant aid project, the bridge replacement project is appropriate from the viewpoint of poverty reduction and human security as mentioned below.

1-1) Vitalization of Agriculture

About 80% of the population in Mozambique is engaged in agriculture, with most living in poverty. It is therefore necessary to vitalize the agriculture in order to reduce the poverty in

Mozambique. It is thus important to develop the road network and construct access roads which provide connections to farms and markets.

The project will contribute to the development of the road network of N1 which is the longest road in Mozambique. The project will not only improve the transport capacity for agriproducts to cover all parts of the country, but will also have a significant impact on poverty reduction.

1-2) Safe River Crossings

Concentrated rainfall in a short period of time often causes flooding in the project areas, damaging roads and bridges.

Two of the bridges on N380 were swept downstream by a flood in 2014. Inhabitants around the bridges and users of N380 had to cross the river on foot until a bypass road near the bridge was completed. Dangerous animals live in and around the river, and flooding spreads diseases such as malaria and leads to epidemics. The Mozambique government has requested the temporary bridges to be replaced with permanent structures as soon as possible also from the viewpoint of human security.

1-3) Road Development Plan

ANE has prepared the master plan on road development with the Ministry of Public Works and Housing and the Road Fund. Formulation of a trunk road network is given high priority in the plan. Especially, development of longitudinal high-quality standard roads running north-south such as N1 are given high priority, and N380 is scheduled to become part of N1 in the near future. A smooth transportation system from South Africa to Tanzania through Mozambique can be secured by improving N380 and its surrounding roads, and development of the trunk road may bring many beneficial effects to the entire region.

The construction and rehabilitation of north-south longitudinal roads including N380 with high-quality standards is given the highest priority in the short- and middle-term plans, and the policy of the project therefore corresponds to the policy of road development in Mozambique.

1-4) Japan's Aid Policy

In accordance with the action plan provided by the Government of Japan (GOJ) for poverty reduction in Mozambique, GOJ has focused on the vitalization of the regional economy including corridor development to achieve poverty reduction by realizing sustainable economic growth using Mozambique's high potential.

Mozambique has some international ports which can be used also by landlocked countries such as Zambia and Malawi. Utilizing geographic characteristics is the most effective way to develop the infrastructure in corridors leading from ports to landlocked countries, and GOJ thus actively supports this.

Nacala Corridor which leads to the landlocked countries Zambia and Malawi from Nacala Port in Mozambique is recognized as a very important transportation route for rich minerals and energy in Mozambique and also has a high potential for agricultural development.

Therefore, GOJ has supported the development of infrastructure such as roads which connect the corridor with surrounding areas and bridges in the corridor.

Since the project is located within the area surrounding the corridor, implementation of the project is in alignment with Japan's aid policy.

2) Effectiveness

2-1) Quantitative Outputs

The following tangible effects are expected after the project has been implemented and an international and domestic logistics network has been developed.

2-1-1) Increase in Daily Traffic Volume

The traffic volume has been increasing by around 7.5% every year according to the traffic survey which ANE carried out between 2010 and 2014. The percentage of heavy vehicle traffic exceeds 60% on some sections of N380, and tends to be higher compared with other provincial roads. N380 is therefore recognized as an industrial road and the cost-effectiveness for road rehabilitation is high.

According to estimates of future traffic volume, the mean traffic on N380 will increase to 570 /12hours in 2022 from 344 /12 hours in 2015.

2-1-2) Reduction of Bridge Crossing Time

As all the existing bridges are one-lane bridges, vehicles have to stop in front of them and wait for on-coming cars to cross. Furthermore, there are bumps on each side of the bridges in order to prevent accidents because the road width on the bridges becomes narrow and changes from two lanes on the access roads to only one lane on the bridges. Vehicles therefore have to slow down to under 30km/h before crossing the bridges.

Once the bridges have been replaced by two-lane bridges, vehicles will not need to stop at the bridges to wait for on-coming cars and do not need to slow down before crossing. The time required to cross the bridges will thus undoubtedly be reduced.

2-1-3) Reduction of Road Closures during the Rainy Season

Two bridges on N380 – Messalo I Bridge and Messalo III Bridge – were damaged due to a flood in March 2014, and it took about 9 months to reconstruct the bridges. Vehicle traffic over both bridges had to be stopped during that period. When the targeted bridges and approach roads are replaced based on the development policy, only the roads between the bridges are likely to suffer damage if a flood similar to that in 2014 occurs again. In such a case, vehicle traffic will have to be closed only for the time it takes to rehabilitate the damaged roads which is less than one month.

2-1-4) Reduction of Travel Time

The bridges to be replaced are located on the Macomia – Oasse section of National Highway

No. 380. If a bridge collapses due to flooding, heavy vehicles must use a detour route which goes from Macomoa to the shore road. It currently takes about 80 minutes to drive on N380 from Macomia to Oasse, but if the Macomia – Mucojo – Oasse route is used as a detour, the trip may take as long as 300 minutes.

Index	Initial value (2015)	Target value (2022) [3 years after completion]
Traffic volume (traffic/12 hours)	344	570
Road closure period	9 months	0 months
Travel time for heavy vehicles	300 minutes	80 minutes

2-2) Qualitative Outputs

In addition to the quantitative outputs mentioned above, the following qualitative outputs are also expected.

2-2-1) Acceleration of Surrounding Area Development by Enhancement of the Road Network

Since N380 connects Nacala Corridor in Mozambique with Mtwara Corridor that runs through Tanzania, Malawi and Mozambique via N381, it is a very important national road from the viewpoint of the development strategy of Mozambique. There are natural gas development projects in offshore Rovuma and LNG projects are now being implemented in Palma in Cabo Delgado Province. N380 forms a very important part of the infrastructure also for these developments.

The expected benefits from replacement of the targeted bridges on N380 include reduction of travel time, mitigation of disaster risk and a decrease in traffic accidents near the bridges. These benefits will also enhance the road network in the northern region of Mozambique. Accelerated development not only in surrounding countries such as Tanzania and Malawi but also in the northern area of Cabo Delgado Province is to be expected.

2-2-2) Improvement of Fundamental Living Conditions

The transport conditions on N380 will be substantially improved because the risk of bridge collapse will decrease and N380 will become a two-lane road. Therefore, healthcare for the people living along N380 will be significantly improved because it will become easier to transport severely ill patients and to urgently procure medicine. Furthermore, the safety of upper grade elementary school students who cross the bridges on foot in order to go to neighboring schools will also be improved since the replacements for the targeted bridges are to be equipped with pedestrian lanes.

2-2-3) Reduction of Transportation Costs

Replacement of the bridges is expected to lead to a reduction of transportation costs since working hours can be decreased due to the increase in average vehicle speed and reduction of travel time.

2-2-4) Decrease in Traffic Accidents near the Bridges

According to people living near the one-lane bridges, there have in the past been some accidents where vehicles have fallen into the river because drivers often do not realize that the road width changes from 2 lanes on the approach roads to only one lane before the bridges. Such car accidents can be prevented by replacing the existing bridges with new two-lane bridges.

2-2-5) Mitigation of Disaster Risk

The existing bridges are temporary Bailey bridges. Although they were constructed only for temporary use, they have already been used for many years. The risk of a bridge collapse has increased because the bridge superstructures have been damaged due to the increase in traffic volume of heavy vehicles and the soil around the bridge foundations has also been eroded due to the increased streamflow during the rainy season.

The risk of a bridge collapse can be mitigated by replacing the bridges with stronger permanent structures.

2-2-6) Benefits for Impoverished People

Except for the people living in villages with markets such as Sunate and Macomia, almost all people living along N380 are self-sufficient and satisfy their own needs. They cultivate crops, make charcoal and timber and sell these at the sides of N380 to get money.

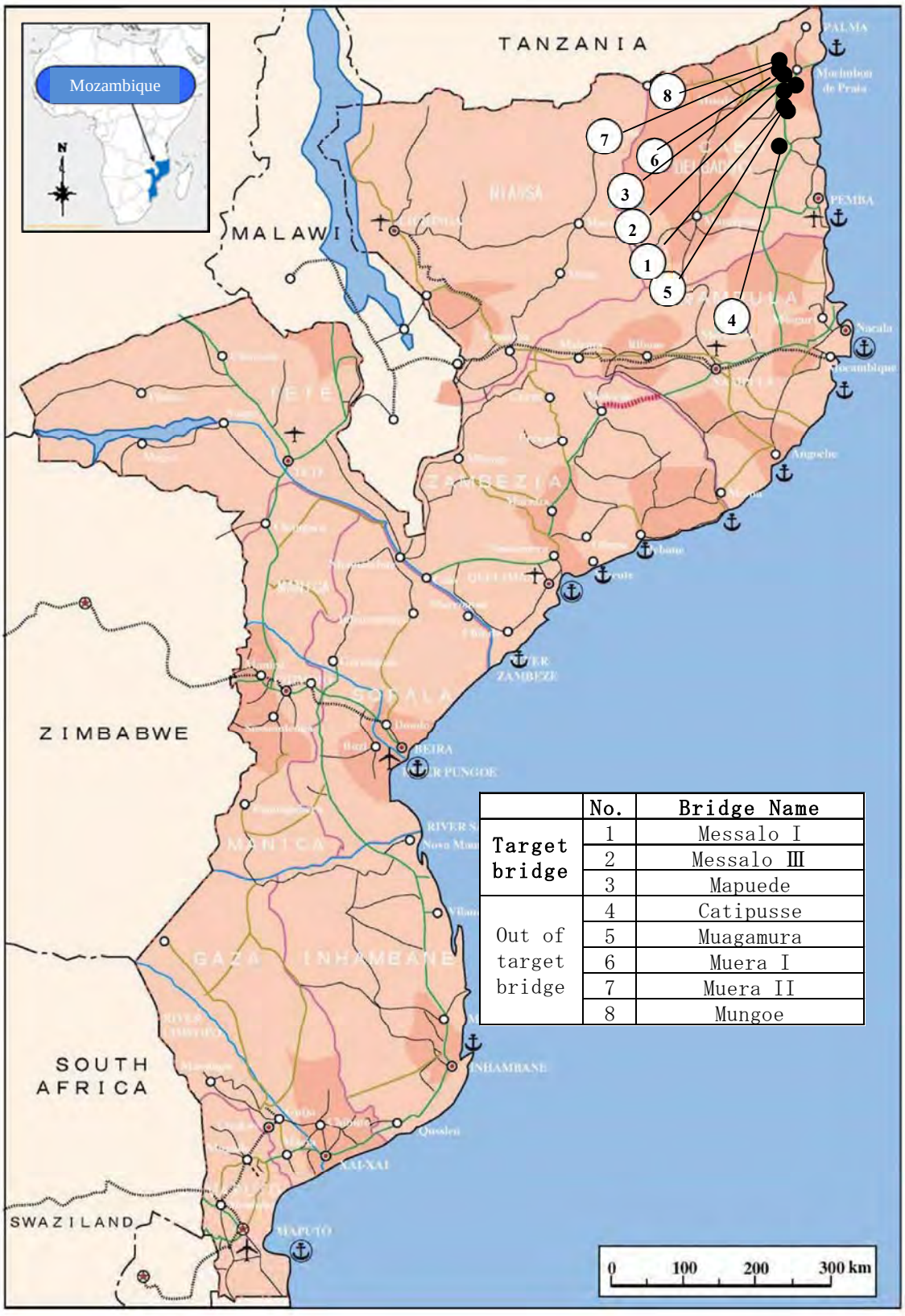
The traffic volume on N380 will increase once the bridges have been replaced.

With the increase in traffic volume on N380, sales of goods at the sides of the road is also expected to increase.

As described in the sections above, the implementation of the project is highly meaningful, appropriate and effective.

Contents

Location Map



	No.	Bridge Name
Target bridge	1	Messalo I
	2	Messalo Ⅲ
	3	Mapuede
Out of target bridge	4	Catipusse
	5	Muagamura
	6	Muera I
	7	Muera II
	8	Mungoe

List of Figures, Photos & Tables

(Figure)

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Abbreviations

ANE	National Roads Administration
AfDB	African Development Bank
CENACARTA	Centro National de Cartografia e Teledeteccao
CFM	Portos e Caminhos de Ferro de Mocambique
DAC	Development Assistance Committee
DNA	National Directorate of Water
EU	European Union
EIA	Environmental Impact Assessment
E/N	Exchange of Notes
FE	Road Fund
GNI	Gross National Income
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
HIV/AIDS	Human Immunodeficiency Virus /Acquired Immunodeficiency Syndrome
HIPC	heavily indebted poor countries
IEE	Initial Environmental Examination
JICA	Japan International Cooperation Agency
LNG	Liquid Natural Gas
M/D	Minutes of Discussions
MITADER	Ministry of Land, Environment and Rural Development
MOPH	Ministry of Public Works and Housing
NGO	Non-Governmental Organization
SADC	Southern Africa Development Community
SATCC	Southern Africa Transport and Communications Commission
PRSP	Poverty Reduction Strategy Papers
PARPA	Action Plan for the Reduction of Absolute Poverty
RAP	Resettlement Action Plan
ROW	Right of Way

CHAPTER 1
BACKGROUND OF THE PROJECT

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1-1 Current Situation

In 1975 after independence from Portugal, the Republic of Mozambique (hereinafter "Mozambique") entered into a 17-year civil war.

The war devastated the economic activity of the country and many social infrastructure facilities, including the road network system, were entirely destroyed. The civil war ended in 1992 with the conclusion of a peace treaty.

Only 16 % of the road network is paved (84 % is unpaved) because the Government of Mozambique could not maintain the roads during the civil war. Economic revitalization was hampered by the very poor road conditions and numerous unpassable roads.

The Ministry of Public Works and Housing (hereinafter "MOPH") was in charge of road administration in the past until the National Roads Administration (hereinafter "ANE") was established for maintaining the roads in 1999.

ANE carried out road rehabilitation under the Roads and Costal Shipping Project (ROCS) in order to rebuild the road network after the civil war.

ROCS included the international highway connecting Mozambique's ports facing the Indian Ocean to Malawi, Zambia and Zimbabwe, and the highway between Maputo, Beira and the main cities in the north of Mozambique.

The Roads and Bridges Management and Maintenance Programme (ROAD III) started in 2001 and was divided into three phases. Implementation of emergency works of roads and bridges and periodical repair of high-priority roads and bridges were carried out by 2010. Under ROAD III, highways linking major cities and access roads from local districts to the highway were maintained in order to improve the economic disparity between the southern and northern regions as part of local economic development activities.

The Road Sector Strategy (2007-2011) was devised in parallel to the implementation of ROAD III. ANE maintained high priority roads including the national corridor to establish the road network for activation of the social economy and local development.

The road network has been developed by many rehabilitation programs depending on the traffic conditions in Mozambique and the overall road length in Mozambique managed by ANE thus totals 30,330.7 km.

On the other hand, the pavement rate is only 21 % for the whole road network as shown in Table 1-1-1.

The total road length in Cabo Delgado Province is 2,937 km, with 770 km (26 %) of paved and 2,167 km of unpaved roads. A problem in Cabo Delgado Province is to improve the pavement rate and the following items would need to be urgently addressed.

1) Inefficient highway network
2) Lack of primary roads passing city centers
3) Insufficient length and number of bypasses
4) Non-existence of alternative routes
5) Insufficient road safety facilities for pedestrians and vehicles
6) Insufficient lanes and road width, poor alignment
7) Damage to paved roads due to chronic flooding

Table 1-1-1 Road Length List (km)

Province	Primary road		Secondary road		Tertiary road		Local road	
	Paved	Unpaved	Paved	Unpaved	Paved	Unpaved	Paved	Unpaved
Maputo	322.0	0.0	50.5	120.5	90.6	477.4	22.0	513.0
Gaza	280.0	0.0	99.0	653.0	181.0	920.0	14.0	564.0
Inhambane	558.0	0.0	60.0	206.0	61.0	1,078.0	4.0	881.0
Sofala	584.0	0.0	0.0	553.0	0.0	848.0	0.0	357.0
Manica	513.0	0.0	0.0	336.0	0.0	960.0	0.0	633.0
Tete	540.0	0.0	287.0	942.0	0.0	788.0	0.0	413.0
Zambezia	730.0	300.0	0.0	720.0	16.0	1,727.0	15.0	981.0
Nampula	559.0	448.0	0.0	181.0	22.0	1,987.0	0.0	864.7
Cabo Delgado	282.0	140.0	234.0	131.0	254.0	1,474.0	0.0	422.0
Niassa	376.0	367.0	107.0	240.0	42.0	1,836.0	0.0	966.0
Sub-total	4,744.0	1,255.0	837.5	4,082.5	666.6	12,095.4	55.0	6,594.7
	Paved total		Unpaved total		Total length			
Total	6,303.1	21%	24,027.6	79%		30,330.7		

Source: ANE Road Inventory

1-2 Background of the Project

The northern part of Mozambique has potential for development of natural resources and agriculture, but infrastructure development is lagging behind due to the effects of the civil war.

In order to improve the road pavement rate, the government of Mozambique has made new investment and maintenance in the road sector an important issue.

The government of Mozambique has designated the northern five province (Cabo Delgado, Tete, Nampula, Zambezia and Niassa) as the "Nacala Corridor area" and has requested Japan for economic assistance.

Cabo Delgado Province has the Mtwara Corridor in the north which is linked to Tanzania and Malawi, and the Nacala Corridor in the south which is the most important area for Japanese

ODA. National Road N380 (hereafter referred to as N380) is an important road which links both corridors to the road network.

N380 is also an important national highway to ensure smooth access to the natural gas development project in the Rovuma basin.

On the other hand, the number of bridges which require reconstruction among the existing bridges in Cabo Delgado Province is high as some were washed away by flooding in March 2014. The target bridges are temporary Bailey bridges which lack durability and only have a single lane, making them a bottleneck which hampers smooth traffic flow on N380.

Against this background, the government of Mozambique has requested the Japanese government for grant aid for the replacement of 8 bridges and expects immediate implementation.

Table 1-2-1 Outline of the Project

Location	N380, Cabo Delgado Province, Mozambique
Overall goal	Economy and social development in north of Mozambique and neighboring countries (Tanzania, Malawi and Zambia) promoted by the improvement of transportation capability of National Road N380.
Objectives	The bridge construction project will contribute to the improvement of National Road N380.
Scope of work	Requested bridges: 1) Messalo I bridge 2) Messalo III bridge 3) Mapuede bridge 4) Catipusse bridge (outside scope) 5) Muagamula bridge (outside scope) 6) Muera I bridge (outside scope) 7) Muera II bridge (outside scope) 8) Mungoe bridge (outside scope)
Government office	Implementing agency: National Road Administration (ANE) Management agency: Ministry of Public Works and Housing (MOPH)

As part of the field survey, various surveys were carried out on issues regarding the construction of the requested bridges, such as issues related to traffic, topography, geology, meteorology, hydrology, environment, social and economic conditions, procurement, construction costs, etc. Based on the results of these surveys, the length of Messalo I and Messalo III bridge was extended from the requested length, and Catipusse, Muagamura, Muera I, Muera II and Mungoe bridges were therefore excluded from the construction scope since they exceed the scope of the grant aid.

1-3 Natural Conditions

1-3-1 Topographic Investigation

The project sites are located between 11-12 degrees south latitude and 40 degrees east longitude along N380. Figure 1-3-1 shows the schematic topographical profile of N380 from the south edge, and Sunate (the road start point) to Oasse (the road end point) at the north edge. N380 generally extends in the north-south direction, and the bridges are located in the hilly mountains (elevation 100-150m) and alluvial lowlands (elevation 45m) of the Messalo River.

As part of the field work, the following surveys were carried out at the bridge sites: topographical survey (establishment of bench marks, road & bridge surveying, river bed surveying). The results are shown in the appendices.

Source: Study Team (Edited from Google Earth)

Figure 1-3-1 Schematic Longitudinal Profile of N380

1-3-2 Geological Investigation

The geological map of N380 in Figure 1-3-2 shows that the road area is mainly composed of rock or sediment from four different geological periods.

a) Precambrian metamorphic rock (biotite gneiss, granitic gneiss)

The distribution range indicates the west-northwest side including the No.1 Catipusse area. The residual soil is sandy. The fresh portion and hard massive rock is used partly as a quarry site.

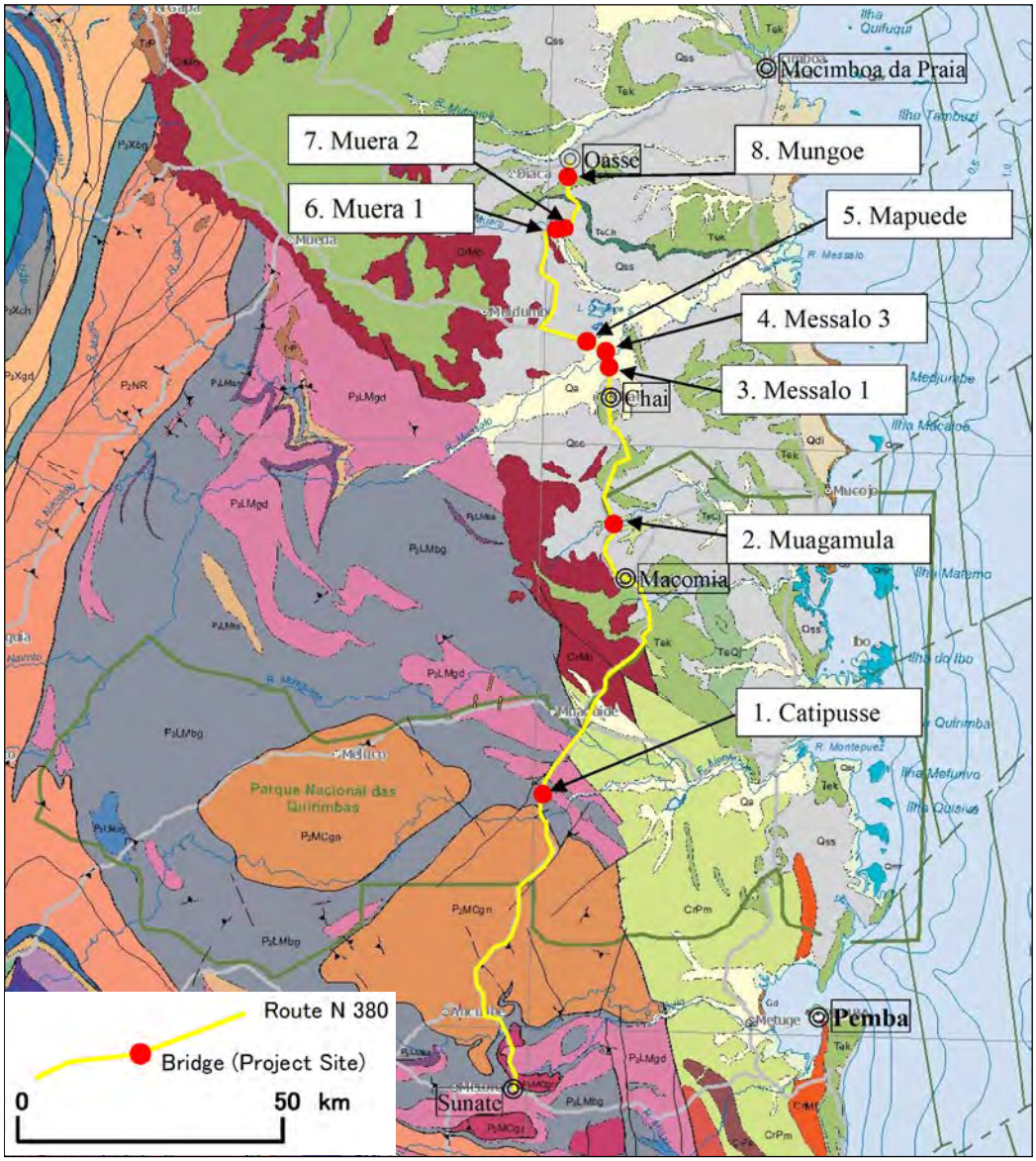
b) Tertiary (Neogene) sedimentary rock (sandstone, siltstone)

Distributed in the hilly mountains near Macomia, Chai and Oasse. Confirmed as bearing layer by geotechnical boring around the bridges. From a civil engineering geological point of view, the rock is evaluated as soft rock.

c) Quaternary unconsolidated sediments (Terrace deposits: sand including rounded gravel)
Fan-shaped Pleistocene terrace deposits are widely distributed in the northern area of Macomia. Very stiff silt and dense sand will be suitable as a bearing layer for the Messalo bridges.

d) Quaternary unconsolidated sediments (Alluvium: silt, sand, gravel, debris)
Distributed in the alluvial lowland of the Messalo River and valleys in the hilly mountains. The deposits are dominated by sand and silt with little gravel. The following was carried out at the bridges sites: geological survey (geotechnical boring with SPT, laboratory testing). The results are shown in the references.

L E G E N D			
Era	Period	Symbol	Sediments or Rock Name
Cenozoic	Quaternary	Qa	Alluvial deposit (silt、sand、gravel, debris)
		Qss	Terrace deposit (sand sheet with local gravel)
	Tertiary(Neogene)	Tek	sandstone, conglomerate, siltstone
Mesozoic	Cretaceous	CrPm	sandstone, marl, limestone, siltstone
		CrMo	coarse sandstone, pebble bearing sandstone
Precambrian		P3LMbg	biotite gneiss ┐ Complex rock masses
		P3LMgd	granitic gneiss ┘



Source: Geological Map of Mozambique, Scale 1:1000,000 (DNG: Geological Survey of Mozambique, 2011)

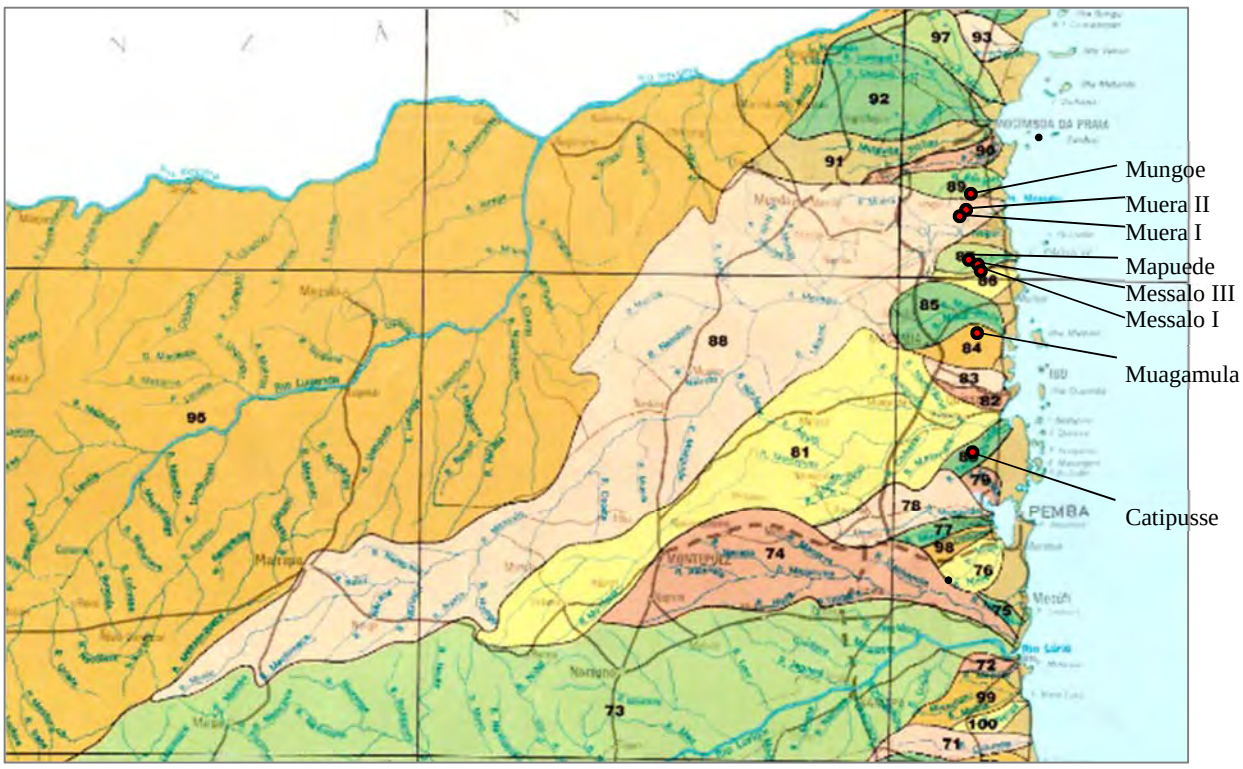
Figure 1-3-2 Geological Map of Study Area

1-3-3 Hydrological Investigation

The rivers located at the target bridges are natural rivers. The catchment area of Messalo River is about 24,000 km^2 and one of the largest rivers in Mozambique. Muera River is connected to Messalo River in the downstream region of N380 and belongs to the Messalo basin. Five of the bridges are included in the Messalo basin as shown in Table 1-3-1 and their catchment area is shown in Figure 1-3-3.

Table 1-3-1 Catchment Area List

	Requested Bridge	Basin	Remarks
1	Catipusse	Montepuez	Connected to Montepuez downstream
2	Muagamula	Muacamula	—
3	Messalo I	Messalo	—
4	Messalo III		
5	Mapuede		Diversion of river upstream
6	Muera I		Connected to Messalo downstream
7	Muera II		
8	Mungoe	Monga	—



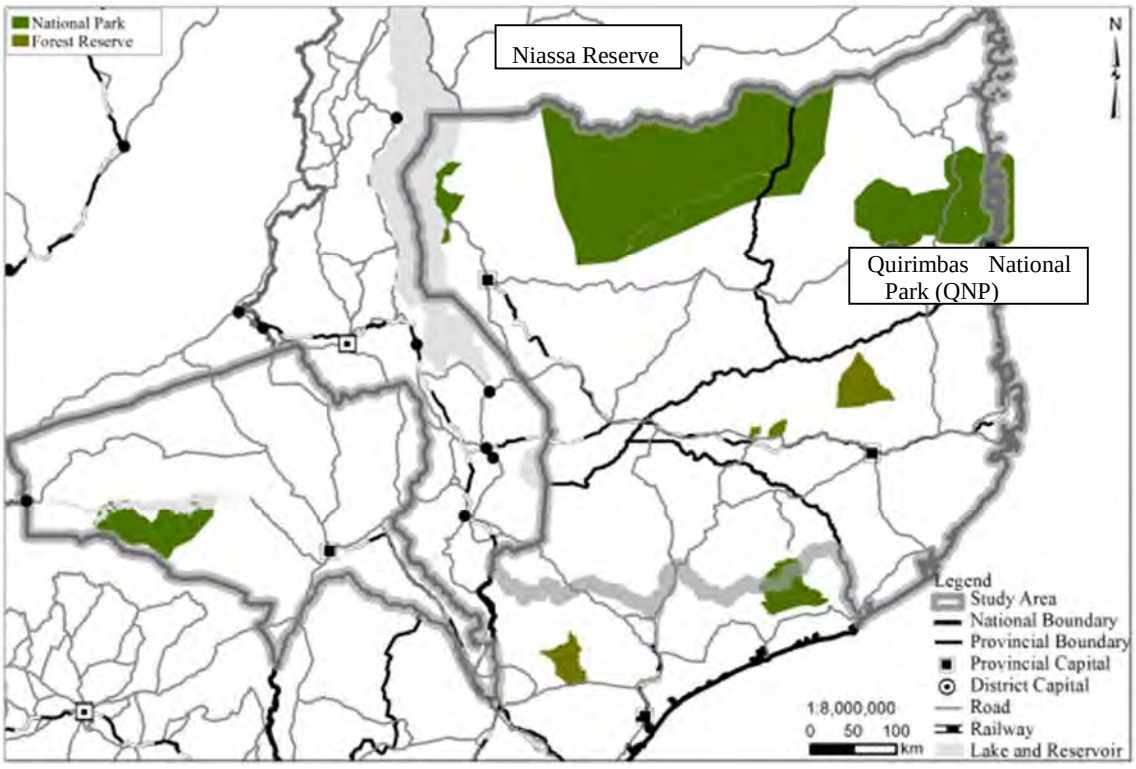
Source: DNA

Figure 1-3-3 Target Basin of Target Bridges

1-4 Environmental and Social Considerations

1-4-1 Current Baseline Environmental and Social Conditions in the Northern Area

One of the prominent environmental features around the study site is Quirimbas National Park (QNP, see Figure 1-4-1).



Source: Project for Nacala Corridor Economic Development Strategies

Figure 1-4-1 Important Ecological Areas in the Northern Part of Mozambique

QNP was created on 4th July 2002 (A = 750,639 ha or 1,854,870 acres) and mainly consists of mountainous areas, terrestrial forests, savanna, coastal forests, mangrove, sand beaches, islands and coral reef. Also, this national park is home to approximately 140,000 residents who have agreed to the declaration of the park which aims to conserve biodiversity for sustainable use and ensure current and future benefits for its residents as well as for the local community (WWF 2015). In addition to the national park, a buffer zone (width = 10 km) which surrounds QNP has also been created.

The entire region covering QNP and the buffer zone was isolated for decades during the Mozambique civil war. On land, there are healthy populations of elephants, lions, leopards, crocodiles and even wild dogs. QNP also has a rich variety of marine life including sea turtles, dugongs and many species of fish.

Around QNP, there are several important ecologically protected areas such as the Niassa Reserve and Selous Game Reserve (Tanzania). From an ecological point of view, such national parks and reserves can be regarded as parts or segments of one regional, continuous biological environment. Integrated protection approaches are therefore suitable for the conservation of these ecosystems. Recently, a comprehensive regional ecological protection and conservation program was implemented by WWF and other major environmental NGOs. Beside these national parks and reserves, the Greater Rovuma Landscape and the Quirimbas-Mtwarra and Niassa-Quirimbas Corridors are key ecological corridors which connect the national parks and reserves (see Figure 1-4-2).

Key ecologically protected areas in Tanzania

Ecologically protected area and nearby ecological corridor around the border between Mozambique and Tanzania

QNP and Niassa-Quirimbas Ecological Corridor

Area 5. Greater Rovuma Landscape
Area 6. Quirimbas-Mtwara Ecological Corridor

Figure1-4-2 Quirimbas National Park, Rovuma Landscape and Quirimbas-Mtwarra Corridor

Table 1-4-1 summarizes the statistics of ecologically protected areas and/or sites in Mozambique.

Table 1-4-1 Summary of Ecologically Important Sites in Mozambique (as of March 2014)

	Category	Number	Area (km^2)	Percentage (%) of the entire country
1	National Park	6	37,476	4.68
2	National Reserve	6	47,700	5.95
3	Game Controlled Area*	2	2,700	0.34
4	Hunting Area	12	50,017	6.24
5	Forest Reserve	26	9,452	1.18
6	Zones of use and of historic and cultural value	0	0	0
Total			147,345	18.38

*: Areas designated for setting-up facilities or lodging inside national reserves.

1-4-2 Local Flora/Fauna of Quirimbas National Park (QNP)

As mentioned earlier, continuous biological environmental studies of QNP are conducted by WWF, major international donors, local universities and institutes in Mozambique. Table 1-4-2 summarizes the inventory of local flora/fauna of QNP, prepared by Universidade Eduardo Mondlane, Maputo, Mozambique.

Table 1-4-2 Floral/Faunal Inventories of Quirimbas National Park (QNP)

Group	Number of species	Threatened species (IUCN, 2009)	Species protected by law (Rep. de Moçambique, 2002)
Mammals	46	6	13
Birds	447	1	12
Reptiles	23	1	1
Amphibians	10	*	*
Insects	750	*	*
Total	1018	7	26

Source: GRNB, 2010 / *: Data deficient

According to the results of studies conducted by CERU (Conservation Ecology Research Unit) in 2008 and 2009, it was found that several elephants migrate inside/outside of QNP. Figures 1-4-3 and 1-4-4 show their typical migration paths and locations obtained from the WWF field studies using telemetry. From these figures, it can be said that their migration paths and locations are densely located around the current Catipusse Bridge. In other words, this observation may indicate that their drinking points, feeding sites and/or habitats may be close to the existing Catipusse Bridge.

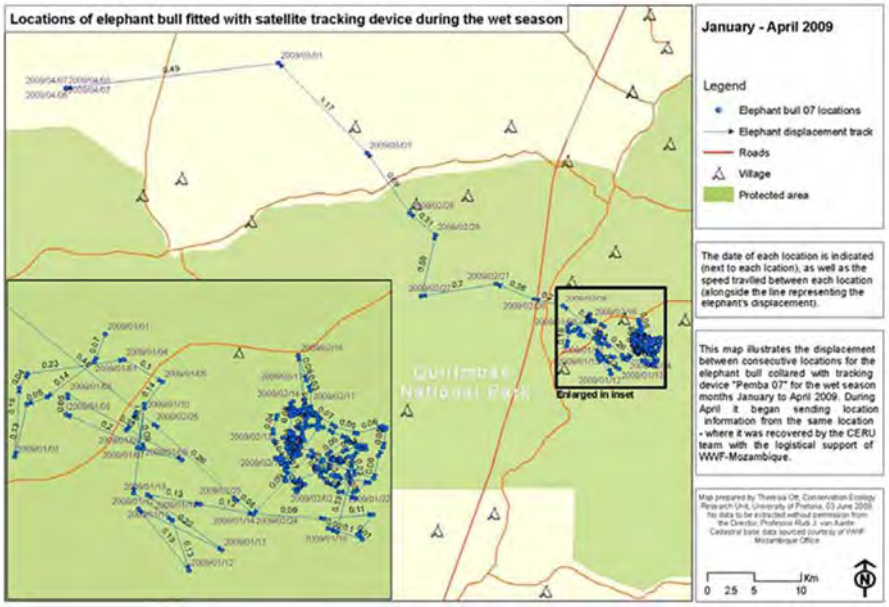


Figure 1-4-3 Typical Elephant Migration Path in Quirimbas National Park (QNP)
Note: Light-green colored areas indicate QNP, and the arrows drawn in the figure indicate elephant migration path.
Source: WWF 2009 Annual Report

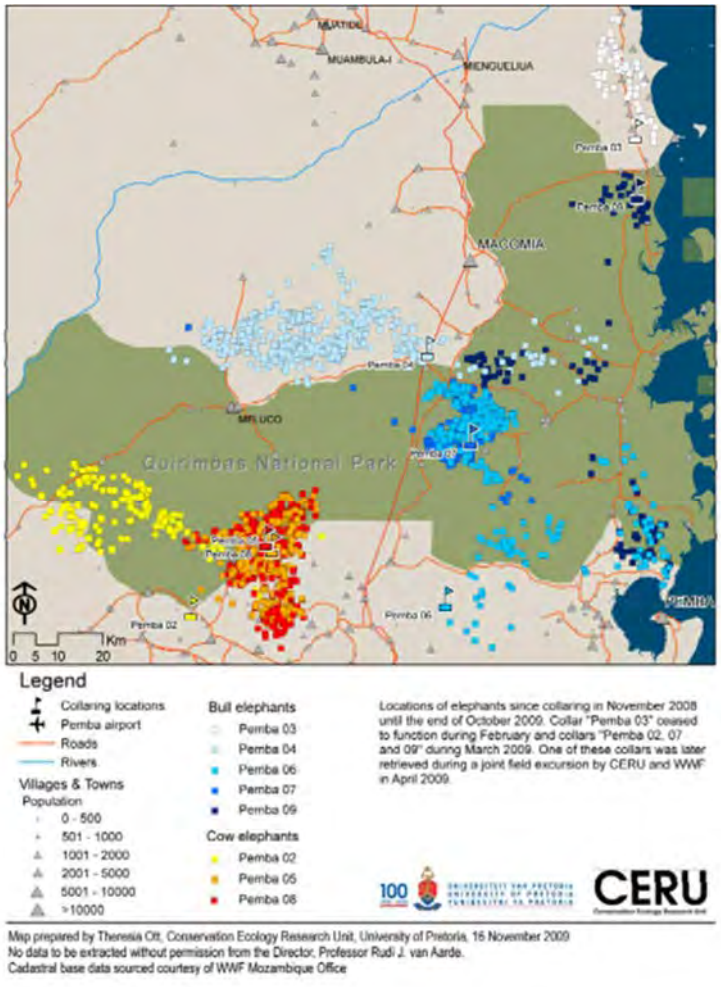
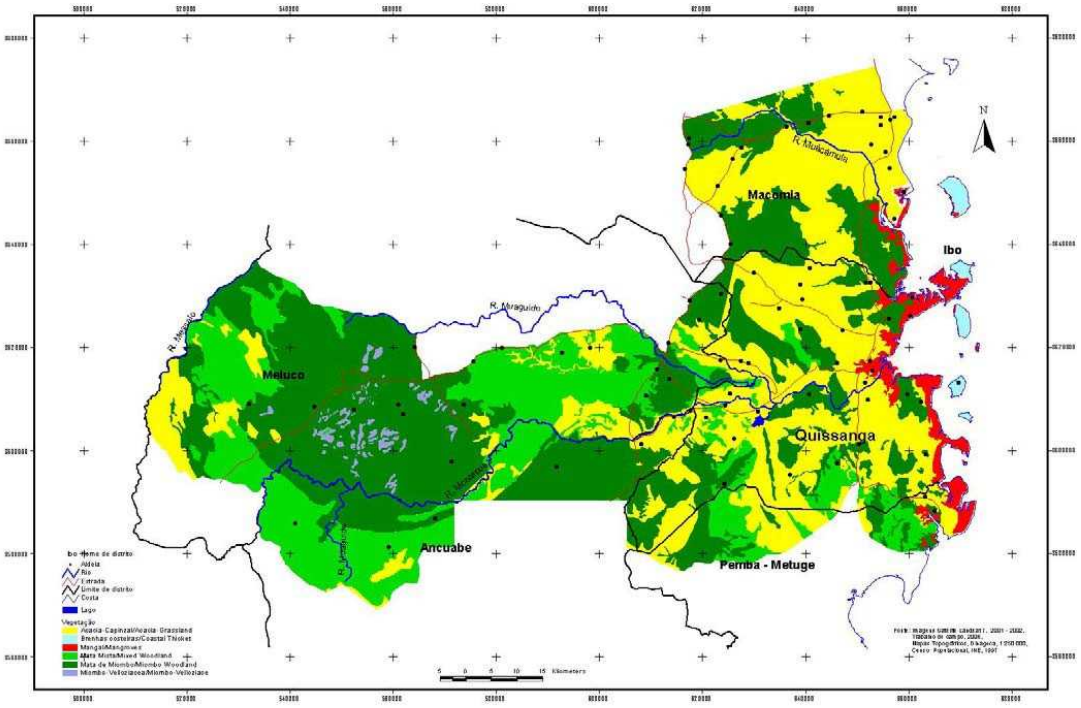


Figure 1-4-4 Location of Identified Individual Elephant in Quirimbas National Park (QNP)
Note: Light-green colored areas indicate QNP, and the "□" symbol indicates locations of individual elephants (8 in total) identified during the observation period between November 2008 – October 2009.

Source: WWF 2009 Annual Report

Figure 1-4-5 and Table 1-4-3 summarize the typical vegetation pattern of QNP.



Source: Bandeira et. al., 2007

Figure 1-4-5 Typical Vegetation Conditions in Quirimbas National Park (QNP)

Table 1-4-3 Typical Floral Inventory of Quirimbas National Park (QNP)

Occupation form	Polygons	Area in km^2	Percentage (%)
Acacia-Grassland	40	2655.7	33.12
Costal Thicket	9	52.4	0.65
Lake	1	4.4	0.05
Mangrove	31	239.4	2.99
Mixed Woodland	39	1709.4	21.32
Miombo Woodland	53	3275.1	40.84
Miombo-Velloziace	64	67.3	0.84
Settlements	13	14.7	0.18
Total	250	8018.6	100.00

Source: Bandeira et. al., 2007

For the proposed bridge rehabilitation project, eight (8) existing bridges are of concern, and the Catipusse and Muagamura bridges are located inside and along the boundary of QNP, respectively. It is noted that the exact topographical location of Muagamura Bridge is to be examined throughout the IEE study which is to be conducted later. Based on these and other

relevant engineering study results, an impact evaluation of the bridge rehabilitation project is also to be conducted.

1-4-3 Environmental Legal Framework and Administration

The Ministry of Land, Environment and Rural Development (MITADER, ex-MICOA) is the supreme environmental administrative body in Mozambique. After the last presidential election, MITADER was created by combining ex-MICOA, the Ministry of Land and other relevant governmental organizations in January 2015. As of April 2015, the organization chart of MITADER was still under preparation (not yet available according to personal communication with MITADER in 2015). The environmental approval process of infrastructure development projects is administered by the National Environmental Impact Assessment Directorate (DINAIA) of MITADER. Provincial MITADER offices are established in the provincial capitals in Mozambique (the local MITADER office in Cabo Delgado Province is located in Pemba).

ANE established the Unit of Social Issues and Environment in 2000, and any environmental issues including the environmental license application process of ANE road projects are handled by this unit in liaison with MITADER (ex-MICOA). In 2005, ANE developed their own environmental training manuals for sustainable road projects. Currently, all environmental license application processes are handled by the Cross Cutting Issues Office of ANE which has 5 permanent staff. In 2012, ANE published the following new guidelines and/or manuals for environmental and social considerations for road projects with assistance from Portugal (ASDI: AGENCIA SUECA DE DESENVOLVIMENTO E COOPERACAO INTERNACIONAL).

- Environmental Guide (October 2012)
- Field Manual (October 2012)

1-4-4 Legal Codes for National Parks in Mozambique

Table 4 summarizes the legal framework for wildlife, forest and national parks across the south of Africa. From this table, it can be seen that the Land Law (1997) covers the management of national parks in Mozambique.

Table 1-4-4 Comparison of Legal Framework for Wildlife, Forests and National Park Protection in the South of Africa

Country	Forest Legislation	Related Legislation
Botswana	Forest Act (Chapter 38:04) and Herbage Preservation (prevention of fires) Act (1992)	Wildlife Conservation and National Parks Act (1992), Seed Act (1976)

Lesotho	Forest Act (1998)	Land Act (1979)
Malawi	Forest Act No. 11 of 1997	
Mozambique	Forest and Wildlife Act (1999)	Reform Land Law No. 19 of 1997
Mauritius	Forest and Reserve Act (1983)	The Wildlife and National Parks Act (1991), Environmental Protection Act (1991)

Source: http://www.fao.org/docrep/005/ac850e/ac850e0g.htm

The following is an outline of the Land Act (1997) enacted in Mozambique.

CHAPTER I General Provisions
CHAPTER II Ownership of the land and public domain
CHAPTER III The right of use and benefit of land
CHAPTER IV Exercising of economic activities
CHAPTER VI Authorization process of applications
CHAPTER VII Payments
CHAPTER VIII Final and transitory provisions
CHAPTER VI Fees
CHAPTER VII Final provisions

Based on this Act, the Land Law Regulation (Decree 66/98 of December) was enacted in 1998.

CHAPTER I General Provisions
CHAPTER II Public domain
CHAPTER III Right of land use and benefit
CHAPTER IV Procedures
CHAPTER V Supervision

According to these regulations, the national parks and environmental reserves are categorized as "total protection zones" (Article 7). Project owners and/or developers shall obtain a special permission and/or license from the Cadastre Services in order to implement any infrastructure development projects therein. As mentioned earlier, the land management authority under the Ministry of Land was merged with MICOA and other relevant ministries to establish MITADER (the Ministry of Land, Environment and Rural Development). A series of discussions with MITADER covering the environmental license application and/or the requirements for the special permission regarding the total protection zone shall be conducted. It is noted that the management of national parks and reserves is administered by the Ministry of Tourism (MITUR) in Mozambique.

1-4-5 Environmental Approval Process

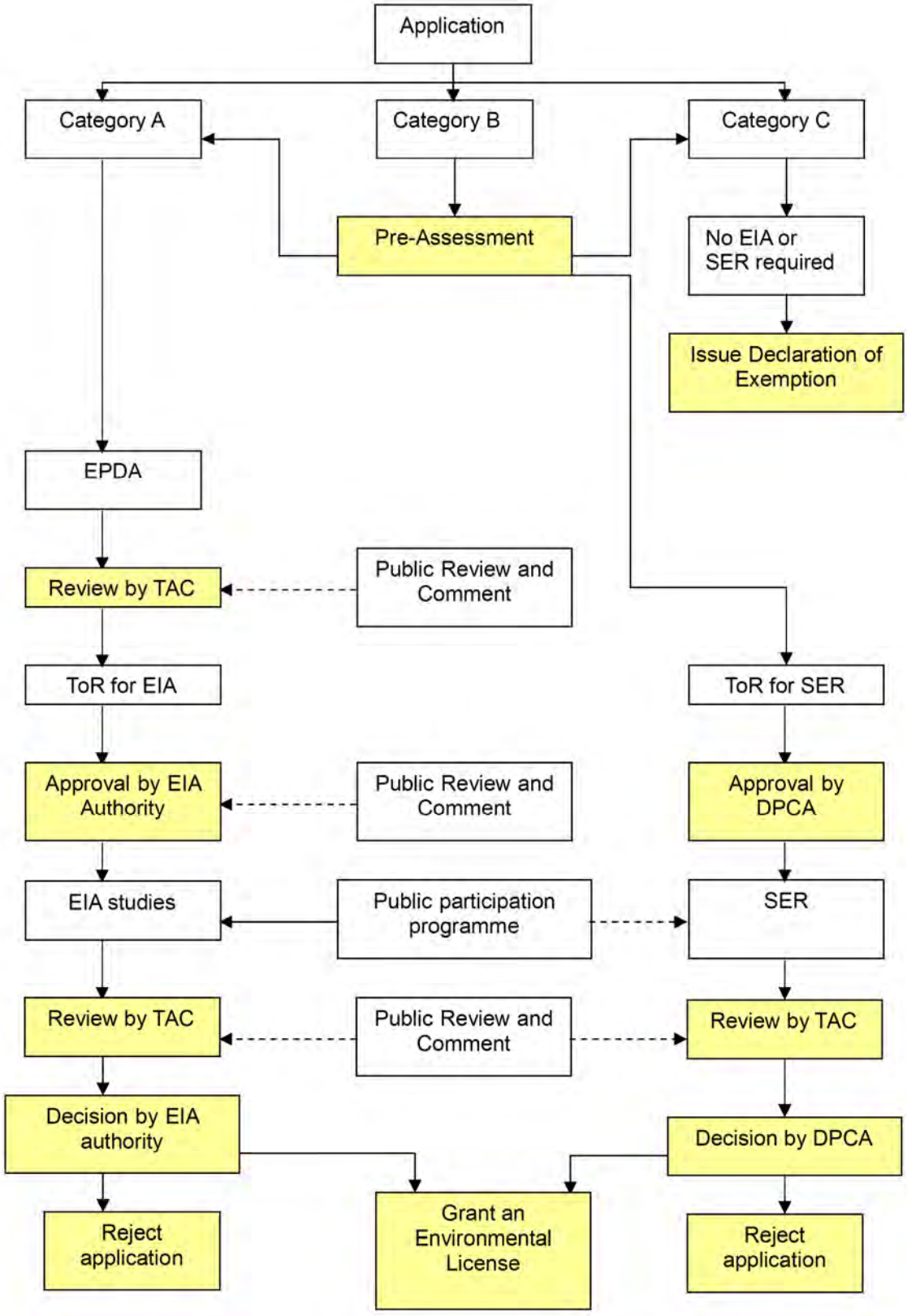
(1) Outline of the EIA Process

Implementation of EIA studies and the environmental license application process of any development projects are administered by Decree No 45 of 2004. There are three environmental categories, i.e. Category A, B and C, depending on the magnitude of potential negative environmental and/or social impacts to be caused by the implementation of the project in

question. For Category A projects, a full-scale EIA report shall be prepared in order to obtain environmental approval, while a SER (Simplified Environmental Report) shall be prepared for Category B projects. The following box summarizes the categorization criteria used for the selection of Category A projects.

a) Areas and ecosystems recognized as having special statute under the national and international legislation such as:
- Coral reefs;
- Mangroves;
- Indigenous forests;
- Small islands;
- Zones of imminent erosion including frontal dunes;
- Zones exposed to desertification;
- Zones or areas of conservation or protection;
- Marshes;
- Zones containing endangered species of animal or vegetation, habitats and ecosystems;
- Zones of unique scenery;
- Zones of archaeological, historical and cultural value to be preserved;
- Protection areas around water supply springs and fountains;

b) Densely populated areas that imply the need for resettlement;
c) Densely populated areas where the activity involves unacceptable levels of pollution or other type of disturbance significantly affecting the resident communities;
d) Regions subject to high levels of development or regions where there are conflicts in the distribution and use of natural resources;
e) Areas along rivers or areas used by local communities as a source of domestic water supply;
f) Zones containing valuable resources such as for instance aquatic, mineral, medicinal plants.



*: Shaded blocks indicate activities by the competent authority.

Figure 1-4-6 Environmental Approval Process in Mozambique

1-4-6 Comparison Between JICA Guidelines and Mozambique Regulations

The EIA legal system in Mozambique is maintained comprehensively in comparison with other African countries, and the JICA guidelines and Mozambique regulations therefore have almost the same contents. A comparison list is shown below.

Table 1-4-5 Comparison Between JICA Guidelines and Mozambique Regulations

Item	JICA	Mozambique
Category B	Potential adverse impacts on the environment and society are less adverse than those of Category A projects.	Project that would also cause negative impact, although with lower duration, intensity, extension, magnitude and/or significance.
Definition	IEE level study is a study that includes an analysis of alternative plans, the prediction and assessment of environmental impacts, and the preparation of mitigation measures and monitoring plans based on easily available information and simple field surveys.	Category B requires a pre-assessment and the process includes the formulation of a TOR and a Simplified Environmental Report (SER).
Civic participation	JICA encourages project proponents etc. to consult with local stakeholders when necessary.	Not mandatory, recommended for project with stakeholders meetings.
Pollution	Water pollution	Surface water resources
	Soil pollution	Soil
	Bottom sediment	Groundwater resources
	Offensive odors	
	Ground subsidence	
	Noise and vibration	Noise and vibration
	Waste	Waste and hazardous materials
National environment	Biota and ecosystems	Fauna
		Flora and vegetation
		Protected areas and species
	Hydrometeor	Soil, erosion risk and land use
	Geographical features	Geology and geomorphology
		Landscape
Social environment	Involuntary resettlement	Involuntary resettlement
		Building materials and basic housing services
	Poor, indigenous, or ethnic people	Culture, ethnic groups, religions and languages
	Limitation of accessibility to information, meetings, etc. on a specific person or group	Demographic characteristics
	Local economies, such as employment, livehood, etc.	Livelihoods
	Land use and local resource utilization	Household structure
	Water usage	
	Existing social infrastructure and services	Roads, transport and communication
		Description of the services and utilities provided
	Social institutions such as social infrastructure and local decision-making institutions	Government and traditional structures
	Cultural heritage	
	Gender	Roles and decision making
	Misdistribution of benefits and damages	Economic profile

Item	JICA	Mozambique
	Local conflicts of interests	Community conflict resolution and decision making
	Children's rights	Education
	Infectious diseases such as HIV/AIDS	Health
Other	Accidents	
	Global warming	Climate

1-4-7 Comparison of Alternative Plan

The alternative plan (bridge replacement) and operation of existing bridges (zero option) are compared based on master plans and environmental, economic and technical aspects. The bridge replacement plan is recommended as the most suitable plan.

Table 1-4-6 Comparison of Alternative Plan

Item	Alternative A	Zero option
Outline	Bridge replacement	Operation of existing bridges
	Permanent bridge replacement of existing bridges.	Use of existing temporary Bailey bridges for traffic.
Development plan	ANE assumes a plan to upgrade the current route (N380) to National Highway No. 1. The master plan recommends replacement with permanent bridges.	The policy is not in accordance with the master plan.
Growth of the regional economy	The road network with the Nacara Corridor and Mtwara Corridor is strengthened by bridge replacement. The economies of neighboring areas and countries are promoted by the development.	The present growth rate is not changed.
Area stability	Transportation conditions are improved because the risk of bridge collapses decrease and the bridges will have 2 traffic lanes. As a result, transportation of emergency patients and procurement of pharmaceutical products are improved. The living conditions of inhabitants around the National Highway are improved.	There is risk of bridge collapses and traffic may be closed.
Traffic volume	Traffic volume may increase.	A significant increase in traffic is not expected.
Annual closure period	No closure period.	Road closure is assumed to be approximately nine months based on the previous large flood in 2014.
Travel time of heavy vehicles	The travel time from Macomia to Oasse will be approximately 80 minutes.	Heavy vehicles cannot use bailey bridges. The travel time from Macomia to Oasse via Mucojo is approximately 300 minutes.
Technical	Superior plan for cost-effectiveness due to low maintenance fees.	A large flood in 2014 interrupted traffic. Existing bridges may collapse again.
Cost	Construction costs.	Only maintenance costs.

Social environment	No inhabitants have to move.	No inhabitants have to move.
Natural environment	There are concerns of increased roadside noise caused by an increase in heavy vehicle traffic.	No change.
	There are concerns of aggravated air quality caused by increased traffic.	
	Temporary contamination may occur during bridge construction.	
Recommendation	Alternative A (bridge replacement) is recommended as the most suitable plan.	

1-4-8 Relevant Road Construction Projects

The environmental approval status of past and on-going road improvement projects along National Road 380 was reviewed by interviewing both ANE and MITADER officials in the Provincial Office (Pemba) in Cabo Delgado Province.

Table 1-4-7 Summary of Road Improvement Projects

	Road Improvement Project	Features
1	National Road 380 rehabilitation (north)	Funded by the Portuguese Government. Environmental license issued and road improvement project already completed (except bridge parts). Requested ANE to provide copy of IEE report (as of April 2015).
2	National Road 380 rehabilitation (south)	Funded by PRC. Bridge parts are excluded. IEE report approved and environmental license issued already in November 2013. However, relevant construction work has not yet been started (as of April 2015). Environmental license is valid for 2 years after approval and will expire unless any construction activities are initiated within 2 years.

1-4-9 Environmental License Application

A series of discussions were held with the Unit of Social Issues and Environment, ANE and DINAIA of MITADER in order to find out a smooth and successful environmental license application process for the proposed bridge rehabilitation projects. As a result of these discussions, it was found that an environmental license application is required for each bridge rehabilitation site (in total eight (8) environmental licenses are required).

(1) Decision by MITADER

The decision by MITADER on carrying out the proposed bridge rehabilitation project has to be based on the procedure shown in Figure 1-4-6. The application letter regarding the preliminary discussions for the environmental category was submitted from ANE to MITADER in April 2015.

In August 2015, the MITADER office in Cabo Delgado issued a decision about the environmental category in conformity with the Environmental Law.

According to the decision, all bridges were classified as Category B for the environmental social consideration regarding bridge replacement and the environmental licences will be obtained through an IEE investigation.

(2) Tender for Selection of the Consultant

Table 1-4-8 shows the environmental licence application and approval schedule.

Table 1-4-8 Environmental Approval Schedule (tentative, as of April 2016)

ITEM	2015										2016											
	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Technical Survet by JICA survey team	■																					
IEE Budget Requst to Road Fund		■	■	■	■	■																
Categorization by MITADER						△																
Selection of Consulting firm for IEE									■	■	■	■	■	■								
Category B: IEE(3 bridges)															■	■	■	■	■			
Appry the IEE license to MITADER																			■	■		
Environmental Approval																				△		

1-4-10 Scoping

Tables 1-4-9 to 1-4-16 summarize the scoping results of the project.

Table 1-4-9 Scoping Result (Catipusse Bridge)

Item		Evaluation		Reason for evaluation result
		Before and during works	In service	
Pollution countermeasures				
1	Air pollution	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of roadside air quality is expected. In service: Aggravation of air quality is expected due to increased traffic.
2	Water pollution	B-	C-	During works: There is a risk of temporary water contamination caused by earthworks during the rainy season. In service: Sand from road shoulders may wash out during rains.
3	Solid waste	B-	D	During works: There might be surplus soil from earthwork. In service: Impact from solid waste is not expected.
4	Soil pollution	B-	D	During works: There is a risk of soil pollution caused by leaking waste fluid. In service: Impact from soil pollution is not expected.
5	Noise and vibration	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of noise and vibration is expected. In service: Increased traffic is expected to aggravate vibration.
6	Land subsidence	D	D	There is not expected to be any work, etc. that could trigger land subsidence.
7	Bad odor	B-	D	During works: Puddles may form due to insufficient drainage and bad odors may develop. In service: Impact from bad odors is not expected.
8	Bottom sediment	D	D	There is not expected to be any work, etc. that could have an impact on the bottom sediment.

Natural environment				
9	Protected areas	A-	B-	The bridge is located in Quirimbas National Park. During works: There are concerns that drinking fountains for wild animals and plants might be temporarily affected by contamination of river water. In service: There is a risk of increased poaching and illegal felling after bridge construction.
10	Ecosystem	A-	B-	The existence of elephant migration paths has been confirmed in the area. During works: There are concerns that drinking fountains for wild animals and plants might be temporarily affected by contamination of river water. In service: There is a risk of increased poaching and illegal felling after bridge construction.
11	Hydrological phenomena	B-	B-	During works/ In service: Sudden floods are expected during the rainy season. Floods may occur due to the bridge bottleneck effect. Overflowing and erosion are also at risk of occurring.
12	Topography and geology	D	D	Since the project aims to replace existing bridges and does not entail large-scale cutting or embankment works, there will likely be almost no impact on topography and geology.
Social environment				
13	Resettlement of residents	D	D	No resettlement of residents is required.
14	Impoverished classes	D	D	There is expected to be almost no impact on the impoverished classes.
15	Minorities and indigenous population	D	D	There are no minorities or indigenous population at the project sites and surrounding areas.
16	Local economy (employment and means of livelihood, etc.)	D	D	Since the project entails bridge replacement, the impact on the local economy is expected to be minimal.
17	Land use and use of local resources	D	D	Since the project entails the replacement of existing bridges, the impact on the local economy is expected to be minimal.
18	Water use	D	D	There is expected to be almost no impact on water use.
19	Existing social infrastructure and social services	D	D	There is expected to be almost no impact on existing social infrastructure and social services.
20	Social infrastructure and social organizations such as local decision making agencies, etc.	D	D	Since the project entails the replacement of existing bridges, the impact on social infrastructure and local decision making agencies, etc. is expected to be minimal.
21	Maldistribution of damage and benefits	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no maldistribution of damage and benefits.
22	Clash of interests in the area	D	D	Since the project entails the replacement of existing bridges, there are expected to be almost no clashes of interests in local areas.
23	Cultural heritage	D	D	There is no cultural heritage at the project sites and surrounding areas.
24	Landscape	D	D	Since the project entails the replacement of existing bridges, the impact on the landscape is expected to be minimal.
25	Gender	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no gender issues.
26	Rights of children	D	D	There is expected to be almost no impact on the rights of children.
27	HIV/AIDS and other infections	B-	D	During works: Since construction workers move in from other areas and stay temporarily around the sites, the risk of infectious diseases such as malaria and dengue fever increases.

				In service: There is expected to be no impact from HIV/AIDS and other infections.
28	Working environment (including labor safety)	B-	D	During works: The civil works are expected to transform the topography, and resulting puddles may temporarily spread dengue fever. In service: There is expected to be no impact on the working environment.
Other				
29	Accidents	B-	C-	During works: Construction equipment will increase traffic volume and traffic jams are therefore expected. The risk of traffic accidents will increase. In service: Traffic is expected to increase after bridge completion, and the number of traffic accidents may therefore also increase.
30	Transboundary impact and climate change	D	D	Since the project entails the replacement of existing bridges and is relatively small-scale, there is expected to be almost no transboundary impact or impact on climate change, etc.

A: Significant negative impact is expected.
B: Negative impact is expected to some extent.
C: Extent of negative impact is unknown. (Further examination is needed in order to clarify the impact as the study progresses.)
D: No impact is expected.

Table 1-4-10 Scoping Result (Muagamura Bridge)

Item		Evaluation		Reason for evaluation result
		Before and during works	In service	
Pollution countermeasures				
1	Air pollution	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of roadside air quality is expected. In service: Aggravation of air quality is expected due to increased traffic.
2	Water pollution	B-	C-	During works: There is a risk of temporary water contamination caused by earthworks during the rainy season. In service: Sand from road shoulders may wash out during rains.
3	Solid waste	B-	D	During works: There might be surplus soil from earthwork. In service: Impact from solid waste is not expected.
4	Soil pollution	B-	D	During works: There is a risk of soil pollution caused by leaking waste fluid. In service: Impact from soil pollution is not expected.
5	Noise and vibration	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of noise and vibration is expected. In service: Increased traffic is expected to aggravate vibration.
6	Land subsidence	D	D	There is not expected to be any work, etc. that could trigger land subsidence.
7	Bad odor	B-	D	During works: Puddles may form due to insufficient drainage and bad odors may develop. In service: Impact from bad odors is not expected.
8	Bottom sediment	D	D	There is not expected to be any work, etc. that could have an impact on the bottom sediment.
Natural environment				
9	Protected areas	B-	B-	The bridge is located in the buffer zone of Quirimbas National Park. During works: There are concerns that drinking fountains for wild animals and plants might be temporarily affected by contamination of river water. In service: There is a risk of increased poaching and illegal felling after bridge construction.

10	Ecosystem	B-	B-	The existence of elephant migration paths has been confirmed in the area. During works: There are concerns that drinking fountains for wild animals and plants might be temporarily affected by contamination of river water. In service: There is a risk of increased poaching and illegal felling after bridge construction.
11	Hydrological phenomena	B-	B-	During works/ In service: Sudden floods are expected during the rainy season. Floods may occur due to the bridge bottleneck effect. Overflowing and erosion are also at risk of occurring.
12	Topography and geology	D	D	Since the project aims to replace existing bridges and does not entail large-scale cutting or embankment works, there will likely be almost no impact on topography and geology.
Social environment				
13	Resettlement of residents	D	D	No resettlement of residents is required.
14	Impoverished classes	D	D	There is expected to be almost no impact on the impoverished classes.
15	Minorities and indigenous population	D	D	There are no minorities or indigenous population at the project sites and surrounding areas.
16	Local economy (employment and means of livelihood, etc.)	D	D	Since the project entails bridge replacement, the impact on the local economy is expected to be minimal.
17	Land use and use of local resources	D	D	Since the project entails the replacement of existing bridges, the impact on the local economy is expected to be minimal.
18	Water use	D	D	There is expected to be almost no impact on water use.
19	Existing social infrastructure and social services	D	D	There is expected to be almost no impact on existing social infrastructure and social services.
20	Social infrastructure and social organizations such as local decision making agencies, etc.	D	D	Since the project entails the replacement of existing bridges, the impact on social infrastructure and local decision making agencies, etc. is expected to be minimal.
21	Maldistribution of damage and benefits	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no maldistribution of damage and benefits.
22	Clash of interests in the area	D	D	Since the project entails the replacement of existing bridges, there are expected to be almost no clashes of interests in local areas.
23	Cultural heritage	D	D	There is no cultural heritage at the project sites and surrounding areas.
24	Landscape	D	D	Since the project entails the replacement of existing bridges, the impact on the landscape is expected to be minimal.
25	Gender	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no gender issues.
26	Rights of children	D	D	There is expected to be almost no impact on the rights of children.
27	HIV/AIDS and other infections	B-	D	During works: Since construction workers move in from other areas and stay temporarily around the sites, the risk of infectious diseases such as malaria and dengue fever increases. In service: There is expected to be no impact from HIV/AIDS and other infections.
28	Working environment (including labor safety)	B-	D	During works: The civil works are expected to transform the topography, and resulting puddles may temporarily spread dengue fever. In service: There is expected to be no impact on the working environment.

Other				
29	Accidents	B-	C-	During works: Construction equipment will increase traffic volume and traffic jam are therefore expected. The risk of traffic accidents will increase. In service: Traffic is expected to increase after bridge completion, and the number of traffic accidents may therefore also increase.
30	Transboundary impact and climate change	D	D	Since the project entails the replacement of existing bridges and is relatively small-scale, there is expected to be almost no transboundary impact or impact on climate change, etc.

Table 1-4-11 Scoping Result (Messalo I Bridge)

Item		Evaluation		Reason for evaluation result
		Before and during works	In service	
Pollution countermeasures				
1	Air pollution	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of roadside air quality is expected. In service: Aggravation of air quality is expected due to increased traffic.
2	Water pollution	B-	C-	During works: There is a risk of temporary water contamination caused by earthworks during the rainy season. In service: Sand from road shoulders may wash out during rains.
3	Solid waste	B-	D	During works: There might be surplus soil from earthwork. In service: Impact from solid waste is not expected.
4	Soil pollution	B-	D	During works: There is a risk of soil pollution caused by leaking waste fluid. In service: Impact from soil pollution is not expected.
5	Noise and vibration	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of noise and vibration is expected. In service: Increased traffic is expected to aggravate vibration.
6	Land subsidence	D	D	There is not expected to be any work, etc. that could trigger land subsidence.
7	Bad odor	B-	D	During works: Puddles may form due to insufficient drainage and bad odors may develop. In service: Impact from bad odors is not expected.
8	Bottom sediment	D	D	There is not expected to be any work, etc. that could have an impact on the bottom sediment.
Natural environment				
9	Protected areas	D	D	There is not expected to be any work, etc. that could have an impact on protected areas.
10	Ecosystem	B-	B-	During works: There are concerns that drinking fountains for wild animals and plants might be temporarily affected by contamination of river water. In service: There is a risk of increased poaching and illegal felling after bridge construction.
11	Hydrological phenomena	B-	B-	During works/ In service: Sudden floods are expected during the rainy season. Floods may occur due to the bridge bottleneck effect. Overflowing and erosion are also at risk of occurring.
12	Topography and geology	D	D	Since the project aims to replace existing bridges and does not entail large-scale cutting or embankment works, there will likely be almost no impact on topography and geology.
Social environment				
13	Resettlement of residents	D	D	No resettlement of residents is required.
14	Impoverished classes	D	D	There is expected to be almost no impact on the impoverished classes.

15	Minorities and indigenous population	D	D	There are no minorities or indigenous population at the project sites and surrounding areas.
16	Local economy (employment and means of livelihood, etc.)	D	D	Since the project entails bridge replacement, the impact on the local economy is expected to be minimal.
17	Land use and use of local resources	D	D	Since the project entails the replacement of existing bridges, the impact on the local economy is expected to be minimal.
18	Water use	B-	D	Small-scale fishing takes place around the bridge. During works: Water pollution is expected to have an impact on fishing. In service: There is expected to be no impact on water use.
19	Existing social infrastructure and social services	D	D	There is expected to be almost no impact on existing social infrastructure and social services.
20	Social infrastructure and social organizations such as local decision making agencies, etc.	D	D	Since the project entails the replacement of existing bridges, the impact on social infrastructure and local decision making agencies, etc. is expected to be minimal.
21	Maldistribution of damage and benefits	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no maldistribution of damage and benefits.
22	Clash of interests in the area	D	D	Since the project entails the replacement of existing bridges, there are expected to be almost no clashes of interests in local areas.
23	Cultural heritage	D	D	There is no cultural heritage at the project sites and surrounding areas.
24	Landscape	D	D	Since the project entails the replacement of existing bridges, the impact on the landscape is expected to be minimal.
25	Gender	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no gender issues.
26	Rights of children	D	D	There is expected to be almost no impact on the rights of children.
27	HIV/AIDS and other infections	B-	D	During works: Since construction workers move in from other areas and stay temporarily around the sites, the risk of infectious diseases such as malaria and dengue fever increases. In service: There is expected to be no impact from HIV/AIDS and other infections.
28	Working environment (including labor safety)	B-	D	During works: The civil works are expected to transform the topography, and resulting puddles may temporarily spread dengue fever. In service: There is expected to be no impact on the working environment.
Other				
29	Accidents	B-	C-	During works: Construction equipment will increase traffic volume and traffic jam are therefore expected. The risk of traffic accidents will increase. In service: Traffic is expected to increase after bridge completion, and the number of traffic accidents may therefore also increase.
30	Transboundary impact and climate change	D	D	Since the project entails the replacement of existing bridges and is relatively small-scale, there is expected to be almost no transboundary impact or impact on climate change, etc.

Table 1-4-12 Scoping Result (Messalo III Bridge)

Item		Evaluation		Reason for evaluation result
		Before and during works	In service	
Pollution countermeasures				
1	Air pollution	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of roadside air quality is expected. In service: Aggravation of air quality is expected due to increased traffic.
2	Water pollution	B-	C-	During works: There is a risk of temporary water contamination caused by earthworks during the rainy season. In service: Sand from road shoulders may wash out during rains.
3	Solid waste	B-	D	During works: There might be surplus soil from earthwork. In service: Impact from solid waste is not expected.
4	Soil pollution	B-	D	During works: There is a risk of soil pollution caused by leaking waste fluid. In service: Impact from soil pollution is not expected.
5	Noise and vibration	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of noise and vibration is expected. In service: Increased traffic is expected to aggravate vibration.
6	Land subsidence	D	D	There is not expected to be any work, etc. that could trigger land subsidence.
7	Bad odor	B-	D	During works: Puddles may form due to insufficient drainage and bad odors may develop. In service: Impact from bad odors is not expected.
8	Bottom sediment	D	D	There is not expected to be any work, etc. that could have an impact on the bottom sediment.
Natural environment				
9	Protected areas	D	D	There is not expected to be any work, etc. that could have an impact on protected areas.
10	Ecosystem	B-	B-	During works: There are concerns that drinking fountains for wild animals and plants might be temporarily affected by contamination of river water. In service: There is a risk of increased poaching and illegal felling after bridge construction.
11	Hydrological phenomena	B-	B-	During works/ In service: Sudden floods are expected during the rainy season. Floods may occur due to the bridge bottleneck effect. Overflowing and erosion are also at risk of occurring.
12	Topography and geology	D	D	Since the project aims to replace existing bridges and does not entail large-scale cutting or embankment works, there will likely be almost no impact on topography and geology.
Social environment				
13	Resettlement of residents	D	D	No resettlement of residents is required.
14	Impoverished classes	D	D	There is expected to be almost no impact on the impoverished classes.
15	Minorities and indigenous population	D	D	There are no minorities or indigenous population at the project sites and surrounding areas.
16	Local economy (employment and means of livelihood, etc.)	D	D	Since the project entails bridge replacement, the impact on the local economy is expected to be minimal.
17	Land use and use of local resources	D	D	Since the project entails the replacement of existing bridges, the impact on the local economy is expected to be minimal.
18	Water use	B-	D	Small-scale fishing takes place around the bridge. During works: Water pollution is expected to have an impact on fishing.

				In service: There is expected to be no impact on water use.
19	Existing social infrastructure and social services	D	D	There is expected to be almost no impact on existing social infrastructure and social services.
20	Social infrastructure and social organizations such as local decision making agencies, etc.	D	D	Since the project entails the replacement of existing bridges, the impact on social infrastructure and local decision making agencies, etc. is expected to be minimal.
21	Maldistribution of damage and benefits	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no maldistribution of damage and benefits.
22	Clash of interests in the area	D	D	Since the project entails the replacement of existing bridges, there are expected to be almost no clashes of interests in local areas.
23	Cultural heritage	D	D	There is no cultural heritage at the project sites and surrounding areas.
24	Landscape	D	D	Since the project entails the replacement of existing bridges, the impact on the landscape is expected to be minimal.
25	Gender	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no gender issues.
26	Rights of children	D	D	There is expected to be almost no impact on the rights of children.
27	HIV/AIDS and other infections	B-	D	During works: Since construction workers move in from other areas and stay temporarily around the sites, the risk of infectious diseases such as malaria and dengue fever increases. In service: There is expected to be no impact from HIV/AIDS and other infections.
28	Working environment (including labor safety)	B-	D	During works: The civil works are expected to transform the topography, and resulting puddles may temporarily spread dengue fever. In service: There is expected to be no impact on the working environment.
Other				
29	Accidents	B-	C-	During works: Construction equipment will increase traffic volume and traffic jam are therefore expected. The risk of traffic accidents will increase. In service: Traffic is expected to increase after bridge completion, and the number of traffic accidents may therefore also increase.
30	Transboundary impact and climate change	D	D	Since the project entails the replacement of existing bridges and is relatively small-scale, there is expected to be almost no transboundary impact or impact on climate change, etc.

Table 1-4-13 Scoping Result (Mapuede Bridge)

Item		Evaluation		Reason for evaluation result
		Before and during works	In service	
Pollution countermeasures				
1	Air pollution	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of roadside air quality is expected. In service: Aggravation of air quality is expected due to increased traffic.
2	Water pollution	B-	C-	During works: There is a risk of temporary water contamination caused by earthworks during the rainy season. In service: Sand from road shoulders may wash out during rains.
3	Solid waste	B-	D	During works: There might be surplus soil from earthwork. In service: Impact from solid waste is not expected.

4	Soil pollution	B-	D	During works: There is a risk of soil pollution caused by leaking waste fluid. In service: Impact from soil pollution is not expected.
5	Noise and vibration	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of noise and vibration is expected. In service: Increased traffic is expected to aggravate vibration.
6	Land subsidence	D	D	There is not expected to be any work, etc. that could trigger land subsidence.
7	Bad odor	B-	D	During works: Puddles may form due to insufficient drainage and bad odors may develop. In service: Impact from bad odors is not expected.
8	Bottom sediment	D	D	There is not expected to be any work, etc. that could have an impact on bottom the sediment.
Natural environment				
9	Protected areas	D	D	There is not expected to be any work, etc. that could have an impact on protected areas.
10	Ecosystem	D	D	There is not expected to be any work, etc. that could have an impact on the ecosystem.
11	Hydrological phenomena	B-	B-	During works/ In service: Sudden floods are expected during the rainy season. Floods may occur due to the bridge bottleneck effect. Overflowing and erosion are also at risk of occurring.
12	Topography and geology	D	D	Since the project aims to replace existing bridges and does not entail large-scale cutting or embankment works, there will likely be almost no impact on topography and geology.
Social environment				
13	Resettlement of residents	D	D	No resettlement of residents is required.
14	Impoverished classes	D	D	There is expected to be almost no impact on the impoverished classes.
15	Minorities and indigenous population	D	D	There are no minorities or indigenous population at the project sites and surrounding areas.
16	Local economy (employment and means of livelihood, etc.)	D	D	Since the project entails bridge replacement, the impact on the local economy is expected to be minimal.
17	Land use and use of local resources	D	D	Since the project entails the replacement of existing bridges, the impact on the local economy is expected to be minimal.
18	Water use	B-	D	Small-scale fishing takes place around the bridge. During works: Water pollution is expected to have an impact on fishing. In service: There is expected to be no impact on water use.
19	Existing social infrastructure and social services	D	D	There is expected to be almost no impact on existing social infrastructure and social services.
20	Social infrastructure and social organizations such as local decision making agencies, etc.	D	D	Since the project entails the replacement of existing bridges, the impact on social infrastructure and local decision making agencies, etc. is expected to be minimal.
21	Maldistribution of damage and benefits	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no maldistribution of damage and benefits.
22	Clash of interests in the area	D	D	Since the project entails the replacement of existing bridges, there are expected to be almost no clashes of interests in local areas.
23	Cultural heritage	D	D	There is no cultural heritage at the project sites and surrounding areas.
24	Landscape	D	D	Since the project entails the replacement of existing bridges, the impact on the landscape is expected to be minimal.
25	Gender	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no gender issues.

26	Rights of children	D	D	There is expected to be almost no impact on the rights of children.
27	HIV/AIDS and other infections	B-	D	During works: Since construction workers move in from other areas and stay temporarily around the sites, the risk of infectious diseases such as malaria and dengue fever increases. In service: There is expected to be no impact from HIV/AIDS and other infections.
28	Working environment (including labor safety)	B-	D	During works: The civil works are expected to transform the topography, and resulting puddles may temporarily spread dengue fever. In service: There is expected to be no impact on the working environment.
Other				
29	Accidents	B-	C-	During works: Construction equipment will increase traffic volume and traffic jam are therefore expected. The risk of traffic accidents will increase. In service: Traffic is expected to increase after bridge completion, and the number of traffic accidents may therefore also increase.
30	Transboundary impact and climate change	D	D	Since the project entails the replacement of existing bridges and is relatively small-scale, there is expected to be almost no transboundary impact or impact on climate change, etc.

Table 1-4-14 Scoping Result (Muera I Bridge)

Item		Evaluation		Reason for evaluation result
		Before and during works	In service	
Pollution countermeasures				
1	Air pollution	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of roadside air quality is expected. In service: Aggravation of air quality is expected due to increased traffic.
2	Water pollution	B-	C-	During works: There is a risk of temporary water contamination caused by earthworks during the rainy season. In service: Sand from road shoulders may wash out during rains.
3	Solid waste	B-	D	During works: There might be surplus soil from earthwork. In service: Impact from solid waste is not expected.
4	Soil pollution	B-	D	During works: There is a risk of soil pollution caused by leaking waste fluid. In service: Impact from soil pollution is not expected.
5	Noise and vibration	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of noise and vibration is expected. In service: Increased traffic is expected to aggravate vibration.
6	Land subsidence	D	D	There is not expected to be any work, etc. that could trigger land subsidence.
7	Bad odor	B-	D	During works: Puddles may form due to insufficient drainage and bad odors may develop. In service: Impact from bad odors is not expected.
8	Bottom sediment	D	D	There is not expected to be any work, etc. that could have an impact on the bottom sediment.
Natural environment				
9	Protected areas	D	D	There is not expected to be any work, etc. that could have an impact on protected areas.
10	Ecosystem	D	D	There is not expected to be any work, etc. that could have an impact on the ecosystem.

11	Hydrological phenomena	B-	B-	During works/ In service: Sudden floods are expected during the rainy season. Floods may occur due to the bridge bottleneck effect. Overflowing and erosion are also at risk of occurring.
12	Topography and geology	D	D	Since the project aims to replace existing bridges and does not entail large-scale cutting or embankment works, there will likely be almost no impact on topography and geology.
Social environment				
13	Resettlement of residents	D	D	No resettlement of residents is required.
14	Impoverished classes	D	D	There is expected to be almost no impact on the impoverished classes.
15	Minorities and indigenous population	D	D	There are no minorities or indigenous population at the project sites and surrounding areas.
16	Local economy (employment and means of livelihood, etc.)	D	D	Since the project entails bridge replacement, the impact on the local economy is expected to be minimal.
17	Land use and use of local resources	D	D	Since the project entails the replacement of existing bridges, the impact on the local economy is expected to be minimal.
18	Water use	D	D	There is expected to be almost no impact on water use.
19	Existing social infrastructure and social services	D	D	There is expected to be almost no impact on existing social infrastructure and social services.
20	Social infrastructure and social organizations such as local decision making agencies, etc.	D	D	Since the project entails the replacement of existing bridges, the impact on social infrastructure and local decision making agencies, etc. is expected to be minimal.
21	Maldistribution of damage and benefits	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no maldistribution of damage and benefits.
22	Clash of interests in the area	D	D	Since the project entails the replacement of existing bridges, there are expected to be almost no clashes of interests in local areas.
23	Cultural heritage	D	D	There is no cultural heritage at the project sites and surrounding areas.
24	Landscape	D	D	Since the project entails the replacement of existing bridges, the impact on the landscape is expected to be minimal.
25	Gender	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no gender issues.
26	Rights of children	D	D	There is expected to be almost no impact on the rights of children.
27	HIV/AIDS and other infections	B-	D	During works: Since construction workers move in from other areas and stay temporarily around the sites, the risk of infectious diseases such as malaria and dengue fever increases. In service: There is expected to be no impact from HIV/AIDS and other infections.
28	Working environment (including labor safety)	B-	D	During works: The civil works are expected to transform the topography, and resulting puddles may temporarily spread dengue fever. In service: There is expected to be no impact on the working environment.
Other				
29	Accidents	B-	C-	During works: Construction equipment will increase traffic volume and traffic jam are therefore expected. The risk of traffic accidents will increase. In service: Traffic is expected to increase after bridge completion, and the number of traffic accidents may therefore also increase.

30	Transboundary impact and climate change	D	D	Since the project entails the replacement of existing bridges and is relatively small-scale, there is expected to be almost no transboundary impact or impact on climate change, etc.

Table 1-4-15 Scoping Result (Muera II Bridge)

Item		Evaluation		Reason for evaluation result
		Before and during works	In service	
Pollution countermeasures				
1	Air pollution	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of roadside air quality is expected. In service: Aggravation of air quality is expected due to increased traffic.
2	Water pollution	B-	C-	During works: There is a risk of temporary water contamination caused by earthworks during the rainy season. In service: Sand from road shoulders may wash out during rains.
3	Solid waste	B-	D	During works: There might be surplus soil from earthwork. In service: Impact from solid waste is not expected.
4	Soil pollution	B-	D	During works: There is a risk of soil pollution caused by leaking waste fluid. In service: Impact from soil pollution is not expected.
5	Noise and vibration	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of noise and vibration is expected. In service: Increased traffic is expected to aggravate vibration.
6	Land subsidence	D	D	There is not expected to be any work, etc. that could trigger land subsidence.
7	Bad odor	B-	D	During works: Puddles may form due to insufficient drainage and bad odors may develop. In service: Impact from bad odors is not expected.
8	Bottom sediment	D	D	There is not expected to be any work, etc. that could have an impact on the bottom sediment.
Natural environment				
9	Protected areas	D	D	There is not expected to be any work, etc. that could have an impact on protected areas.
10	Ecosystem	D	D	There is not expected to be any work, etc. that could have an impact on the ecosystem.
11	Hydrological phenomena	B-	B-	During works/ In service: Sudden floods are expected during the rainy season. Floods may occur due to the bridge bottleneck effect. Overflowing and erosion are also at risk of occurring.
12	Topography and geology	D	D	Since the project aims to replace existing bridges and does not entail large-scale cutting or embankment works, there will likely be almost no impact on topography and geology.
Social environment				
13	Resettlement of residents	D	D	No resettlement of residents is required.
14	Impoverished classes	D	D	There is expected to be almost no impact on the impoverished classes.
15	Minorities and indigenous population	D	D	There are no minorities or indigenous population at the project sites and surrounding areas.
16	Local economy (employment and means of livelihood, etc.)	D	D	Since the project entails bridge replacement, the impact on the local economy is expected to be minimal.
17	Land use and use of local resources	D	D	Since the project entails the replacement of existing bridges, the impact on the local economy is expected to be minimal.
18	Water use	D	D	There is expected to be almost no impact on water use.
19	Existing social infrastructure and social services	D	D	There is expected to be almost no impact on existing social infrastructure and social services.

20	Social infrastructure and social organizations such as local decision making agencies, etc.	D	D	Since the project entails the replacement of existing bridges, the impact on social infrastructure and local decision making agencies, etc. is expected to be minimal.
21	Maldistribution of damage and benefits	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no maldistribution of damage and benefits.
22	Clash of interests in the area	D	D	Since the project entails the replacement of existing bridges, there are expected to be almost no clashes of interests in local areas.
23	Cultural heritage	D	D	There is no cultural heritage at the project sites and surrounding areas.
24	Landscape	D	D	Since the project entails the replacement of existing bridges, the impact on the landscape is expected to be minimal.
25	Gender	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no gender issues.
26	Rights of children	D	D	There is expected to be almost no impact on the rights of children.
27	HIV/AIDS and other infections	B-	D	During works: Since construction workers move in from other areas and stay temporarily around the sites, the risk of infectious diseases such as malaria and dengue fever increases. In service: There is expected to be no impact from HIV/AIDS and other infections.
28	Working environment (including labor safety)	B-	D	During works: The civil works are expected to transform the topography, and resulting puddles may temporarily spread dengue fever. In service: There is expected to be no impact on the working environment.
Other				
29	Accidents	B-	C-	During works: Construction equipment will increase traffic volume and traffic jam are therefore expected. The risk of traffic accidents will increase. In service: Traffic is expected to increase after bridge completion, and the number of traffic accidents may therefore also increase.
30	Transboundary impact and climate change	D	D	Since the project entails the replacement of existing bridges and is relatively small-scale, there is expected to be almost no transboundary impact or impact on climate change, etc.

Table 1-4-16 Scoping Result (Mungoe Bridge)

Item		**Evaluation**		**Reason for evaluation result**
		Before and during works	In service	
Pollution countermeasures				
1	Air pollution	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of roadside air quality is expected. In service: Aggravation of air quality is expected due to increased traffic.
2	Water pollution	B-	C-	During works: There is a risk of temporary water contamination caused by earthworks during the rainy season. In service: Sand from road shoulders may wash out during rains.
3	Solid waste	B-	D	During works: There might be surplus soil from earthwork. In service: Impact from solid waste is not expected.
4	Soil pollution	B-	D	During works: There is a risk of soil pollution caused by leaking waste fluid. In service: Impact from soil pollution is not expected.

5	Noise and vibration	B-	B-	During works: Construction vehicles increase local traffic. Temporary aggravation of noise and vibration is expected. In service: Increased traffic is expected to aggravate vibration.
6	Land subsidence	D	D	There is not expected to be any work, etc. that could trigger land subsidence.
7	Bad odor	B-	D	During works: Puddles may form due to insufficient drainage and bad odors may develop. In service: Impact from bad odors is not expected.
8	Bottom sediment	D	D	There is not expected to be any work, etc. that could have an impact on the bottom sediment.
Natural environment				
9	Protected areas	D	D	There is not expected to be any work, etc. that could have an impact on protected areas.
10	Ecosystem	D	D	There is not expected to be any work, etc. that could have an impact on the ecosystem.
11	Hydrological phenomena	B-	B-	During works/ In service: Sudden floods are expected during the rainy season. Floods may occur due to the bridge bottleneck effect. Overflowing and erosion are also at risk of occurring.
12	Topography and geology	D	D	Since the project aims to replace existing bridges and does not entail large-scale cutting or embankment works, there will likely be almost no impact on topography and geology.
Social environment				
13	Resettlement of residents	D	D	No resettlement of residents is required.
14	Impoverished classes	D	D	There is expected to be almost no impact on the impoverished classes.
15	Minorities and indigenous population	D	D	There are no minorities or indigenous population at the project sites and surrounding areas.
16	Local economy (employment and means of livelihood, etc.)	D	D	Since the project entails bridge replacement, the impact on the local economy is expected to be minimal.
17	Land use and use of local resources	D	D	Since the project entails the replacement of existing bridges, the impact on the local economy is expected to be minimal.
18	Water use	D	D	There is expected to be almost no impact on water use.
19	Existing social infrastructure and social services	D	D	There is expected to be almost no impact on existing social infrastructure and social services.
20	Social infrastructure and social organizations such as local decision making agencies, etc.	D	D	Since the project entails the replacement of existing bridges, the impact on social infrastructure and local decision making agencies, etc. is expected to be minimal.
21	Maldistribution of damage and benefits	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no maldistribution of damage and benefits.
22	Clash of interests in the area	D	D	Since the project entails the replacement of existing bridges, there are expected to be almost no clashes of interests in local areas.
23	Cultural heritage	D	D	There is no cultural heritage at the project sites and surrounding areas.
24	Landscape	D	D	Since the project entails the replacement of existing bridges, the impact on the landscape is expected to be minimal.
25	Gender	D	D	Since the project entails the replacement of existing bridges, there is expected to be almost no gender issues.
26	Rights of children	D	D	There is expected to be almost no impact on the rights of children.
27	HIV/AIDS and other infections	B-	D	During works: Since construction workers move in from other areas and stay temporarily around the sites, the risk of infectious diseases such as malaria and dengue fever increases.

				In service: There is expected to be no impact from HIV/AIDS and other infections.
28	Working environment (including labor safety)	B-	D	During works: The civil works are expected to transform the topography, and resulting puddles may temporarily spread dengue fever. In service: There is expected to be no impact on the working environment.
Other				
29	Accidents	B-	C-	During works: Construction equipment will increase traffic volume and traffic jam are therefore expected. The risk of traffic accidents will increase. In service: Traffic is expected to increase after bridge completion, and the number of traffic accidents may therefore also increase.
30	Transboundary impact and climate change	D	D	Since the project entails the replacement of existing bridges and is relatively small-scale, there is expected to be almost no transboundary impact or impact on climate change, etc.

1-4-11 Draft TOR for Environmental and Social Considerations Survey

Table 1-4-17 shows the draft TOR for the environmental and social considerations survey which is based on the scoping results.

Table 1-4-17 Draft TOR for Environmental and Social Considerations Survey

Environmental Item	Survey Item	Survey Method
Air quality	① Confirmation of environmental standards, etc. (Japanese environmental standards, WHO standards, etc.) ② Understanding of current air quality ③ Gauging of the level of increase in traffic volume based on traffic demand projection ④ Confirmation of homes, schools, hospitals, etc. around the target sites ⑤ Impact during the works	② Survey of existing materials ② Forecast of impacts based on results of traffic demand projection ③ Site reconnaissance and interviews ④ Confirmation of work contents, methods, period, positions, and scope, types of construction machinery, operating positions, operating periods, number of running work vehicles, their running periods, traffic lines, etc.
Water quality	① River water quality ② Use of river water in daily life	① Survey of existing materials, information collection at related agencies ② Site reconnaissance and interviews in local areas
Solid waste	① Method for treating construction waste	① Interviews at related agencies, surveys of similar projects
Soil pollution	① Measures to prevent oil leaks during construction	① Confirmation of work contents, methods, period, types of construction machinery and equipment, operating and storage positions, etc.
Noise and vibration	① Confirmation of environmental standards, etc. (Japanese environmental standards, WHO standards, etc.) ② Distance from sources to residential areas, hospitals and schools ③ Impact during the works	① Survey of existing materials ② Site reconnaissance and interviews ③ Confirmation of work contents, methods, period, positions, and scope, types of construction machinery, operating positions, operating periods, number of running work vehicles, their running periods, traffic lines, etc.
	① Confirmation of scale of land acquisition	① Related legal systems and instances, etc. ② Satellite photographs of the target area

Land acquisition and resettlement of residents		③ Confirmation of buildings around the target road (homes, schools, medical facilities, etc.) ④ Confirmation of land use conditions around the target road based on land use maps and interviews during the site reconnaissance ⑤ Preparation of a resident resettlement plan (summary) based on the Mozambique Lands Act, JICA Environmental and Social Consideration Guidelines, World Bank Operational Policy 4.12, etc.
Existing social infrastructure and social services	① Existence of homes, schools, medical facilities, etc. around the project target sites	① Survey of existing materials, interviews at related agencies, site reconnaissance
HIV/AIDS and other infections	① HIV/AIDS prevalence rate around the project sites ② Agencies conducting related activities	① Survey of existing materials, interviews at related agencies ③ Interviews at related agencies
Working environment (including labor safety)	① Labor safety measures	① Survey of similar project cases (contents of contracts with subcontractors, etc. of similar projects)
Accidents	① Increased accidents when the bridges go into service (distribution of homes and various facilities, human moving distances, positional relationship with expected transport facilities)	① Survey of existing materials, site reconnaissance
Stakeholder discussions (SHM)	Two-stage implementation: ① Scoping plan ② Explanation of the draft final report	① Door to door visits, group interviews Period: March 2015 to April 2016 Targets: ANE or NGO Contents of discussions: Purpose of survey, schedule, explanation of scoping plan

1-4-12 Results of Environmental and Social Considerations Survey

Tables 1-4-18 to 1-4-20 show the results of the environmental and social considerations survey based on site reconnaissance, interviews at related agencies, and collection of materials for the Messalo I, Messalo III, and Mapuede bridges.

Table 1-4-18 Results of Environmental and Social Considerations Survey (Messalo I Bridge)

Item		Evaluation in scoping		Evaluation based on survey results		Reason for evaluation result
		Before and during works	In service	Before and during works	In service	
1	Air pollution	B-	B-	C-	D	The neighboring area has a good environment without factories and houses. Pollutants from cars and construction machinery will most likely spread downwind from the river basin and thus the atmospheric pollutant density will decrease through advection and diffusion. Such damping effects will likely have little impact. During works: The operation of construction machinery will have an impact on air pollution. In service: The traffic is estimated to increase from 344 vehicles in 2015 to 570 in 2022 which means that there will still be relatively little traffic. The house nearest the bridge is approximately 3km away and the impact on air quality is expected to be small.
2	Water pollution	B-	C-	B-	D	A small fishing community exists close to the project site. Washing and small-scale fishing could be observed during

						the site survey. A simple water quality measurement indicated that the water quality is fairly good. During works: The substructure works will basically be done during the dry season in accordance with the construction plan. The coffer dam method will be used for excavation, and the water quality is not expected to be worsened by this construction method. In the dry season, passing water will disappear in the target river. In service: Because the road will be equipped with culverts and drainage pits, water pollution is not expected since rainwater can be appropriately managed.
3	Solid waste	B-	D	C-	N/A	During works: Construction activities may generate waste.
4	Soil pollution	B-	D	B-	N/A	During works: Since large crane trucks and piling machines will be used for construction, temporary soil pollution may occur mainly because of oil leaks from the construction machines.
5	Noise and vibration	B-	B-	D	D	There are no houses or facilities around the project site. Because the nearest house is located approximately 3km away from the bridge, impact from noise is not expected.
6	Land subsidence	D	D	N/A	N/A	
7	Bad odor	B-	D	D	N/A	During works: Puddles do not form because the surrounding areas are flat. Impact from bad odors is therefore not expected during construction.
8	Bottom sediment	D	D	N/A	N/A	
9	Protected areas	D	D	N/A	N/A	
10	Ecosystem	B-	B-	C-	D	Based on interviews with inhabitants, it was confirmed that there are no elephants in the bridge area. During works: The substructure works will basically be done during the dry season in accordance with the construction plan. The coffer dam method will be used for excavation. There will be no impact on animals and plants downstream of the bridge site because the construction plan does not negatively affect water quality. In service: There is not expected to be any impact on the ecosystem. NGOs are worried about increased poaching when the traffic volume increases.
11	Hydrological phenomena	B-	B-	D	D	During works: There is no impact on river bank erosion since construction will take place in the dry season. In service: An oval pier shape was adopted to ensure smooth river flow. Based on the hydraulic analysis results, the planned bridge length (175m) and span length is longer than the existing bridge (45m) which should provide better protection against scour.
12	Topography and geology	D	D	N/A	N/A	
13	Resettlement of residents	D	D	N/A	N/A	
14	Impoverished classes	D	D	N/A	N/A	
15	Minorities and indigenous population	D	D	N/A	N/A	
16	Local economy (employment and means of livelihood, etc.)	D	D	N/A	N/A	
17	Land use and use of local resources	D	D	N/A	N/A	
18	Water use	B-	D	C-	N/A	During works: The coffer dam method will be used for pier works in the river in the dry season and the water quality is not expected to be worsened, nor is there expected to be any impact on fishing activities.

19	Existing social infrastructure and social services	D	D	N/A	N/A	
20	Social infrastructure and social organizations such as local decision making agencies, etc.	D	D	N/A	N/A	
21	Maldistribution of damage and benefits	D	D	N/A	N/A	
22	Clash of interests in the area	D	D	N/A	N/A	
23	Cultural heritage	D	D	N/A	N/A	
24	Landscape	D	D	N/A	N/A	
25	Gender	D	D	N/A	N/A	
26	Rights of children	D	D	N/A	N/A	
27	HIV/AIDS and other infections	B-	D	B-	N/A	During works: Because approximately 60 workers from neighboring districts will temporarily stay in the camp, infectious diseases such as malaria and dengue fever might spread.
28	Working environment (including labor safety)	B-	D	B-	N/A	During works: Work at height during girder erection involves risks.
29	Accidents	B-	C-	B-	D	During works: Construction equipment will increase traffic volume and traffic jams are therefore expected. The risk of traffic accidents will increase. Crocodiles inhabit the target river. In service: The bridge will have two lanes instead of the current single lane and the alignment will be straight. This is effective for reducing traffic accidents.
30	Transboundary impact and climate change	D	D	N/A	N/A	

A+/-: Significant negative impact is expected.
B+/-: Negative impact is expected to some extent.
C+/-: Extent of negative impact is unknown. (Further examination is needed in order to clarify the impact as the study progresses.)
D: No impact is expected.

Table 1-4-19 Results of Environmental and Social Considerations Survey (Messalo III Bridge)

Item		Evaluation in scoping		Evaluation based on survey results		Reason for evaluation result
		Before and during works	In service	Before and during works	In service	
1	Air pollution	B-	B-	C-	D	The neighboring area has a good environment without factories and houses. Pollutants from cars and construction machinery will most likely spread downwind from the river basin and thus the atmospheric pollutant density will decrease through advection and diffusion. Such damping effects will likely have little impact. During works: The operation of construction machinery will have an impact on air pollution. In service: The traffic is estimated to increase from 344 vehicles in 2015 to 570 in 2022 which means that there will still be relatively little traffic. The house nearest the bridge is approximately 3km away and the impact on air quality is expected to be small.
2	Water pollution	B-	C-	B-	D	A small fishing community exists close to the project site. Washing and small-scale fishing could be observed during the site survey. A simple water quality measurement indicated that the water quality is fairly good.

						During works: The substructure works will basically be done during the dry season in accordance with the construction plan. The coffer dam method will be used for excavation, and the water quality is not expected to be worsened by this construction method. In the dry season, passing water will disappear in the target river. In service: Because the road will be equipped with culverts and drainage pits, water pollution is not expected since rainwater can be appropriately managed.
3	Solid waste	B-	D	C-	N/A	During works: Construction activities may generate waste.
4	Soil pollution	B-	D	B-	N/A	During works: Since large crane trucks and piling machines will be used for construction, temporary soil pollution may occur mainly because of oil leaks from the construction machines.
5	Noise and vibration	B-	B-	D	D	There are no houses or facilities around the project site. Because the nearest house is located approximately 3km away from the bridge, impact from noise is not expected.
6	Land subsidence	D	D	N/A	N/A	
7	Bad odor	B-	D	D	N/A	During works: Puddles do not form because the surrounding areas are flat. Impact from bad odors is therefore not expected during construction.
8	Bottom sediment	D	D	N/A	N/A	
9	Protected areas	D	D	N/A	N/A	
10	Ecosystem	B-	B-	C-	D	Based on interviews with inhabitants, it was confirmed that there are no elephants in the bridge area. During works: The substructure works will basically be done during the dry season in accordance with the construction plan. The coffer dam method will be used for excavation. There will be no impact on animals and plants downstream of the bridge site because the construction plan does not negatively affect water quality. In service: There is not expected to be any impact on the ecosystem. NGOs are worried about increased poaching when the traffic volume increases.
11	Hydrological phenomena	B-	B-	D	D	During works: There is no impact on river bank erosion since construction will take place in the dry season. In service: An oval pier shape was adopted to ensure smooth river flow. Based on the hydraulic analysis results, the planned bridge length (140m) and span length is longer than the existing bridge (74m) which should provide better protection against scour.
12	Topography and geology	D	D	N/A	N/A	
13	Resettlement of residents	D	D	N/A	N/A	
14	Impoverished classes	D	D	N/A	N/A	
15	Minorities and indigenous population	D	D	N/A	N/A	
16	Local economy (employment and means of livelihood, etc.)	D	D	N/A	N/A	
17	Land use and use of local resources	D	D	N/A	N/A	
18	Water use	B-	D	C-	N/A	During works: The coffer dam method will be used for pier works in the river in the dry season and the water quality is not expected to be worsened, nor is there expected to be any impact on fishing activities.
19	Existing social infrastructure and social services	D	D	N/A	N/A	

20	Social infrastructure and social organizations such as local decision making agencies, etc.	D	D	N/A	N/A	
21	Maldistribution of damage and benefits	D	D	N/A	N/A	
22	Clash of interests in the area	D	D	N/A	N/A	
23	Cultural heritage	D	D	N/A	N/A	
24	Landscape	D	D	N/A	N/A	
25	Gender	D	D	N/A	N/A	
26	Rights of children	D	D	N/A	N/A	
27	HIV/AIDS and other infections	B-	D	B-	N/A	During works: Because approximately 60 workers from neighboring districts will temporarily stay in the camp, infectious diseases such as malaria and dengue fever might spread.
28	Working environment (including labor safety)	B-	D	B-	N/A	During works: Work at height during girder erection involves risks.
29	Accidents	B-	C-	B-	D	During works: Construction equipment will increase traffic volume and traffic jams are therefore expected. The risk of traffic accidents will increase. Crocodiles inhabit the target river. In service: The bridge will have two lanes instead of the current single lane and the alignment will be straight. This is effective for reducing traffic accidents.
30	Transboundary impact and climate change	D	D	N/A	N/A	

Table 1-4-20 Environmental and Social Consideration Result (Mapuede III bridge)

Item		Evaluation in scoping		Evaluation based on survey results		Reason for evaluation result
		Before and during works	In service	Before and during works	In service	
1	Air pollution	B-	B-	C-	D	The neighboring area has a good environment without factories and houses. Pollutants from cars and construction machinery will most likely spread downwind from the river basin and thus the atmospheric pollutant density will decrease through advection and diffusion. Such damping effects will likely have little impact. During works: The operation of construction machinery will have an impact on air pollution. In service: The traffic is estimated to increase from 344 vehicles in 2015 to 570 in 2022 which means that there will still be relatively little traffic. The house nearest the bridge is approximately 300m away and the impact on air quality is expected to be small.
2	Water pollution	B-	C-	B-	D	A small fishing community exists close to the project site. Washing and small-scale fishing could be observed during the site survey. A simple water quality measurement indicated that the water quality is fairly good. During works: The substructure works will basically be done during the dry season in accordance with the construction plan. The coffer dam method will be used for excavation, and the water quality is not expected to be worsened by this construction method. In the dry season, passing water will disappear in the target river. In service: Because the road will be equipped with culverts and drainage pits, water pollution is not expected since rainwater can be appropriately managed.

3	Solid waste	B-	D	C-	N/A	During works: Construction activities may generate waste.
4	Soil pollution	B-	D	B-	N/A	During works: Since large crane trucks and piling machines will be used for construction, temporary soil pollution may occur mainly because of oil leaks from the construction machines.
5	Noise and vibration	B-	B-	D	D	There are no houses or facilities around the project site. Because the nearest house is located approximately 300m away from the bridge, impact from noise is not expected.
6	Land subsidence	D	D	N/A	N/A	
7	Bad odor	B-	D	N/A	N/A	During works: Puddles do not form because the surrounding areas are flat. Impact from bad odors is therefore not expected during construction.
8	Bottom sediment	D	D	N/A	N/A	
9	Protected areas	D	D	N/A	N/A	
10	Ecosystem	D	D	N/A	N/A	
11	Hydrological phenomena	B-	B-	D	D	During works: There is no impact on river bank erosion since construction will take place in the dry season. In service: An oval pier shape was adopted to ensure smooth river flow. Based on the hydraulic analysis results, the planned bridge length (35m) and span length is longer than the existing bridge (24m) which should provide better protection against scour.
12	Topography and geology	D	D	N/A	N/A	
13	Resettlement of residents	D	D	N/A	N/A	
14	Impoverished classes	D	D	N/A	N/A	
15	Minorities and indigenous population	D	D	N/A	N/A	
16	Local economy (employment and means of livelihood, etc.)	D	D	N/A	N/A	
17	Land use and use of local resources	D	D	N/A	N/A	
18	Water use	B-	D	C-	N/A	During works: The coffer dam method will be used for pier works in the river in the dry season and the water quality is not expected to be worsened, nor is there expected to be any impact on fishing activities.
19	Existing social infrastructure and social services	D	D	N/A	N/A	
20	Social infrastructure and social organizations such as local decision making agencies, etc.	D	D	N/A	N/A	
21	Maldistribution of damage and benefits	D	D	N/A	N/A	
22	Clash of interests in the area	D	D	N/A	N/A	
23	Cultural heritage	D	D	N/A	N/A	
24	Landscape	D	D	N/A	N/A	
25	Gender	D	D	N/A	N/A	
26	Rights of children	D	D	N/A	N/A	
27	HIV/AIDS and other infections	B-	D	B-	N/A	During works: Because approximately 60 workers from neighboring districts will temporarily stay in the camp,

						infectious diseases such as malaria and dengue fever might spread.
28	Working environment (including labor safety)	B-	D	B-	N/A	During works: Work at height during girder erection involves risks.
29	Accidents	B-	C-	B-	D	During works: Construction equipment will increase traffic volume and traffic jams are therefore expected. The risk of traffic accidents will increase. Crocodiles inhabit the target river. In service: The bridge will have two lanes instead of the current single lane and the alignment will be straight. This is effective for reducing traffic accidents.
30	Transboundary impact and climate change	D	D	N/A	N/A	

1-4-13 Mitigation Measures

Table 1-4-21 shows the detailed environmental impact of project implementation and the measures for mitigating them.

Table 1-4-21 Summary of Environmental Impact and Mitigation Measures

Item	Element (Work)	Mitigation Measures	Responsible authority	Management authority	Cost
Air pollution	Piling work	・Regular checks and maintenance of construction machines for excavation work. ・Minimization of exhaust gases from construction machines. ・Periodical monitoring.	Contractor	ANE	Included in the Contractor's safety management plan cost.
	Soil pit, quarry site	・Sprinkling of water to suppress dust. ・Periodical monitoring.			
	Base course work	・Sprinkling of water to suppress dust. ・Periodical monitoring.			
	Transportation	・Regular checks and maintenance of vehicles. ・Minimization of exhaust gases. ・Safe driving at appropriate speeds. ・Submission and management of material transportation plan. ・Periodical monitoring.			
Water pollution	Piling work	・Adoption of cofferdam construction method and construction of piers during the dry season. ・Periodical monitoring.	Contractor	ANE	Included in the Contractor's safety management plan cost.
	Cuttings and embankments	・Preventive measures against soil outflow using sandbags. ・Periodical monitoring.			
Solid waste	Cuttings and embankments	・Transportation of waste to disposal sites appointed by ANE. ・Submission and management of waste management plan. ・Periodical monitoring.	Contractor	ANE	Included in the Contractor's safety management plan cost.
	Transportation	・Transportation of waste to disposal sites appointed by ANE. ・Submission and management of the waste management plan. ・Periodical patrols.			

Soil pollution	Piling work	・Regular checks and maintenance of construction machines to prevent oil leaks. ・Periodical patrols.	Contractor	ANE	Included in the Contractor's safety management plan cost.
	Storage	・Establishment of appropriate storage facilities. ・Periodical patrols.			
Ecosystem	Bridge work	・Experts should routinely observe animals and plants, and patrols should be organized in animal and plant habitats. Confirmation of the presence of wild animals which have left the national park. ・Unidentified vehicles passing the bridge should be reported to the police to prevent poaching. ・Periodical patrols.	Contractor	ANE	Included in the Contractor's safety management plan cost.
Water use	Piling work	・Adoption of cofferdam construction method and construction of piers during the dry season. ・Periodical monitoring.	Contractor	ANE	Included in the Contractor's safety management plan cost.
HIV/AIDS and other infections	Labor	・Regular seminars on the prevention of infectious diseases. Medical examinations. ・ Implementation of periodical safety management seminars.	Contractor	ANE	Included in the Contractor's safety management plan cost.
Working environment	Erection work	・Installation of safety fences at high work locations. ・Submission and management of safety management plan. ・Implementation of periodical safety management seminars.	Contractor	ANE	Included in the Contractor's safety management plan cost.
Accidents	Transportation	・Control of driving speed. ・Submission and management of transportation plan. ・ Laborers shall work inside cofferdams in the river in order to prevent damage from aquatic animals. ・Implementation of periodical safety management seminars.	Contractor	ANE	Included in the Contractor's safety management plan cost.

1-4-14 Environmental Management Plan

(1) Organization System

The establishment of good liaison between ANE, MITADER, surrounding communities, relevant NGOs and other parties plays a vital role. Figure 1-4-7 and 1-4-8 show a schematic diagram of the organization system during and after construction. In order to avoid undesirable events, it is important to take a comprehensive proper public participation approach and have an information disclosure process prior to project implementation.

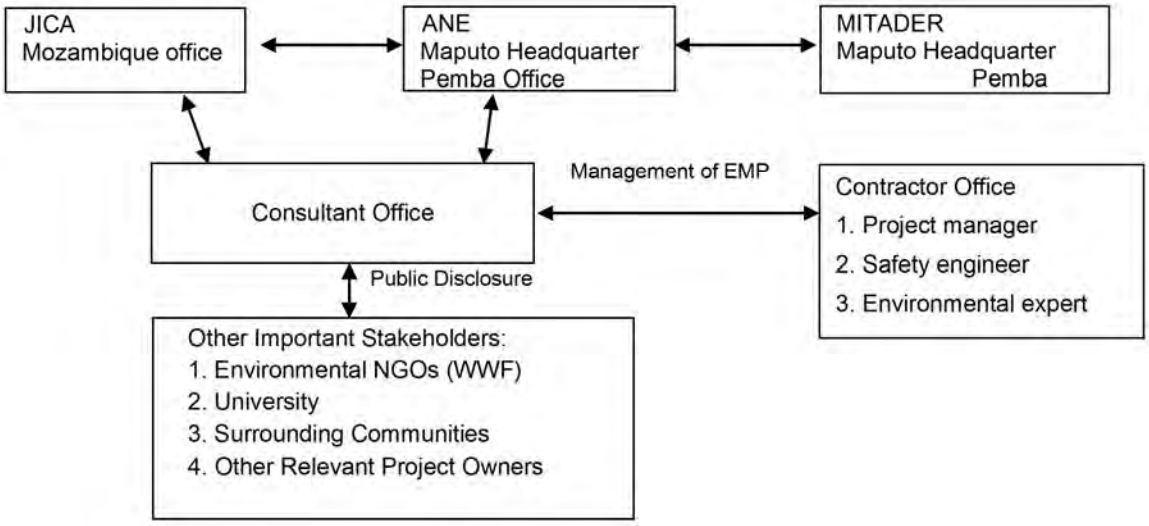


Figure 1-4-7 Organization System (during works)

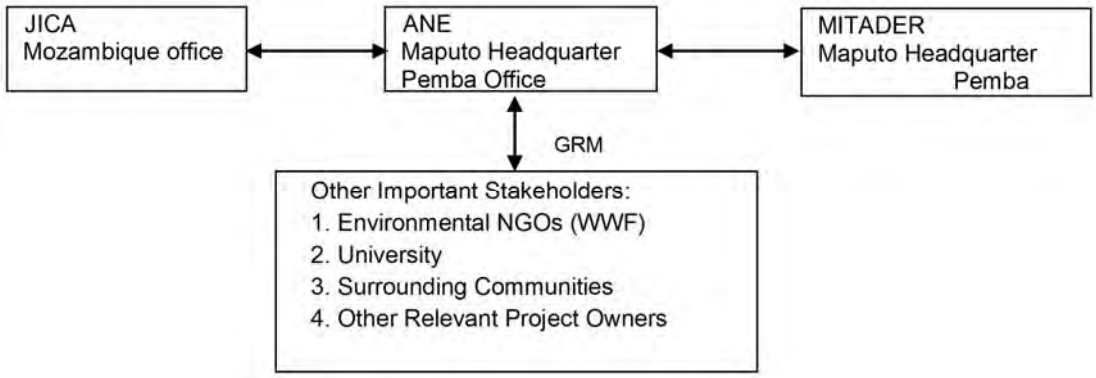


Figure 1-4-8 Organization System (in service)

(2) Environmental Monitoring

Table 1-4-22 summarizes the fundamental directions of environmental monitoring activities, to be implemented within the environmental management plan of the proposed bridge rehabilitation project.

Table 1-4-22 Monitoring Plan

Item	Influence	Countermeasures	Method & frequency	Responsible organization
Air pollution	Spreading of pollution due to operation of construction machinery	● Careful maintenance of construction machinery ● Utilization of sprinkling and cover sheets etc.	Visual inspection / everyday Sprinkling on dust / accordingly	Contractor
Water pollution	Contamination due to wastewater	● Water quality monitoring	pH, turbidity (visual inspection or turbidity meter) / every month	Contractor (ANE: after completion)

		● Installation of sediment stopper etc.		
Waste	Construction waste Waste by workers	● Disposal at designated waste treatment site ● Preparation of Waste Management Plan	Patrol around the site to prevent illegal disposal / every month Check on Waste Management Plan / every month	Contractor
Soil pollution	Leakage oil from construction equipment storage yard Leakage of materials from storage	● Careful daily maintenance and inspection	Inspection on leakage / everyday	Contractor
Ecosystems	Plants and animals	● Check on plants and animals ● Prevention of poaching	Patrol around the Site / every month Reporting of unidentified vehicles to the local police / accordingly	Contractor (ANE: after completion)

1) ANE

ANE provides construction management engineers and manages the environmental monitoring results. ANE reports to JICA during the service period.

2) Contractor

The Contractor carries out the following activities in the environmental management plan:

・Review of environmental management plan at the time of bidding.

・ Making of list of enforcement persons in charge of the construction management plan since they meet the experience of similar projects in the tender documents.

・ Review the monitoring plan before the start of construction and make a construction plan.

・Set up an organization system and enforce environmental monitoring.

・Submit the monitoring plan to ANE for approval.

・ Report the results of the monitoring plan to JICA and ANE every month.

1-4-15 Stakeholder Consultations

Table 1-4-23 shows the results of the stakeholder meetings.

Table 1-4-23 Summary of Stakeholder Consultations

Date and Venue	Contents	Concerns
14 March, 2015 Messalo bridge	Bridge replacement plan and the construction period were explained by the Survey Team.	The inhabitants could not walk and crossed in the river on foot because Messalo III bridge collapsed by a flood of 2014. The inhabitants can cross the bridge in peace after construction of the permanent bridge by Japanese government. The inhabitants welcome the enforcement of the project. I hope that sales of the road sale (vegetables) increase by traffic increasing.

14 March, 2015 Mapuede bridge	Bridge replacement plan and the construction period were explained by the Survey Team.	Mapuede bridge collapsed in the past. Water level had reached by road surface. The inhabitants are afraid of the current bridge when it flowed out. The inhabitants can cross the bridge in peace after construction of the permanent bridge by Japanese government. The inhabitants welcome the enforcement of the project. I hope that sales of the road sale (vegetables) increase by traffic increasing. The inhabitants worry that accidents may increase because run speed may rises.
25 March, 2015 WWF office	Outline of bridge replacement plan (8 bridges) was explained by the Survey Team.	The attendant worry about influence on promotion of poaching by the traffic increase and the illegal felling. There is a plan to surround the national park neighborhood with a fence and to propose the traffic prohibition of the night national highway in the government.
31 March, 2016 MITADER office	Explanation of location, scope and tentative schedule of the project (3 bridges)	It is out of control at Quirimbas - Mtwara corridor.
31 March, 2016 WWF office	Explanation of location, scope and tentative schedule of the project (3 bridges)	The habit of the elephant senses a person and a car sensitively, and escapes. During a construction period, there is not the thing meeting in the bridge site. The habits of the crocodile do not inhabit the place where speed is fast in river and the place without water. There is possibility hiding behind in the puddle. The counter measures during the construction are to prevent from entering underwater.

1-5 Existing Bridges

The current conditions were observed by the survey team and the cause of the damage of existing bridges was investigated. The current conditions are shown in Table 1-5-1.

Table 1-5-1 Current Conditions

No.	Bridge name	Cause of damage
1	Catipusse bridge	Reinforcement concrete slab bridge (2 span) collapsed by the cause of an abutment scoured and sunk. The traffic is released by Bailey bridge.
2	Muagamula bridge	T girder concrete bridge (2 span) was blown up during a civil war and collapsed. The reinforcement concrete slab bridge was built upstream, but an abutment pier sank afterwards by scoring. The traffic release by Bailey bridge.
3	Messalo I bridge	Messalo I bridge was built in Messalo river basin and low water channel. Existing bridge sunk at the time of a flood of February, 2014. The traffic is released by Bailey bridge.
4	Messalo III bridge	Messalo III bridge was built in Messalo river basin and low water channel. Existing bridge sunk at the time of a flood of February, 2014 and 2 span of reinforcement concrete slab washed away. The traffic is released by Bailey bridge.
5	Mapuede bridge	Box culvert collapsed by a cause an scored and sunk. A Bailey bridge was launched at downstream. The water level reach to 10cm below of the bailey bridge slab.
6	Muera I bridge	The bridge located in wetlands. 2 span of reinforcement concrete slab washed away and build the H section steel girder on H section support in temporary.
7	Muera II bridge	The temporary steel truss bridge located in wetlands. A guard rail on the deck does not installed in the bridge.
8	Mungoe bridge	Pipe culvert collapsed by the cause of an abutment scoured and sunk. There is about 5m gap between the existing culvert and river bed at downstream region. A Bailey bridge was launched on pipe culvert at downstream region.

The following tables shows the existing conditions of the bridges.

Bridge Inspection Record 1. 14-Mar-15

Bridge name		Catipusse bridge	Road name		N 380
Province		Cabo Delgado	Distance and built year		Sunate 68km+500、1965
Length		37.0m (Bailey)	Width		4.3m
Span length		-	Width of lane		4.0m
Number of span		One span	Width of pedestrian		none
Coordinates		South 12° 36'10.87",East 40° 1'0.14"	Number of lane		single
Traffic	Heavy vehicle	Many track rate	Road Condition	Surrounding environmen	No houses
	Car	Most traffic		Upstream	Maize firm
	Bike	Few		Downstream	No firm
	Pedestrian	Few		Sunate side	2 lane pavement road
Control	Weight	20ton		Oasse side	2 lane pavement road
	Height	none		ROW	25m from road center line
	Width	4.0m	River condition	Channel changing	Stable
	Other	none		Scouring	Record of scouring
Public attachment		none		River name	Catipusse
Superstructure	Structure	Bailey bridge (12bay 3.04m)			
	Present condition	Existing concrete bridge was about 10m length with 2pan slab bridge and collupsed by a flood in 2003. Bailey bridge laid on existing abut. One span of slab girder still remain around the site and other one was broken away.			
Substructure	Structure	Abut : Gravity type Pier : none			
	Present condition	River bed contain the fine sand and is scouring. Abut (Oasse side) was sank down for scouring. It is assumed that Abut sank because there is no pile foundation.			
Road	Present condition	Road holizontal alignment : Straight at bridge Vertical alignment : Almost flat incline			
Others	Present condition	Telephone cable is installed at upstream (26m away from the bridge)			
Evaluation	It is not stable condition that sinking of abut may happen on next flood.				

Photo	
	
Overall view of bridge	Elevation
	
Upstream from the bridge	Downstream from the bridge
	
Current condition of existing bridge	Heavy traffic

Bridge Inspection Record 2. 14-Mar-15

Bridge name		Muagamura bridge	Road name		N 380
Province		Cabo Delgado	Distance and built year		Macomia 12km+800
Length		33.0m (Bailey)	Width		4.3m
Span length		-	Width of lane		4.0m
Number of span		One span	Width of pedestrian		none
Coordinates		South 12° 8'12.81",East 40° 7'14.17"	Number of lane		single
Traffic	Heavy vehicle	Many track rate	Road Condition	Surrounding environmen	No houses
	Car	Most traffic		Upstream	Maize firm
	Bike	Few		Downstream	No firm
	Pedestrian	Few		Sunate side	2 lane pavement road
Control	Weight	20ton		Oasse side	2 lane pavement road
	Height	none		ROW	25m from road center line
	Width	4.0m	River condition	Channel changing	Stable
	Other	none		Scouring	Record of scouring
Public attachment		none		River name	Muagamura
Superstructure	Structure	Bailey(11bay 3.04m)			
	Present condition	There were two existing concrete bridges. First bridge(PCT, 30m) was blew off during civil war at downstream. Second concrete bridge(20m) at existing alignment was sank by a flood. Bailey bridge was launched on existing abut as current condition.			
Substructure	Structure	Abut : Gravity type Pier : none			
	Present condition	River bed contain the fine sand and is scouring. Abut (both side) was sank down for scouring. Sinking of Abut assumed that there is no pile foundation.			
Road	Present condition	Road holizontal alignment : If the new alignment shift to downstream, it will be straight. Vertical alignment : Almost flat incline			
Others	Present condition	Telephone cable is installed at upstream (26m away from the bridge)			
Evaluation	It is not stable condition that sinking of abut may happen on next flood.				

Photo	
 Overall view of bridge	 Elevation
 Upstream from the bridge	 Downstream from the bridge
 Current condition of existing bridge	 The bridge at downstream

Bridge Inspection Record 3. 14-Mar-15

Bridge name		Messalo I bridge	Road name		N 380
Province		Cabo Delgado	Distance and built year		Macomia 48km+700、2014(bailay)
Length		45.0m (concrete bridge)	Width		4.3m(Bailay)
Span length		(concrete bridge 9@5.0m)	Width of lane		4.0m(bailey)
Number of span		9 span(concert bridge)	Width of pedestrian		none(bailey)
Coordinates		South 11° 50'58.78",East 40° 6'23.07"	Number of lane		Single(bailey)
Traffic	Heavy vehicle	Many track rate	Road Condition	Surrounding environmen	No houses
	Car	Most traffic		Upstream	No firm
	Bike	Few		Downstream	No firm
	Pedestrian	Few		Sunate side	2 lane pavement road
Control	Weight	20ton		Oasse side	2 lane pavement road
	Height	none		ROW	25m from road center line
	Width	4.0m	River condition	Channel changing	Stable
	Other	none		Scouring	Record of scouring
Public attachment		none		River name	Messalo
Superstructure	Structure	Bailey (16bay 3.04m)			
	Present condition	Bailey(48.6m) was installed in February, 2014 because P4 and P5 were sank by a flood. The bailey just launch on existing concrete bridge. Width of lane at existing concrete bridge(L=45m) is 2@3m＝6m.			
Substructure	Structure	Abut : Gravity type Pier : Wall type			
	Present condition	River bed contain the fine sand and is scouring. Pier were sank down for scouring. It is assumed that Abut sank because there is no pile foundation.			
Road	Present condition	Road holizontal alignment : Straight at bridge Vertical alignment : Almost flat incline			
Others	Present condition	The flow is one of branch of Messalo river. From bridge to road(1.5km) way to Macomia is overflow and 10 days traffic close on every yeas. Telephone cable is installed at upstream (5m away from the bridge). Design drawings			
Evaluation	If the pier wash away , bailey also corrupts because the bailey bridge do not have original pier.				

Photo

Overall view of bridge

Elevation

Upstream from the bridge

Downstream from the bridge

Current condition of existing bridge

Flood on 2014

Bridge Inspection Record 4. 14-Mar-15

Bridge name		Messalo Ⅲ bridge	Road name		N 380
Province		Cabo Delgado	Distance and built year		Macomia 49km+400、2014(bailay)
Length		74.7m (Concrete 29.7m＋Bailey 45.6m)	Width		4.3m(bailay)
Span length		4.7m+5@5.0m+2@22.8m	Width of lane		4.0m(bailey)
Number of span		6 Span+2 span	Width of pedestrian		none (bailey)
Coordinates		South 11° 50'36.11",East 40° 6'14.58"	Number of lane		Single(bailey)
Traffic	Heavy vehicle	Many track rate	Road Condition	Surrounding environmen	No houses
	Car	Most traffic		Upstream	No firm
	Bike	Few		Downstream	No firm
	Pedestrian	Few		Sunate side	2 lane pavement road
Control	Weight	20ton		Oasse side	2 lane pavement road
	Height	none		ROW	25m from road center line
	Width	4.0m	River condition	Channel changing	Stable
	Other	none		Scouring	Record of scouring
Public attachment		none		River name	Messalo
Superstructure	Structure	RC slab bridge+Bailay(15bay 3.04m)			
	Present condition	Existing concrete bridge is RC slab bridge (L=74.4m, 15 span). 9 span corrupted and 6 span remained as existing bridge.			
Substructure	Structure	Abut : Gravity type Pier : Wall type			
	Present condition	River bed contain the fine sand and is scouring. Pier were sank down for scouring.			
Road	Present condition	Road holizontal alignment : Straight at bridge Vertical alignment : Almost flat incline Telephone cable is installed at upstream (5m away from the bridge)			
Others	Present condition	The flow is one of branch of Messalo river. marshy areas Design drawings. From bridge to Mapuede bridge is overflow and 10 days traffic close on every yeas.			
Evaluation	It is not stable condition that sinking of abut may happen on next flood.				

Photo	
	
Overall view of bridge	Elevation
	
Upstream from the bridge	Downstream from the bridge
	
Flood on 2014	Bailey section

Bridge Inspection Record 5. 14-Mar-15

Bridge name		Mapuede brige	Road name		N 380
Province		Cabo Delgado	Distance and built year		Macomia 52km+000
Length		24.0m (bailay)	Width		4.3m
Span length		-	Width of lane		4.0m
Number of span		Single	Width of pedestrian		none
Coordinates		South 11° 49'46.79",East 40° 4'35.79"	Number of lane		single
Traffic	Heavy vehicle	Many track rate	Road Condition	Surrounding environmen	Houses at 200 m awasy from bridge
	Car	Most traffic		Upstream	No firm
	Bike	Few		Downstream	No firm
	Pedestraian	Few		Sunate side	2 lane pavement road
Control	Weight	20ton		Oasse side	2 lane pavement road
	Height	none		ROW	25m from road center line
	Width	4.0m	River condition	Channel changing	Stable
	Other	none		Scouring	Record of scouring
Publich attachment		none		River name	Mapuede
Superstructure	Sttucture	Bailay (8bay 3.04m)			
	Present condition	Concrete structure remained at upstream on river bed. Bailay bridge was installed on the site. Team obsurbed the water level was only 2m from deck.			
Substructure	Sttucture	Abut : Gravity type Pier : none			
	Present condition	River bed contain the fine sand and is scouring at center of river Water flow was fast at the bridge because so much water at upstream as marshely area. Revetment also has a damaged durin the Team survey.			
Road	Present condition	Road holozontal alighnment : Straight at bridge Vertical alighnment : Almost flat incline			
Others	Present condition	The flow is one of branch of Messalo river. The bridge was oveflow on every yeas. Telephone cable is intralled at upstream (15.5m away from the bridge).			
Evaluation	There is not enough the clearance. It is not stable condition that sinking of abut may happen on next flood.				

Photo	
 Overall view of bridge	 Elavation
 Upstream from the bridge	 Downstream ftom the bridge
 Marshy area at upstream	 Scouring at revetment

Bridge Inspection Record 6. 14-Mar-15

Bridge name		Muera I brige	Road name		N 380
Province		Cabo Delgado	Distance and built year		Macomia 85km+700
Length		45.0m	Width		7.3m
Span length		7@5.0m+2@5.0m	Width of lane		6.3m
Number of span		9 span	Width of pedestrian		2@0.5m
Coordinates		South 11° 38'10.00",East 40° 0'56.00"	Number of lane		Double
Traffic	Heavy vehicle	Many track rate	Road Condition	Surrounding environmen	No house
	Car	Most traffic		Upstream	Banana, Maiz, Mango firm
	Bike	Few		Downstream	Banana, Maiz, Mango firm
	Pedestraian	Few		Sunate side	2 lane pavement road
Control	Weight	none		Oasse side	2 lane pavement road
	Height	none		ROW	25m from road center line
	Width	6.3m	River condition	Channel changing	Stable
	Other	none		Scouring	Record of scouring
Publich attachment		none		River name	Muera
Superstructure	Sttucture	RC slab bridge + temporary bridge			
	Present condition	Two span corupsed and installed temporary bent.			
Substructure	Sttucture	Abut : Gravity type Pier : Wall type			
	Present condition	River bed contain the fine sand and explored the footing Pier was sank down for scouring. Temporary bend by H section steel was installed as the girder support.			
Road	Present condition	Road holozontal alighnment : If the new alighment shift to downstreare, it will be straight. Vertical alighnment : Almost flat incline			
Others	Present condition	There is marshelu are at Muera river.			
Evaluation	It is not stable condition that sinking of abut may happen on next flood.				

Photo	
 Overall view of bridge	 Elavation
 Upstream from the bridge	 Downstream ftom the bridge
 Temporary bent	 Temporary girder

Bridge Inspection Record 7. 14-Mar-15

Bridge name		Muera II bridge	Road name		N 380
Province		Cabo Delgado	Distance and built year		Macomia 85km+900
Length		20.0m	Width		3.8m
Span length		-	Width of lane		3.4m
Number of span		Single	Width of pedestrian		2@0.2m
Coordinates		South 11° 38'8.42",East 40° 1'3.18"	Number of lane		Single
Traffic	Heavy vehicle	Many track rate	Road Condition	Surrounding environmen	No house
	Car	Most traffic		Upstream	Banana, Maiz, Mango firm
	Bike	Few		Downstream	Banana, Maiz, Mango firm
	Pedestraian	Few		Sunate side	2 lane pavement road
Control	Weight	20ton		Oasse side	2 lane pavement road
	Height	none		ROW	25m from road center line
	Width	4.0m	River condition	Channel changing	Stable
	Other	none		Scouring	Record of scouring
Publich attachment		none		River name	Muera
Superstructure	Sttucture	Steel truss girder			
	Present condition	The bridge design as temporary structure and no gurdrail and pedestrican way. Crack on concrete deck observed.			
Substructure	Sttucture	Abut : Gravity type Pier : none			
	Present condition	River bed contain the fine sand and is scouring.			
Road	Present condition	Road holozontal alighnment : Slightlu curve tower to Oasse Vertical alighnment : About few % flat incline towerd to Oasse			
Others	Present condition	There is marshelu are at Muera river.			
Evaluation	Member of truss has been corroded and need paint. Temporary structure should replace as soon as possible.				

Photo	
	
Overall view of bridge	Elavation
	
Upstream from the bridge	Downstream ftom the bridge
	
Heavy track traffic	Member of truss

Bridge Inspection Record 8. 14-Mar-15

Bridge name		Mungoe brige	Road name		N 380
Province		Cabo Delgado	Distance and built year		Macomia 99km+200
Length		24.0m (Bailey)	Width		4.3m
Span length		-	Width of lane		4.0m
Number of span		Single	Width of pedestrian		none
Coordinates		South 11° 32'3.30",East 40° 1'54.61"	Number of lane		single
Traffic	Heavy vehicle	Many track rate	Road Condition	Surrounding environmen	No houses
	Car	Most traffic		Upstream	No firm
	Bike	Few		Downstream	No firm
	Pedestraian	Few		Sunate side	2 lane pavement road
Control	Weight	20ton		Oasse side	2 lane pavement road
	Height	none		ROW	25m from road center line
	Width	4.0m	River condition	Channel changing	Stable
	Other	none		Scouring	Record of scouring
Publich attachment		none		River name	Mungoe
Superstructure	Sttucture	Bailay (1bay 4.04m)			
	Present condition	Existing structure (L=15.5m) is pipe culvert (4 pipes). Bailay is launch on pipe culvert.			
Substructure	Sttucture	Abut : Gravity type Pier : none			
	Present condition	River bed contain the fine sand and is scouring. Vertical gap occurred at downstrem of culvert and should be remove the culvert as soon as possible.			
Road	Present condition	Road holozontal alighnment : Slightlu curve tower to Oasse Vertical alighnment : About few % flat incline towerd to Oasse			
Others	Present condition	Scouring at the river bed downstream occurred intencity about 5m gap.			
Evaluation	Water flow obstruct by the culver and should be remove immediately.				

Photo	
 Overall view of bridge	 Elavation
 Upstream from the bridge	 Downstream ftom the bridge
 Damaged pipe culvert	 Gap between outlet and river bed

1-6 Social Conditions Survey

1-6-1 Outline of Cabo Delgado Province and Districts

(1) Outline of the Project Site

The investigation of old eight bridges on N380 will be implemented for bridge replacement connecting Sunate and Mocinboa da Praia in Cabo Delgado Province located in northern Mozambique. Cabo Delgado Province has a border of Tanzania. In the north province, Mtwara Corridor runs to connect Tanzania, Malawi and Mozambique. Nacala Corridor runs from the east to the west in the south province. N380 is a very important road, because it connects both corridors.

Source: ANE

Figure 1-6-1 Major Road Network and 6 Districts along N380 in Cabo Delgado Province

The province consists of 16 districts. Of 16 districts, N380 from Sunale to Mocinboa da Praia connects 6 districts - Ancuabe, Meluco, Quissanga, Macomia, Muidumbe, and Mocinboa da Praia.

(2) Development of Natural Gas, Liquefied Natural Gas (LNG) and the New City at Palma

1) Present Situation of Natural Gas Development in Area 1

The natural gas in Cabo Delgado Province has high potential to meet the increasing global demand.

The oil and gas exploration in the Rovuma River Basin started almost 50 years ago (1950'). Wentworth Resources Limited, an independent energy company, had bid for and won concessions in three Rovuma Basin areas – one onshore and two offshores. At that time the Company was partnered with Anadarko and the Mozambique national oil company in the Onshore and Offshore Rovuma Concessions.

The company began working in all three concession areas in 2006 and by 2008 new geological data had been acquired in Onshore and Offshore Rovuma, Mozambique. Anadarko's initiative to drill deep-water wells in the Offshore Rovuma Area 1 Concession began in the late 2009.

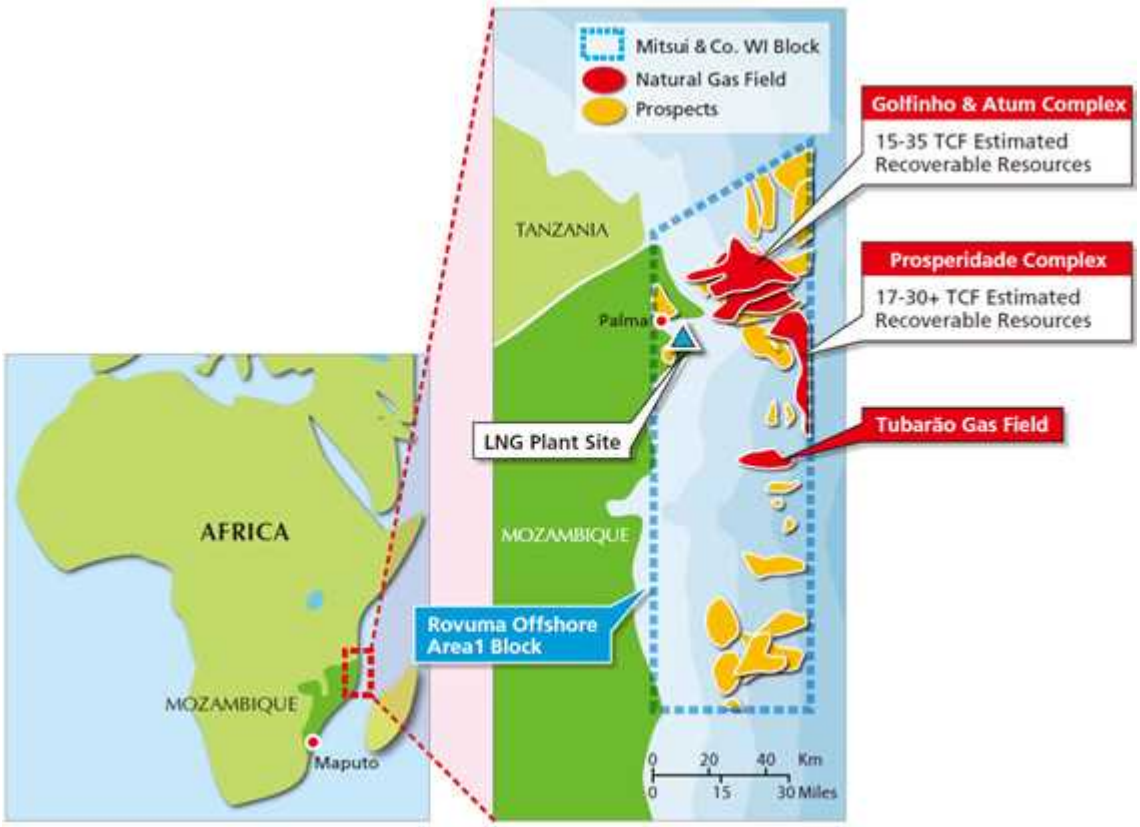
Anadarko, the operator of Area 1, and partners (interest owners of Rovuma Area 1) signed to order the basic design on construction of the plant for producing liquefied natural gas (LNG) in December, 2012. An area where the plant developed will be about 7,000ha. The plant is expected to be constructed next to the Palma port. The plant, which will receive natural gas not only from Area 1 but also from Area 4 which is adjacent to Area 1, has an annual production capacity of 20 million tons of LNG. The plant is supposed to start operation at the end of 2018 and to produce 10 million tons of LNG at first.

Table 1-6-1 Interest Owners and their Share of Rovuma Area 1

Interest Owner	Share
Anadarko Moçambique Area 1 Lda	36.5%（Operator）
Mitsui E&P Mozambique Area 1 Limited	20%
Empresa Nacional de Hidrocarbonetos, ep's	15%
BPRL Ventures Mozambique B.V.	10%
Videocon Mozambique Rovuma 1 Limited	10%
PTT Exploration & Production Plc	8.5%

Source: MITSUI & CO. LTD. (from the summary of Mozambique Area 1 LNG Project)

The produced liquefied natural gas is expected to be exported to countries such as Japan and India, and also used domestically.



Source: MITSUI & CO. LTD. (from the summary of Mozambique Area 1 LNG Project)

Figure 1-6-2 Location of Rovuma Offshore Area 1, Gas Field and Proposed Site of LNG Plant

Source: Anadarko Petroleum Corporation

Figure 1-6-3 Conceptual Drawing of LNG Plant in Palma

2) Master Plan for the Future of Natural Gas

The LNG project in Palma has been prioritized by the government of Mozambique. The government plans to start with one or two mega projects in Palma, and then evaluate future projects – such as a gas power plant and a fertilizer plant.

The projects will be developed in Palma, near the source of Rovuma gas. A significant amount of infrastructure needs to be developed to build the LNG plant in Palma.

3) The City Development Plan at Palma

The district government of Palma has released a new urbanization plan for a new city development in Palma. This comes after the plans for the LNG Park which necessitates the resettlement action plan. The new urbanization area is about 18,000 ha. The planning and the management of a future industrial park and urban area which will support the LNG plant are outlined in the plan. The plan recommends the installation of heavy industries associated with the transformation of natural gas and its derivatives, as well as the establishment of new residences for about 10,000 local workers.

(3) Ports in Cabo Delgado Province

The present situation about the Pemba port, the main port in the province, and the Palma port which locates in Palma where development of natural gas and LNG is being implemented is described in this section.

1) Pemba Port

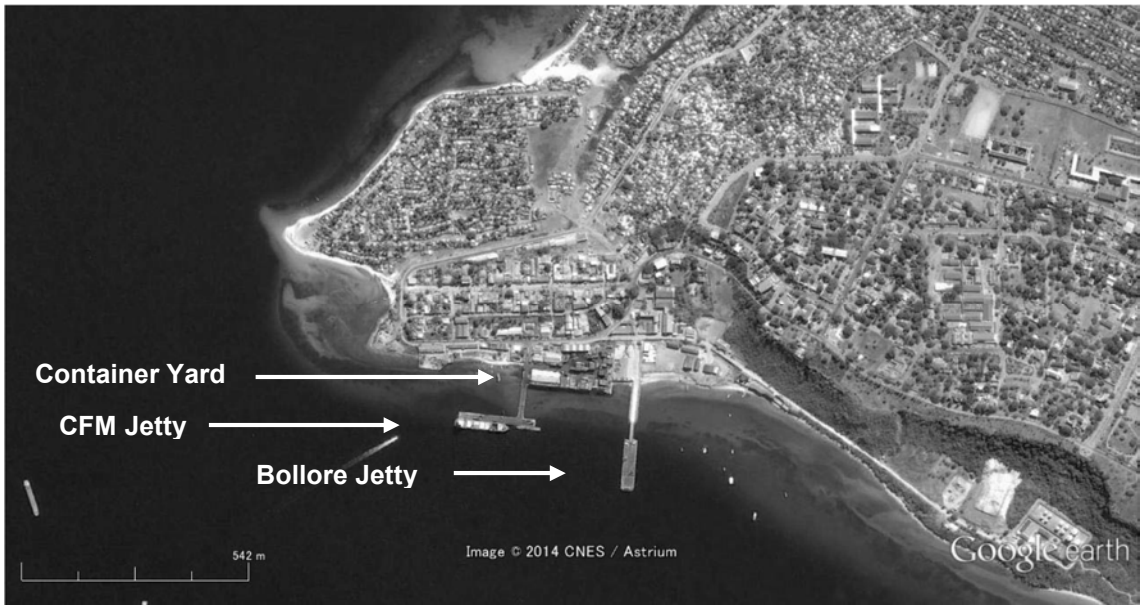
The Pemba port locates in 200km away from the north of Nacala Port. The Port and Railways Corporation (CFM) is directly responsible for the port operation and management. The Pemba port is well-sheltered inside the Pemba bay and has 20m depth.

① Port Facilities

The layout of port facilities is shown in Figure 1-6-4. The port has only one jetty, of which the length and width are 185m and 70m respectively. Water depth alongside the jetty is 7.5m (12m at high tide). The tidal level difference is 4.5m. The jetty is connected to the land by a 79m long bridge. The jetty was constructed in 1957 and refurbished in 1996.

The port provides a warehouse (1,700m2), container yard (which is being expanded to 7,000m2) and 2 reach stackers for container handling in the yard. There is no gantry quay crane provided.

In addition, Bollore, one of the offshore gas development companies, has constructed a jetty for supply boats that work with the offshore rigs/platforms.



Source: Google earth 2015

Figure 1-6-4 Pemba Port

A container ship from China

CFM Jetty

Container Yard

Bollore Jetty

Photo 1-6-1 Pemba Port

② Throughput Volume of Cargo

In 2011, a total of 65 commercial cargo vessels come to the port, all of which were general cargo vessels except for 3 tankers. The calling of supply boats and other vessels relating to the gas development project at Rovuma basin has been increasing recently.

The cargo throughput has increased up to 169,800 tons consisting of 116,700 tons for the containerized cargo and 53,100 tons for the non-containerized cargo. The international cargo constitutes the majority at more than 80%. The growth rate for 2010-2011 was recorded as

29% due to the export increase of timber and imports relating to the gas development. The cargo handling volume in 2010 and 2011 is shown in Table 1-6-2 below.

Table 1-6-2 Cargo Throughput of Pemba Port (2010 & 2011)

Items	Unit	2010		2011	
		Domestic Cargo	International Cargo	Domestic Cargo	International Cargo
Loading (Export)	1,000 ton	**23.4**	**65.2**	**18.9**	**89.3**
Container		3.3	65.2	0.8	88.8
Miscellaneous		20.1	0.0	18.1	0.5
Unloading (Import)		**13.1**	**29.2**	**10.4**	**51.2**
Fuel		4.9	-	3.3	-
Container		0.6	22.3	0.8	26.3
M. Transport		-	0.0	-	0.1
Miscellaneous		7.6	6.9	6.3	24.8
Total		**36.5**	**94.4**	**29.3**	**140.5**
Grand Total		**130.9**		**169.8**	

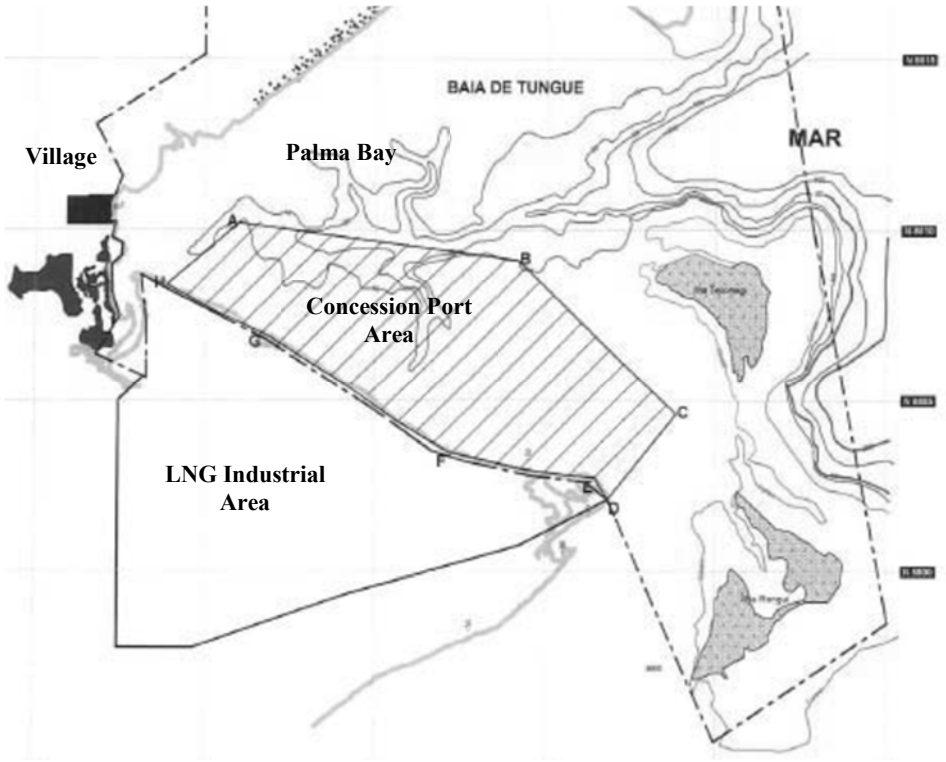
Source: CFM

2) Palma Port

The Palma port locates in 400km away from the north of Nacala Port and 30km away from the south of the Tanzania border. There are currently no port facilities, but some small fishermen's boats are observed along the shoreline near the small village located in the west end of the bay.


Photo 1-6-2 Shoreline and a Village in Palma

The south shore shallow area of the bay is planned for the new port development area (6,000ha) for which Cabo Delgado Ports (PCD) has been made the concession contract. The concession contract for the land area facing this port area (7,000ha) has been made by the natural gas developers to develop LNG plant facilities.



Source: ENH

Figure 1-6-5 Development Area of Palma Port and LNG

(4) Population

1) Past Trend of Population and Population Growth

According to the result of the Population and Housing Census conducted in 1997 and 2007, the total population in Mozambique accounted for 16,076 thousand and 20,632 thousand respectively. On the other hand, the population in Cabo Delgado Province accounted for 1,380 thousand and 1,634 thousand respectively. Population growth of Mozambique and the province from 1997 to 2007 was 2.53% and 1.70% respectively. The share of provincial population in the national population accounted for 8.6% in 1997 and 7.9% in 2007.

Table 1-6-3 Population and Growth Rate of Mozambique and Cabo Delgado Province

Item	Population		Annual Growth (%)
	1997	2007	1997 - 2007
Mozambique	16,075,708	20,632,434	2.53
Cabo Delgado	1,380,202	1,634,162	1.70
	8.6%	7.9%	

Source: National Statistics Institute (INE), Population and Housing Census, 1997 and 2007

2) INE's Population Projection of Mozambique and Cabo Delgado Province

In 2010, National Statistics Institute (INE) released the demographic projection of Mozambique during 2007-2040 by province and district level, which is based on the population projection programs developed by the Bureau of the Census of the United States.

Basic parameters of this projection of Mozambique and Cabo Delgado Province during 2007-2035 are shown in the table below.

Table 1-6-4 Basic Parameters of INE's Population Projection of Mozambique and Cabo Delgado Province during 2007-2035

Item		2007	2010	2015	2020	2025	2035
Population (1,000)	Mozambique	20,632	22,417	25,728	29,310	33,165	41,554
	Cabo Delgado	1,634	1,731	1,893	2,037	2,173	2,437
	(%)	7.9	7.7	7.4	6.9	6.6	5.9
Total Fertility Rate	Mozambique	5.7	5.6	5.2	4.8	4.3	3.5
	Cabo Delgado	5.7	5.6	5.2	4.6	4.1	3.2
Crude Birth Rate (per 1,000 persons)	Mozambique	42.2	41.6	39.2	36.3	33.4	29.0
	Cabo Delgado	41.2	40.7	37.6	33.9	31.0	26.8
Crude Death Rate (per 1,000 persons)	Mozambique	14.6	13.7	12.4	10.9	9.4	7.3
	Cabo Delgado	16.5	16.1	15.7	14.2	12.4	9.7
Annual Growth Rate (%)		(97-07)	(07-10)	(10-15)	(15-20)	(20-25)	(25-35)
	Mozambique	2.53	2.80	2.79	2.64	2.50	2.28
	Cabo Delgado	1.70	1.94	1.80	1.47	1.30	1.15

Source: INE, Population Projection 2007-2040

3) Population Projection of 6 Districts along N380

Table 1-6-5 shows the population projection of the 6 districts near to N380 across, Cabo Delgado Province and Mozambique in 2010, 2011 and 2012.

Table 1-6-5 Population Projection of 6 Districts along N380

		2010			2011			2012		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Whole Country*1		10,799,284	11,617,597	22,416,881	11,108,128	11,941,493	23,049,621	11,426,321	12,274,394	23,700,715
Cabo Delgado Province*2		837,718	893,482	1,731,200	853,707	910,487	1,764,194	869,849	927,486	1,797,335
		7.8%	7.7%	7.7%	7.7%	7.6%	7.7%	7.6%	7.6%	7.6%
6 Districts*3	Ancuabe	55,147	59,157	114,304	55,940	59,992	115,932	56,704	60,784	117,488
	Quissanga	19,014	20,211	39,225	19,158	20,503	39,661	19,158	20,633	39,791
	Meluco	12,370	13,194	25,564	12,454	13,272	25,726	12,535	13,347	25,882
	Macomia	40,865	43,899	84,764	41,496	44,516	86,012	42,141	45,142	87,283
	Muedumbe	36,648	39,615	76,263	36,980	39,921	76,901	37,290	40,199	77,489
	Mocimboa	47,865	49,668	97,533	48,902	50,635	99,537	49,981	51,632	101,613
	total	211,909	225,744	437,653	214,930	228,839	443,769	217,809	231,737	449,546
		25.3%	25.3%	25.3%	25.2%	25.1%	25.2%	25.0%	25.0%	25.0%

Source: *1 – Stastistical Yearbook 2013 Mozambique, *2 – Population Projection of Cabo Delgado 2007–2040, *3 – Statistics of Ancuabe, Quissanga, Meluco, Macomia, Muedumbe, and Mocimboa District 2013

(5) Work Force

1) Economically Active Population (EAP)

In 2007, the economically active population in Mozambique was 7,371 thousand. The agriculture sector employed the highest portion at about 75.2% (5,544 thousand). On the other hand, the economically active population of Cabo Delgado Province was 670 thousand. The agriculture sector employed the highest portion at about 87% (585 thousand).

Table 1-6-6 Economically Active Population (EAP) by Economic Sector in 2007

Sector	Mozambique	Cabo Delgado	%
Agriculture	5,543,928	584,853	10.5
Industry	489,298	22,489	4.6
Service	1,337,733	62,908	4.7
Total	7,370,959	670,250	9.1
Agriculture	75.2%	87.3%	
Industry	6.6%	3.4%	
Service	18.1%	9.4%	
Total	100.0%	100.0	

Source: "The Project for Nacala Corridor Economic Development Strategies" done by the JICA Study Team in 2014

2) Unemployment Ratio

According to the report of "The Project for Nacala Corridor Economic Development Strategies" done by the JICA Survey Team in 2014, the unemployment ration of Mozambique and Cabo Delgado Province in 2004/05 was 18.7% and 10.9% respectively. The ratio of the province was almost half of the whole nation.

(6) GRDP and GRDP per Capita

1) GRDP

The total GRDP in Cabo Delgado Province accounted for about MT 9,199 million in 2011 (2003 constant prices), which accounted for 4.7% of the GRDP in Mozambique.

The economic growth rates are shown in Table1-6-7 below. As seen in the table, Mozambique and the province have marked steady high growth rates at 7-8% since 2000.

Table 1-6-7 GRDP and Growth Rate of GRDP

	GRDP (Million MT, 2003 Constant Prices)				Annual Growth Tate (%)		
	1997	2000	2007	2011	97-00	00-07	07-11
Mozambique	69,073.7	84,989.3	151,299.9	197,524.4	7.2	8.6	6.9
Cabo Delgado	3,518.2	4,038.1	6,904.0	9,198.6	4.7	8.0	7.4
Province	5.1%	4.8%	4.6%	4.7%			

Source: The Project for NACALA CORRIDOR Economic Development Strategy done by the JICA Study Team in 2014

2) GRDP per Capita

GRDP per capita in Mozambique and the province was 4,297 MT and 2,549 MT in 1997 and 7,333 MT and 4,225 MT in 2007 respectively. GRDP per capita in the province was around 60% of GRDP per capita in the whole country. Economic activity in the province is rather small than the whole country.

Table 1-6-8 GRDP per Capita of Mozambique and Cabo Delgado Province

	GRDP per Capita (MT at 2003 Constant Price)		Proportion of GRDP to the Whole Country		Annual Growth Rate (%)
	1997	2007	1997	2007	1997 - 2007
Mozambique	4,297	7,333	1.0	1.0	5.5
Cabo Delgado	2,549	4,225	0.59	0.58	5.2

Source: The Project for NACALA CORRIDOR Economic Development Strategy done by the JICA Study Team in 2014

(7) Poverty and Inequality

1) Poverty Ratio

Poverty ratio in Mozambique and Cabo Delgado Province in 1997, 2003 and 2009 is shown in Table1-6-9 below.

Poverty ratio decreased by 14.7% from 69.4% in 1997 to 54.7% in 2009 in the whole country. The ratio also declined by 20% from 57.4% in 1997 to 37.4% in 2009 in the province. The ratio of the province is low compared to the whole country.

Table 1-6-9 Poverty Ratio of Mozambique and Cabo Delgado Province

	Poverty Ratio (%)			Gap of Poverty Ratio		
	1997	2003	2009	1997-2003	2003-2009	1997-2009
Mozambique	69.4	54.1	54.7	-15.3	+0.6	-14.7
Cabo Delgado	57.4	63.2	37.4	+5.8	-25.8	-20.0

Source: The Project for NACALA CORRIDOR Economic Development Strategy done by the JICA Study Team in 2014

2) Inequality

Gini coefficient, an indicator for measuring inequality of the income distribution, is generally used for indicating inequality. Gini coefficient with 0 represents perfect equality, while coefficient with 1 implies perfect inequality.

The Gini coefficient of Cabo Delgado Province declined down to 0.098 from 0.445 in 2003 to 0.347 in 2008, indicating narrowing income disparity.

Table 1-6-10 Gini Coefficient of Mozambique and Cabo Delgado Province

	2003	2008	Gap
Mozambique	0.415	0.414	-0.001
Cabo Delgado	0.445	0.347	-0.098

Source: The Project for NACALA CORRIDOR Economic Development Strategy done by the JICA Study Team in 2014

(8) Agriculture

1) Size of Farmers in Mozambique

The number of total farm-households (agriculture & livestock) in Mozambique is 3,827,797, while their total cultivated area is only 5,633,850 ha. Average cultivated area of all farm-

households is 1.47 ha. About 99% of farm-households are classified as small, and their average cultivated area is only 1.43 ha.

Table 1-6-11 No. of Farm-Households and their Cultivated Areas in Mozambique

	Small	Medium	Large	Total
Farm-Households (HH)	3,801,259	25,654	884	3,827,797
%	99.3	0.7	0.0	100.0
Cultivated Area (ha)	5,428,571	130,651	74,628	5,633,850
%	96.4	2.3	1.3	100.0
Average Cultivated Area (ha/households)	1.43	5.09	84.42	1.47

Source: The Project for NACALA CORRIDOR Economic Development Strategy done by the JICA Study Team in 2014

Note: Farm scale is defined as follows.

- Small-scale farmer: all factors are under "Limit 1"
- Medium: if one factor is greater than or equal to "Limit 1"
- Large: if one factor is greater than or equal to "Limit 2"

Factors	Limit 1	Limit 2
Non irrigated cultivation area (ha)	10	50
Irrigated cultivation, crops horticulture, floriculture	5	10
Number of head of cattle	10	100
Number of head of goats / sheep / swine	50	500
Number of poultry	2,000	10,000

2) Size of Cultivated Farm in Cabo Delgado Province

Table 1-6-12 shows cultivated areas by size of farm in Cabo Delgado Province. The total cultivated area in the province is 491,151 ha, of which 487,273 ha or 99.2% is cultivated by small farmers, whereas 0.7% and 0.1% are cultivated by medium and large farmers respectively.

Table 1-6-12 Cultivated Areas by Farm Size in Cabo Delgado Province (unit: ha)

	Small	Medium	Large	Total
Cabo Delgado Province	487,273	3,194	684	491,151
%	99.2	0.7	0.1	100.0

Source: The Project for NACALA CORRIDOR Economic Development Strategy done by the JICA Study Team in 2014

Note: Farm scale is defined the same as in the Note of Table1-6-11.

(9) Tourism

1) Number of Tourist, Nights, and Nights per Tourist

Table 1-6-13 shows the number of international and domestic tourists visited Cabo Delgado Province, the number of nights to stay and the number of nights per tourist in the past 4 years from 2011 to 2014.

Total number of international and domestic tourists visited the province increased by about 31% from about 58,900 in 2011 to about 108,200 in 2014. Domestic visitors increased by

about 71% during the same period and reached to about 44,300 in 2014. The number of international visitors, however, was broadly flat.

The number of guest bed nights increased by about 40% from about 147,300 days in 2011 to about 206,600 days in 2014. The domestic guest bed nights increased 15% during 4 years. However, the international guest bed nights increased significantly by 85% at the same period.

An overall average number of nights per guest increased by about 7% from 2.5 nights/guest in 2011 to 2.7 nights/guest in 2014. Though average number of nights per domestic guest decreased by about 33% from 3.6 nights/guest to 2.4 nights/guest, international bed nights increased by about 86% from 1.6 nights/guest in 2011 to 3.0 nights/guest in 2014.

Table 1-6-13 No. of Tourists, Nights and Nights per Tourist

		2011	2012	2013	2014	2011-2014
No. of Guest	Domestic	25,938	34,033	34,665	44,279	70.7%
	Foreign	32,969	29,224	30,515	32,816	-0.5%
	Total	58,907	63,257	65,180	77,095	30.9%
No. of Night	Domestic	94,042	95,300	101,215	108,189	15.0%
	Foreign	53,226	62,283	83,716	98,409	84.9%
	Total	147,268	157,583	184,931	206,598	40.3%
Night/Guest	Domestic	3.6	2.8	2.9	2.4	-32.6%
	Foreign	1.6	2.1	2.7	3.0	85.8%
	Total	2.5	2.5	2.8	2.7	7.2%

Source: Statistics of Tourism in Cabo Delgado Province, 2014

2) Accommodation

Table1-6-14 shows the number of accommodations, rooms and beds in Cabo Delgado Province, 6 districts other districts in the province.

The number of accommodations, rooms and beds in the province are 101, 1,236 and 1,852 and the number of accommodations, rooms and beds in 6 districts are 20, 191 and 231 in 2014 respectively.

Table 1-6-14 No. of Accommodation Facilities

	Accommodation	Room	Bed
Province	101	1,236	1,852
6 Districts	20	191	231
Other Districts	81	1,045	1,621

Source: Statistics of Tourism in Cabo Delgado Province, 2014

(10) Education

The Ministry of Education (MINED) is responsible for formulation of education policies, implementation of primary education, secondary education, non-formal and adult education, technical and vocational education and tertiary education. There are provincial directorates

of education and culture and the district services for education, youth and technology. These entities are responsible for management of the local education system from the opening of primary schools to the placement and management of teachers.

1) Education System

The general education system in Mozambique consists of 7 years primary education (EP), 5 years secondary education (ESG), and 4 or more years higher education (Universities). 7 years of EP consists of 5 years EP 1 (Grade 1 ~ 5) and EP 2 (Grade 6 and 7). 5 years ESG also consists of 3 years ESG 1 (Grade 8 ~ 10) and ESG 2 (Grade 11 and 12).

The technical and vocational education (TVE) system also provided by MINED. TVE schools provide training in industry, commercial and agriculture subjects. There are two levels of TVE, namely post-primary (PPTVE: Grade 8 ~ 13) and higher education (Institutes, etc.). PPTVE consists of basic (PPTVE 1) and intermediate levels (PPTVE 2). Basic level schools admit students that have completed the Grade 7 of EP 2, while intermediate level schools admit students that have completed the Grade 10 of ESG 1 or PPTVE 1. Duration of PPTVE 1 and 2 are three years.

Compulsory education is not defined by the law in Mozambique. Since 2005, school fee for primary schools has been eliminated as one of the measures to attain Millennium Development Goals (MDGs).

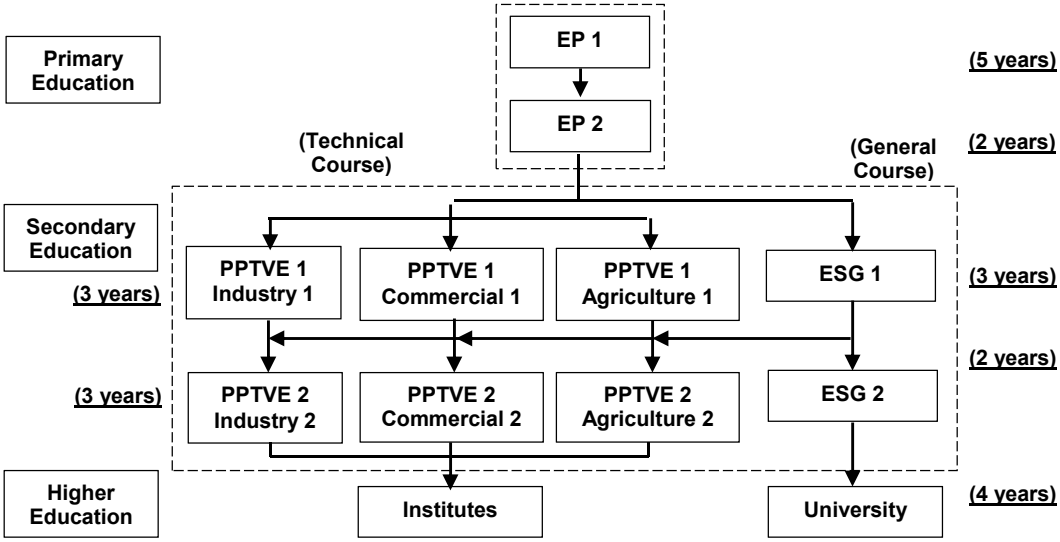


Figure 1-6-6 Education System

2) Number of Education Facility

The number of primary and secondary education facility in Cabo Delgado Province and 6 districts along N380 in 2013 is shown in table 1-6-15.

Table 1-6-15 No. of Education Facilities (2013)

Province & District		Primary		Secondary	
		EP1	EP2	ESG 1	ESG 2
C. Delgado Province		941	316*1	45	21
6 Districts	Ancuabe	56	2	3	1
	Quissanga	37	11	1	0
	Meluco	32	9	2	0
	Macomia	48	12	1	1
	Muidumbe	66	21	2	1
	Mocimboa	50	22	2	2
Total of 6 Districts		289	77	11	5
		30.7%	24.4%	24.4%	23.8%

Source: District Statistics of Ancuabe, Quissanga, Meluco, Macomia, Muidumbe, and Mocimboa, November 2013

Note: *1 - Data of year 2012

The number of EP1 and EP2 of primary school are 941 and 316 and the number of ESG1 and ESG2 of secondary school are 45 and 21 in the province in 2013 respectively.

The number of EP1 and EP2 of primary school in 6 districts are 289 and 77 respectively. It amounts to 30.7% and 24.4% of the province. The number of ESG1 and ESG2 of secondary school in the districts are 11 and 5 respectively. It amounts to 24.4% and 23.8% of the province respectively.

3) Number of Student, Teacher and Student per Teacher

The number of students, teachers and students per teacher in primary and secondary school in Cabo Delgado Province and 6 districts along N380 in 2013 is shown in the table below.

Table 1-6-16 No. of Students, Teachers and Students per Teacher (2013)

Province & District		EP 1, 2			ESG 1, 2		
		Student	Teacher	Stu. Per Tec.	Student	Teacher	Stu. Per Tec.
C. Delgado Province		313,943	6,732	46.6	43,638	1,465	29.8
6 Districts	Ancuabe	24,740	455	54.4	1,795	39	46.0
	Quissanga	8,070	232	34.8	294	21	14.0
	Meluco	5,711	196	29.1	1,030	28	36.8
	Macomia	16,283	310	52.5	1,029	31	33.2
	Muidumbe	18,651	350	53.3	2,039	56	36.4
	Mocimboa	20,464	401	51.0	3,256	91	35.8
Total of 6 Districts		93,919	1,944	48.3	9,443	266	35.5
		29.9%	28.9%		21.6%	18.2%	

Source: District Statistics of Ancuabe, Quissanga, Meluco, Macomia, Muidumbe, and Mocimboa, November 2013

The number of students and teachers in EP1 and EP2 of primary school in the province are 313,943 and 6,732 respectively. The average number of primary school students per teacher is 46.6 students. The number of students and teachers in ESG1 and ESG2 of secondary school in the province are 43,638 and 1,465 respectively. One teacher has about 29.8 secondary school students.

The number of students and teachers in EP1 and EP2 of primary school in 6 districts are 93,919 and 1,944 respectively. It amounts to 29.9% and 28.9% of the province. The average number of primary school students per teacher is 48.3 students. The number of students and teachers in ESG1 and ESG2 of secondary school in the province are 9,443 and 266 respectively. It also amounts to 21.6%% and 18.2% of the province. The average number of secondary school students per teacher is 35.5 students.

4) Literacy Rate and Enrolment Rate

According to the report of "The Project for Nacala Corridor Economic Development Strategies" done by the JICA Study Team in 2014, the literacy rate of the five provinces in the corridor in 2008 was as low as 31%, less than half of that of the other provinces at 66%.

Primary school Gross Enrolment rate (GER) of 5 provinces in the corridor and other provinces in Mozambique in 2010 was about 95% and about 93% respectively. There was no significant difference between the five provinces and other provinces.

(11) Health Care System

The Ministry of Health (MISAU) is responsible for the formulation of health policies and implementation of projects. MISAU prepares strategic plans for the sector and outlines principal strategies that provide orientation for district and provincial planning.

Mozambican health system consists of public sector organizations and private sector organizations. The public sector relies on the National Health Services (SNS) as the main service provider on the national scale. SNS is organized in four levels.

Table 1-6-17 Health Care System in Mozambique

Level		Health Facilities
Primary Level	(Level I)	Health centers, Health post
Secondary Level	(Level II)	District hospital, rural hospitals, general hospitals
Third Level	(Level III)	Provincial hospitals
Fourth Level	(Level IV)	Central hospitals

Source: The Project for NACALA CORRIDOR Economic Development Strategy done by the JICA Survey Team in 2014

1) Number of Health Facilities

Table1-6-18 below shows the number of health facilities in 6 districts in Cabo Delgado Province and the province in 2012.

Total 111 health facilities which consist of one Provincial Hospital (Level III), 3 Rural Hospitals (Level II) and 102 Health Centers and 5 Health Posts (both Level I) exist in the province.

36 health facilities are in 6 districts. It consists of one level II Rural Hospital in Mocimboa da Praia, and 34 Health Centers and one Health Post which are both Level I.

Table 1-6-18 No. of Health Facilities in 6 Districts & Cabo Delgado Province in 2012

Province & District		Level IV		Level Ⅲ	Level Ⅱ			Level I		Total
		Central hospital	Psychiatric hospital	Provincial hospital	Rural hospial	General hospital	District hospital	Health center	Health post	
C. Delgado Province				1	3			102	5	111
6 Districts	Ancuabe							6		6
	Quissanga							6	1	7
	Meluco							5		5
	Macomia							7		7
	Muidumbe							6		6
	Mocimboa				1			4		5
Total of 6 Districts					1			34	1	36

Source: District Statistics of Ancuabe, Quissanga, Meluco, Macomia, Muidumbe, and Mocimboa, November 2013

1) Number of Health Service Staff in Cabo Delgado Province

Table1-6-19 below shows the number of health service staff and population per staff in the province in 2012. The province has 3,554 health service staffs. One staff offers medical services to average 506 provincial residents.

Table 1-6-19 No. of Health Service Staff in Cabo Delgado Province in 2012

	Higher	**Medium**	**Basic**	**Elementary**	**General Support**	**Total**
Population of Cabo Delgado Province in 2012: 1,797,335						
No. of Staff	111	715	843	1,085	800	3,554
Population per Staff	1,619	2,514	2,132	1,657	2,247	506

Source: Statistic Yearbook 2012, Mozambique

(12) Border Posts in Cabo Delgado Province

1) Number of Border Posts

There is a border post with Tanzania at N'gapa in Cabo Delgado Province. The immigration and customs divisions have each office and the transporter is required to have their documentation processed at least twice in each country. Vehicles are required to obtain temporary export and import permission.

2) Working Hours

The border in the province is open from 6 am to 6 pm. Logistics operators should consider the working hours to cross the border.

(13) Road Development Situation in Cabo Delgado Province

1) Road Networks

The classified roads in Mozambique consist of national roads (primary and secondary) and regional roads (tertiary and vicinal roads). These roads are administrated by the National Road

Administration (ANE). Urban roads and unclassified roads fall under the jurisdiction of the municipal councils and the district administrations respectively.

According to ANE's data as of 2015, the classified road network in Cabo Delgado Province is 2,937 km, of which about 26% (770 km) are paved. Total length of primary roads which consists of 167 km of N1 and 255 km of N14 is 422 km, of which about 67% (282 km) are paved. Total length of secondary roads including N380 is 365 km, of which about 64% (234 km) is paved. About two third of the national road is paved. On the other hand, pavement ratio of regional road is very low. Total length of tertiary road is 1,728 km. This is about 60% of total length of the road network in the province. Of 1,728 km, only 254 km (14.70%) is paved. Vicinal road of 422 km length is not paved.

Table 1-6-20 Road Network in Cabo Delgado Province

Classification		Unit	Paved	Unpaved	Total
National Road	Primary	km	282	140	422
		%	66.82%	33.18%	100.00%
	Secondary	km	234	131	365
		%	64.11%	35.89%	100.00%
Regional Road	Tertiary	km	254	1,474	1,728
		%	14.70%	85.30%	100.00%
	Vicinal	km	0	422	422
		%	0.00%	100.00%	100.00%
Total		km	770	2,167	2,937
		%	26.22%	73.78%	100.00%

Source: ANE, data as of 2015

2) Programs and Projects on Road Development

ANE sets following 4 objectives. To achieve the objectives, ANE provided the priority projects in road sector as the "Strategic objectives for the five-year period 2015-2019".

- Improve the pass ability of roads, prioritizing those that have a major impact on socio-economic development of the country
- Making the connection between the main regions of the country and develop the main corridors
- Improve the capacity at national, provincial and local levels in the design, management and maintenance of the road network, and
- Promoting Road Safety actions and Use of Control of Roads and Right of Way

Projects supposed to be implemented in Cabo Delgado Province in the strategic objectives are as follows.

Table 1-6-21 Road Projects in Cabo Delgado Province

Road	Section	Length	Contents of the Project
N1	Rio Lurio – Metoro	74 km	Completion of the rehabilitation works – pavement and rehabilitation of the road, construction of bridges
N14	Ruaca – Montepuez	135 km	Road pavement
N380	Sunate – Macomia	118 km	Rehabilitation of the road Rehabilitation of bridges is not included.
N381	Negomane – Mueda	175 km	Pavement works
A bridge construction over Lio Ricao			
R698	Mueda – Montepuez	220 km	Study on pavement of the road
R775, R1260	Palma – Namoto	40 km	Study on pavement of the road

Source: ANE – Priority Projects of Road Sector for Five Years from 2015 to 2019

Of the projects in Table1-6-22, N380 and N381 projects have already been started. The present situation of the two projects is as follows.

Table 1-6-22 Present Situation of Two Road Projects (N380 Sunale ~ Macomia and N381 Mueda ~ Negomano)

Project	Present Situation of the Project
N380: Sunate ~ Macomia (118 km)	The project including bridge improvement has already been requested to Chinese Government. An environmental license for the project was already issued in November 2013. Road standard of this section is the same with the section between Macomia and Oasse. Designing the section has not been done yet. The conference between China and African countries on budgets and its allocation of projects requested from the countries is supposed to be held in 2015. Adoption of the project will be judged in the conference.
N381: Mueda ~ Negomano (175 km)	A Tunisian consulting firm is now implementing the F/S for the project on the AfDB budget. The F/S will be completed in June, 2015. Way of raising funds on the detail design and construction of the road such as loan or grant, and a funding agency has not been decided yet. This road is a part of the road from Tanzania to Mozambique and surrounding countries such as Zambia and Malawi through N380 and N1.

Source: Hearing to ANE in Maputo

Two roads in the table1-6-22 are very important because the roads are a part of the road from Tanzania to Mozambique and surrounding countries such as Zambia and Malawi. Moreover, in the future, these roads will be a part of N1 to Tanzania from Maputo, the capital of Mozambique.

(14) Rural Water Supply

The coverage of rural water supply in Cabo Delgado Province reached 74.0% in 2011.

The conditions of rural water supply are classified into two categories: “improved drinking water source” and “unimproved drinking water source.” The former comprises small water supply systems, borehole/protected dug wells with hand pumps, whereas the latter includes unprotected dug wells, surface water and others.

The majority of rural water supply in Cabo Delgado Province is provided by borehole and protected dug wells with hand pump.

Table 1-6-23 Percentage of Service Population by Type of Water Facilities in Cabo Delgado Province in 2011

Water Source	%
Hand pump	64.9%
Small water supply system	9.0%
Unimproved drinking water source	26.0%

Source: The Project for NACALA CORRIDOR Economic Development Strategy done by the JICA Study Team in 2014

(15) Gender

Followings are composite indexes for measuring the gender equality.

- HDI (Human Development Index)
- GDI (Gender – related Development Index)
- GEM (Gender Empowerment Measure), and
- GGGI (Global Gender Gap Index)

Each composite index is calculated based on various indicators related to gender classified into health, education, living standard, economic activities and empowerment.

Table 1-6-24 Indicators by Composite Index for Measuring Gender Equality

Composite Index			Indicators for calculating Composite Index
HDI	Index for calculation of GDI	Long Life & Health	Life Expectancy at Birth
		Education	Adult Literacy Rate, Total Enrolment Rate
		Living Standard	GDP per Capita (PPP)
GDI	Same indicators used in HDI by sex		
GEM	Difference of gender on economic and political decision making	Economic Activities	Ratio of legislator, high government official, and management position by sex, Ratio of expert and technician by sex
		Political Empowerment	Ratio of Seat in national parliament by sex
		Economic Resource	Male and Female Income
GGGI	Calculates ratio of male and female.	Economic Activities	Ratio of Labor Force by sex, Reward for Labor by sex , Average Income by sex, Ratio of legislator, high government official, and management position by sex, Ratio of expert and technician by sex
		Achievement of Education	Literacy Rate, Enrolment Ration in primary, secondary and tertiary education
		Health and Life	Health Life Expectancy, Sex Ratio at birth
		Political Empowerment	Ratio of Seat in national parliament by sex, Ratio of Seat in national parliament by sex, etc.

Source: Provided by the Study Team based on the Human Development Report (HDI, GDI and GEM) and Global Gender Gap Report

World Bank collects data on above mentioned indicators by country, and compiles and publishes as the gender statistics. Followings are gender related indicators on Mozambique.

Classification	Indicators
● Demography	Population by sex and age
● Economy & Living Standard	GDP, GDP per capita, GNI per capita
● Long Life & Health	Life expectancy at birth by sex, Fertility rate, Sex ratio at birth, Public expenditure to health sector, Access to improved water resources, Access to improved sanitation facilities
● Education	Literacy rate by youth and adult by sex, Enrolment rate in primary, secondary and tertiary education by sex, School completion ratio in primary and secondary education, Public expenditure to education sector
● Political Empowerment	Women in ministerial level position, Seats held by women in national parliament
● Economic Activities	Ratio of female teacher by primary, secondary and tertiary education, Labor force of female, Female labor participation rate (age +15)

Table 1-6-25 below shows the gender related indicators in 2000, 2005, 2010 and 2013 in Mozambique.

Table 1-6-25 Gender-related Indicators

Index			Unit	2000	2005	2010	2013
Demography							
No. of Female	0-14		x 1,000	3,998	4,696	5,422	5,843
	15-64		x 1,000	5,159	5,756	6,418	6,872
	over 65		x 1,000	333	387	449	488
	Total		x 1,000	9,489	10,838	12,288	13,203
Total no. of male			x 1,000	8,787	10,172	11,679	12,631
Total no. of both sexes			x 1,000	18,276	21,010	23,967	25,834
Economy							
GDP			Current US$	4.31E+09	6.58E+09	1.02E+10	1.56E+10
GDP per capita			Current US$	235.8	313.1	424.1	605.0
GNI per capita			Atlas method US$	230	290	460	610
			PPP US$	440	650	880	1,100
Long Life & Health							
Life expectancy at birth			Female (year)	48.96	49.15	50.18	50.77[*1]
			Male (year)	45.96	46.62	48.14	48.95[*1]
Fertility rate			birth per woman	5.78	5.67	5.41	5.26[*1]
Sex ratio at birth			Male births per female births	-	-	1.03	1.03[*1]
Public expenditure to health sector (% of GDP)				4.31	4.31	3.29	2.84[*1]
Access to improved water source (% of population)				41.1	44.5	47.8	49.2[*1]
Access to improved sanitation facilities (% of population)				14.1	17	19.8	21[*1]
Education							
Literacy rate	Youth females aged 15-24		%	-	50.04[*2]	56.54[*3]	-
	Youth males aged 15-24			-	74.36[*2]	79.84[*3]	-
	Females aged 15 and over			-	33.19[*2]	36.45[*3]	-
	Males aged 15 and over			-	65.58[*2]	67.35[*3]	-
Enrollment ratio	Primary	Female	% net	49.91	71.74	86.45	83.89[*1]
		Male		61.54	79.19	91.93	88.60[*1]
	Secondary	Female		2.66	6.07	15.14	17.32[*1]
		Male		3.74	7.77	16.92	18.15[*1]
	Tertiary	Female	% gross	-	0.94	2.90[*3]	-
		Male		-	1.89	4.70[*3]	-
School Completion	Primary	Female	%	12.48	33.84	55.11	48.13[*1]
		Male		19.74	48.5	65.50	56.25[*1]
	Lower Secondary	Female		2.04	5.01	12.12	14.36[*1]
		Male		3.06	7.32	14.67	15.90[*1]

Index		Unit	2000	2005	2010	2013
Public expenditure to education sector (% of GDP)			-	5.2	-	-
Political Empowerment (Decision Makers)						
Women in ministerial level position		%	-	13	25.9	27.6*1
Seats held by women in national parliament		%	30	34.8	39.2	39.2
Economic Activities						
Ratio of female teachers	Primary	%	25.70	29.91	39.20	40.97*1
	Secondary		-	17.77	17.95	19.07*1
	Tertiary		23.30	21.17	24.82*4	-
Labor Force	Female	x 1,000	4,816	5,369	5,919	6,293
	Total		8,771	9,919	11,095	11,881
Female labor participation rate (ages 15+)		%	87.7	87.4	86.2	85.5
Unemployment rate (% of labor force)	Female	%	9.6	9.3	9.3	9.3
	Male		8.6	8.3	8.3	8.3

Source: Gender Statistics, World Bank (http://data.worldbank.org/data-catalog/gender-statistics)
Note: *1 – 2012, *2 – 2003, *3 – 2009, *4 – 2011

Population by age, sex, and urban/rural residence based on the Census in 2007 is shown in Table 1-2-26 below.

Table 1-2-26 Population by Age, Sex and Urban/Rural Residence in 2007

Age		Total					Urban Area		Rural Area	
		Total	Male		Female		Total		Total	
		Population	Population	%	Population	%	Population	%	Population	%
0–14	Population	9,490,607	4,727,764	49.8	4,762,843	50.2	2,601,942	27.4	6,888,665	72.6
	%	46.9	48.5		45.3		42.3		48.9	
15–59	Population	9,838,840	4,585,827	46.6	5,253,013	53.4	3,331,839	33.9	6,507,001	66.1
	%	48.6	47.1		50.0		54.2		46.1	
60+	Population	922,776	433,099	46.9	489,677	53.1	218,193	23.6	704,583	76.4
	%	4.6	4.4		4.7		3.5		5.0	
Total	Population	20,252,223	9,746,690	48.1	10,505,533	51.9	6,151,974	30.4	14,100,249	69.6
	%	100.0	100.0		100.0		100.0		100.0	

Source: Demographic Yearbook 2013 - UN

1-6-2 Social Conditions of the Study Area

N380, which connects four big villages – Sunate, Macomia, Oasse and Mocimboa da Praia, passes through 6 districts – Ancuabe, Quissanga, Meluco, Macomia, Muedumbe and Mocimboa da Praia in Cabo Delugado Province. Present conditions of the section between Sunate and Oasse on N380 are as follows.

(1) Conditions of N380 and Adjacent Roads

N380 is largely divided into two sections - Sunate and Macomia section and Macomia and Mocimboa da Praia section. Adjacent roads of N380 are N1 of Pemba and Sunate section, R762 of Mocimboa da Praia and Palma section, R698 of Oasse and Mueda section, N381of Mueda and N'gapa section and R766 of Macomia and Mucojo section. Present conditions of these roads are shown in Table 1-6-27 and Photo 1-6-3 below.

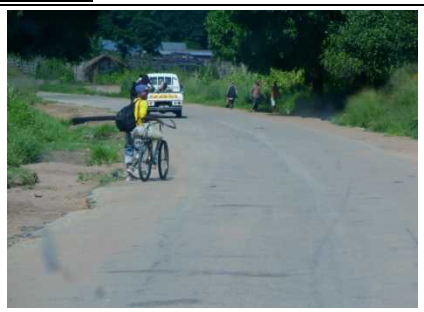
Table 1-6-27 Present Conditions of N380 and Adjacent Roads

Section	Distance	Outline
Pemba ~ Sunate (N1)	About 80km	● A part of N1 ● 2 lanes each way within Pemba city ● Very few streetlights are provided along the road except within Pemba city and the interchange at N1 and N380. ● Road width of the section between Pemba and Sunate is 10 ~ 12m. ● A climbing lane has been developed at hilly area. ● Relatively good pavement condition of the road
Sunate ~ Macomia (N380)	About 120km	● A part of N380. ● 2-lane road with about 8m width ● No streetlight is provided along the road except at the center of Macomia village. ● Though potholes are seen in places on the road, pavement condition of the road is rather good. ● The environment license for rehabilitation of this road section by Chinese Government had already been issued. ● Planed road width is the same with the width of Macomia ~ Mocimboa da Praia section.
Macomia ~ Mocimboa da Praia (N380)	About 150km	● Except bridges, rehabilitation works of this road section had already been completed by Portuguese Government. ● No streetlight is provided along the road except within Mocimboa da Praia. ● Pavement condition of the road is good.
Macomia ~ Palma (R762)	About 80km	● Rehabilitation works of this road section had already been finished by Portuguese Government. ● No streetlight provided along the road ● Pavement condition of the road is good.
Oasse~Mueda (R698)	About 55km	● 8m width of the road ● Pavement condition of the road is not very good. ● No streetlight except the center of Mueda ● Portuguese Government has the plan on rehabilitation of the road.
Mueda ~ N'gapa ~ Negomane (N381)	About 175km	● The access road to the border with Tanzania. ● The bridge over Rovuma River was constructed and opened in the early 2010. ● Narrow and unpaved road (a sandy road) ● Almost no traffic
Macomia ~ Mucojo (R766)	About 45km	● The access road which passes through Quirimbas National Park to the marine resort area ● No streetlight along the road ● Narrow and unpaved road (a sandy road) ● Almost no traffic

(N1 road in Pemba City)

(Climbing Lane in hilly area)

Pemba ~ Sunate (N1)

	
(N380 near Sunate)	(Pavement condition of N380)
Sunate ~ Macomia (N380)	
	
(N380 near Oasse)	(A bridge between Oasse and Mocimboa)
Macomia ~ Mocimboa (N380)	
	
(A bridge between Mocimboa and Palma)	(R762 between Mocimboa and Palma)
Mocimboa ~ Palma (R762)	
	
(Pavement condition of R698)	(R698 near Mueda)
Oasse~Mueda (R698)	
	
(Sand Road)	(Border Gate at N'gapa)
Mueda ~ N'gapa (N381)	

(Uniao Bridge – from Mozambique side)

(Uniao Bridge over the Rovma river)

Bridge (Uniao) over the Rovma River

(Sand Road)

(A Resort Lodge at Mocojo)

Macomia ~ Mucojo (R766)

Photo 1-6-3 Present Conditions of N380 and its Adjacent Roads

(2) Villages Along N380

Forty one villages shown in Table 1-6-28 below exist within the section between Sunate and Oasse on N380 in 6 districts.

Table 1-6-28 Name and No. of Villages along N380 by District

District	Villages	No. of Villages
Ancuabe	Sunale, Nankumi, Natocua, Muakide, Nacussa, Jiote, Nicuita, Biaque, Rapale, Mopanha	10
Quissanga	Quissanga II, Chongueia, Linde, Milamba, Nivico, Maua, Village 19	7
Meluco	Pedreira, Massasse, Mitambo, Uinguia, Nangororo, Roma	6
Macomia	Koko, Nagate, Bangala 2, Songueia, Machova, Macomia, Muagamula, Aldeia da Paz, Nova Zambezia, 5 Congresso, Chai	11
Muedumbe	Meangalewa, Xitaxi, Chitunda, Mungue	4
Mocimboa da Praia	Antadorra, Chinda, Oasse	3
Total		41

(3) Present Situation of Areas Around Bridges to be Replaced

Table 1-6-29 shows the name of bridges replaced and its adjacent villages.

Table 1-6-29 Target Bridges and Adjacent Villages

Bridge	Adjacent Villages
Catipusse	Maua (Quissanga District) and Massasse (Melco District)
Muagamula	Aldeia da Paz and Nova Zambezia (both within Macomia District)
Messalo I	Chai (Macomia District) and Meangalewa (Muedambe District)
Messalo III	
Mapuede	Meangalewa and Xitaxi (both within Muedambe District)
Muera I	Mungue (Muedumbe District) and Antadorra (Mocimboa District)
Muera II	
Mungoe	Antadorra and Chinda (both within Mocimboa District)

The current situation of the surrounding areas at bridges is shown in table 1-6-30 below.

Table 1-6-30 Existing Situation of Areas Surrounding the Bridges

Bridge	Existing Situation of Areas Surrounding the Bridges
Catipusse	● No village and house exists within about 1.5 km radius from the bridge. ● Main land use within a 200m radius of the bridge is grassland. ● Shrubs scatter in grassland. ● Small fields of maize and cassava etc. scatter at both sides of the road. ● Almost no water exists at dry season. ● The present bridge and an access road to the bridge have never been covered by water. ● Some villagers near the bridge use the bridge for cultivation, gathering firewood and going to a hospital in Nivico village.
Muagamula	● No village and house exists within about 1.5 km radius from the bridge. ● Main land use within a 200m radius of the bridge is grassland. ● Shrubs scatter in grassland. ● Small fields of maize and cassava etc. scatter at both sides of the road. ● Almost no water exists at dry season. ● The present bridge and an access road to the bridge have never been covered by water. ● Some villagers near the bridge use the bridge for cultivation, gathering firewood. ● Primary school pupils use the bridge for going to the primary school in Nova Zambezia village.
Messalo I	● No village and house exists within about 1.5 km radius from the bridge. ● Grassland is main land use within a 200m radius of the bridge. ● Small fields of maize and cassava etc. scatter at both sides of the road. ● Almost no water exists at dry season. ● The bridge and an access road were damaged by the flood in March 2014. ● Some villagers catch fish near the bridge in rainy season. ● Villagers use the bridge for going to the hospital in Macomia. ● Crocodiles inhabit in Messalo river.(hearing from villagers)
Messalo III	● No village and house exists within about 1.5 km radius from the bridge. ● Grassland is main land use within a 200m radius of the bridge. ● Shrubs scatter in grassland. ● Small fields of maize and cassava etc. scatter at both sides of the road. ● Almost no water exists at dry season. ● The bridge was partially broken by the flood in March 2014. ● Few villagers use the bridge. ● Crocodiles inhabit in Messalo river.(hearing from villagers)
Mapuede	● Meangalewa village exists about 300m away from north side of the bridge. ● Main land use within a 200m radius of the bridge is grassland. ● Shrubs scatter in grassland. ● Small fields of maize and cassava etc. scatter at both sides of the road.

	● Almost no water exists at dry season. ● The present bridge and an access road to the bridge have never been covered by water. ● Many Meangalewa villagers use the bridge for cultivation and gathering firewood. ● Villagers around Meangalewa village use the bridge for going to the hospital in Meangalewa.
Muera I and II	● No village and house exists within about 1.5 km radius from the bridge. ● Main land use within a 200m radius of the bridge is grassland. ● Shrubs scatter in grassland. ● Small fields of maize and cassava etc. scatter at both sides of the road. ● River water exists even at dry season. ● The present bridge and an access road to the bridge have never been covered by water. ● Some villagers use the bridge for cultivation and gathering firewood. ● Crocodiles inhabit in Muera river area.(hearing from villagers)
Mungoe	● No village and house exists within about 1.5 km radius from the bridge. ● Main land use within a 200m radius of the bridge is grassland. ● Shrubs scatter in grassland. ● Small fields of maize and cassava etc. scatter at both sides of the road. ● Almost no water exists at dry season. ● The present bridge and an access road to the bridge have never been covered by water. ● Some villagers near the bridge use the bridge for cultivation, gathering firewood and going to the hospital in Meangalewa village.

Catipusse Bridge

Muagamula Bridge

Messalo Bridge 1

Messalo Bridge 3

Mapuede Bridge

Muera Bridge 1

Muera Bridge 2



Mungoe Bridge

Photo 1-6-4 Present Situation of Surrounding Area of Bridges

(4) Present Living Environment Conditions of Villages along N380

1) Housing Locations and Conditions

N380 is categorized as the secondary road. Therefore, the width of Right of Way (ROW) of the road is 15m from the edge of the road. The area of ROW belongs to ANE. Except public facilities, construction of buildings such as houses within the area is banned in principle. However, many houses can be seen within the area in almost all villages along N380, even in the section of the road between Macomia and Oasse which has already been rehabilitated.


Houses along N380 between Sunate and Macomia

Houses along N380 between Macomia and Oasse

Photo 1-6-5 Housing along N380

2) Design and Type of Local Houses

Almost all houses along N380 are a detached one-story mud house with a thatched roof.

	
A Typical Local House along N380 (1)	A Typical Local House along N380 (2)

Photo 1-6-6 Typical Local Houses along N380

3) Water Supply

Except residents living in a part of Macomia, residents along N380 use ground water as domestic water (for drinking, washing and taking shower). Each village along the road has multiple wells and hand pumps and villagers in each village share the wells and the pumps with each other. The depth of the wells is about 5m to 10m. The pumps were installed by NGOs.

The water supply facility using ground water, constructed during the Portuguese colonial period, has still remained in Macomia. No maintenance for the facility has been implemented after the independence from Portugal. Therefore, facilities for purification and distribution of water do not function completely. However, ground water from surrounding mountains has still been flowing into the intake facility constructed under the ground. The water flows into the urban area of Macomia through old water distribution pips. Owners of lands where the pipe exists install a faucet in the pipe and sell the water to villagers in Macomia. The water clouded due to no treatment.

	
A Well in a Village	A Hand pump in a Village

	
Collection of Rain Water	Selling Water in Makomia

Photo 1-6-7 Water Supply System along N380

4) Electricity

A substation exists along N380. Electric wires run parallel to both side of the road. However, no village along the road uses electricity except a part of Sunate, Macomia and Oasse. Villagers who have electric equipment have a solar panel for using the equipment.

	
A Pole Transformer in a Village	A Solar Panel

Photo 1-6-8 Electricity Supply System along N380

5) Market

A market full of small shops exists in Sunate, Macomia and Meangalewa. Villagers living in the villages and adjacent villages use the markets for shopping for food, clothes and goods for entertainment.

	
A Market in Sunale	A Market in Macomia

A Market in Meangalewa

Photo 1-6-9 Markets along N380

(5) Present Educational Situation

1) Present Condition of Educational Facilities

There are primary schools, a general secondary school and a technical school along N380. There are also five universities in Pemba and one in Mocimboa da Praia.

Though all of 40 villages along N380 except Songueia Village in Macomia District have a primary school, the school having a class for 7 grades from 1 to 7 exists only in 18 villages. Remaining 22 schools do not have a class for the upper grades such as Grade 5 to 7. Most of the upper grades pupils in such schools go to a primary school having upper grade classes in a neighboring village on foot alongside N380. Of these pupils, pupils in Grade 6 and 7 in Muagamula village and Nava Viba Village cross Muagamula Bridge on N380 and go to the primary school in Nova Zambezia Village.

A general secondary school having grade 8 to 12 and a technical school having grade 8 to 10 exist in Macomia Village. The total number of students in the general school is about 1,100. Of which, about 400 are female students. Many students board in Macomia or a house in the school. About 160 students board in the house in the school.

A technical school having grade 8 to 10 has been established in Macomia in February 2012. The school has electricity, machinery and carpentry course. About 350 students including about 100 female students study in the school at present. Almost all graduates went on to institutes having grade 11 to 13 classes in Nampula, Beira, Maputo and Pemba.

2) Present Class Conditions

In Mozambique, 45 to 50 students in a classroom of a primary school are standardized. However, the number of teachers and classrooms is low compared to the number of students in many primary schools along N380. Therefore, students in the school are divided into two groups - morning session group and afternoon session group.

The number of female students in Grade 6 and 7 is less than half of the number of Grade 1 to 5. According to teachers, followings are main reasons for not attending a school.

- Female students in the upper grades of the school have to do the housework and field work as the main labor force in a family.
- They do not attend school due to marriage and delivery.
- Their husbands do not have understanding on education.

Table 1-6-31 Present School Conditions (example)

Village	Grade	No. of Pupil	No. of Teachers
Chinda	G1 ~ 7	G1 ~ 5: 343 (Boy - 168, Girl - 175) G6 ~ 7: 39 (Boy - 16, Girl - 23) Total: 382 (Boy - 184, Girl - 198)	5 teachers (76 pupil/teacher)
Antadorra	G1 ~ 4	Total: 75	1 teacher (75 pupil/teacher)
Xitaxi	G1 ~ 7	G1 ~ 5: 420 (Boy - 301, Girl - 119) G6 ~ 7: 113 (Boy - 87, Girl - 26) Total: 533 (Boy - 388, Girl - 245)	10 teachers (53 pupil/teacher)
Meangalewa	G1 ~ 7	G1 ~ 5: 1,670 (Boy - 872, Girl - 798) G6 ~ 7: 225 (Boy - 129, Girl - 96) Total: 1,895 (Boy - 388, Girl - 245)	27 teachers (70 pupil/teacher)
Chai	G1 ~ 7	G1 ~ 5: 768 (Boy - 428, Girl - 340) G6 ~ 7: 115 (Boy - 71, Girl - 44) Total: 883 (Boy - 388, Girl - 245)	14 teachers (63 pupil/teacher)

Signboard of a primary school G1~5 in Massasse

Primary school in Chinda

Secondary school in Macomia

Technical school in Macomia

Photo 1-6-10 Educational Facilities along N380

Table 1-6-32 Educational Facilities by Village along N380

District	Village	Education Facility	Remarks
Ancuabe (10)	**Sunate**	1 primary school (Grade 1 ~ 7)	
	Nankumi	1 primary school (Grade 1 ~ 6)	G7 pupils go to Sunate
	Natocua	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Muakide
	Muakide	1 primary school (Grade 1 ~ 7)	
	Nacussa	1 primary school (Grade 1 ~ 7)	
	Jiote	1 primary school (Grade 1 ~ 7)	
	Nicuita	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Jiote
	Biaque	1 primary school (Grade 1 ~ 7)	
	Rapale	1 primary school (Grade 1 ~ 3)	G4 ~ 7 pupils go to Biaque

District	Village	Education Facility	Remarks
	Mopanha	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Biaque
Quissanga (6)	Quissanga II	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Linde
	Chongueia	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Linde
	Linde	1 primary school (Grade 1 ~ 7)	
	Ujama	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Nivico
	Nivico	1 primary school (Grade 1 ~ 7)	
	Maua	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Nivico
	Catipusse Bridge		
Meluco (4)	Pedreira	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Mitambo
	Massasse	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Mitambo
	Mitambo	1 primary school (Grade 1 ~ 7)	
	Uinguia	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Mitambo
Quissanga (1)	**Village 19**	1 primary school (Grade 1 ~ 7)	
Meluco (2)	**Nangororo**	1 primary school (Grade 1 ~ 7)	
	Roma	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Imbada
Macomia (12)	Koko	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Nagate
	Nagate	1 primary school (Grade 1 ~ 7)	
	Bangala 2	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Nagate
	Songueia	No primary school	Pupils go to Macomia
	Machova	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Macomia
	Macomia	4 primary schools (Grade 1 ~ 7) 1 secondary school (Level 1&2) 1 technical school (Level 1)	
	Muagamula	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Nova Zambezia
	Nova Viba	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Nova Zambezia
	Muagamula River (Muagamula Bridge)		
	Aldeia da Paz	1 primary school (Grade 1 ~ 4)	G5 ~ 7 pupils go to Nova Zambezia
	Nova Zambezia	1 primary school (Grade 1 ~ 7)	
	5 Congresso	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Chai
	Chai	1 primary school (Grade 1 ~ 7)	
	Messalo River (Messalo Bridge 1)		
Muedumbe (4)	Messalo River (Messalo Bridge 2, 3)		
	Meangalewa	1 primary school (Grade 1 ~ 7)	
	Pwede River (Mapuede Bridge)		
	Xitaxi	1 primary school (Grade 1 ~ 7)	
	Chitunda	1 primary school (Grade 1 ~ 7)	
	Mungue	1 primary school (Grade 1 ~ 5)	G6 & 7 pupils go to Magaia
	Muera River (Muera Bridge 1 & 2)		
Mocimboa da Praia (2)	Antadorra	1 primary school (Grade 1 ~ 4)	G5 ~ 7 pupils go to Criaca
	Nango River (Mungoe Bridge)		
	Chinda	1 primary school (Grade 1 ~ 7)	

(6) Health Care Facilities

Only 6 of 41 villages along N380 have a health care center. The center in Biaque, Nivico, Chai and Chitunda Village provides only 3 services – maternity, pediatric and outpatient care. Patients who cannot received expert and/or high quality specialized medical treatment at the center are sent to the bigger health center in Meangalewa and/or Macomia. In case these centers cannot either perform appropriate medical measures to such patients, patients need to be sent to the hospital in Pemba or other city.

The health center in Macomia receives average 150 child patients and 250 adult patients per day. The center in Macomia has 39 beds, 3 doctors and 11 nurses (7 female and 4 male nurses).

A signboard of a health center in Imbada

A Health Center in Macomia

A sign board of a hospital construction in Macomia

A health Center in Chai

Photo 1-6-11 Health Care Facilities along N380

Table 1-6-33 Health Care Facilities by Village along N380

District	Village	Health Facility	Remarks
Ancuabe (10)	Sunale	No health facility	Go to Ancuabe
	Nankumi	No health facility	Go to Ancuabe
	Natocua	No health facility	Go to Ancuabe
	Muakide	No health facility	Go to Ancuabe
	Nacussa	No health facility	Go to Biaque
	Jiote	No health facility	Go to Biaque
	Nicuita	No health facility	Go to Biaque
	Biaque	**A health center**	Maternity, pediatrics and outpatient care
	Rapale	No health facility	Go to Biaque
	Mopanha	No health facility	Go to Biaque
Quissanga (6)	Quissanga II	No health facility	Go to Biaque
	Chongueia	No health facility	Go to Nivico
	Linde	No health facility	Go to Nivico
	Ujama	No health facility	Go to Nivico
	Nivico	**A health center**	Maternity, pediatrics and outpatient care
	Maua	No health facility	Go to Nivico
	Catipusse Bridge		
Meluco (4)	Pedreira	No health facility	Go to Nivico or Muaguide (District center)
	Massasse	No health facility	Go to Muaguide (District center)
	Mitambo	No health facility	Go to Muaguide (District center)
	Uinguia	No health facility	Go to Muaguide (District center)
Quissanga (1)	Village 19	No health facility	Go to Muaguide (District center)
Meluco (2)	Nangororo	No health facility	Go to Imbada
	Roma	No health facility	Go to Imbada
Macomia (12)	Koko	No health facility	Go to Imbada
	Nagate	No health facility	Go to Macomia
	Bangala 2	No health facility	Go to Macomia
	Songueia	No health facility	Go to Macomia
	Machova	No health facility	Go to Macomia
	Macomia	**A health center**	Large scale of health center (regional core)

District	Village	Health Facility	Remarks
	Muagamula	No health facility	Go to Macomia
	Nova Viba	No health facility	Go to Macomia
	Muagamula River (Muagamula Bridge)		
	Aldeia da Paz	No health facility	Go to Macomia
	Nova Zambezia	No health facility	Go to Chai or Macomia
	5 Congresso	No health facility	Go to Chai or Macomia
	Chai	**A health center**	Maternity, pediatrics and outpatient care
	Messalo River (Messalo Bridge 1)		
Muedumbe (4)	Messalo River (Messalo Bridge 2, 3)		
	Meangalewa	**A health center**	Large scale of health center (regional core)
	Pwede River (Mapuede Bridge)		
	Xitaxi	No health facility	Go to Chitunda or Meangalewa
	Chitunda	**A health center**	Maternity, pediatrics and outpatient care
	Mungue	No health facility	Go to Chitunda or Meangalewa
	Muera River (Muera Bridge 1 & 2)		
Mocimboa da Praia (2)	Antadorra	No health facility	Go to Chitunda or Meangalewa
	Nango River (Mungoe Bridge)		
	Chinda	A health center	No doctor, go to Mbau

(7) Conditions of Crossing Bridges on N380

Two Messalo Bridge I & III were damaged and partially collapsed by the flood in March, 2014 and people and vehicles could not cross the bridges for one to two months. Except this event, people and vehicles have been crossing over bridges on N380 after the end of a civil war in Mozambique in 1992.

Present Situation of Crossing Bridges on N380

All bridges on N380 except eight bridges which are supposed to be replaced are double lane. Therefore, a vehicle crossing the bridges does not need to wait oncoming cars at the bridges. Moreover, no bump for reducing speed at the bridges is provided near the bridges. Because of these, all vehicles can cross the bridges smoothly.

One of bridges which are supposed to be replaced has two lanes. Remaining 7 bridges have just one lane with 3.5 ~ 4.2 m width. Therefore, a vehicle has to wait at the bridges in case oncoming cars are crossing a bridge. Furthermore, the number of lanes is reduced from two to one at the bridges, therefore, a bridge sign is set up at one side of a road in front of the bridges and bumps are built on a road at both sides of the bridges for attention to and safety of drivers. A vehicle crossing the bridges, therefore, has to reduce running speed. Because of these, total driving time of vehicles running on N380 increases.

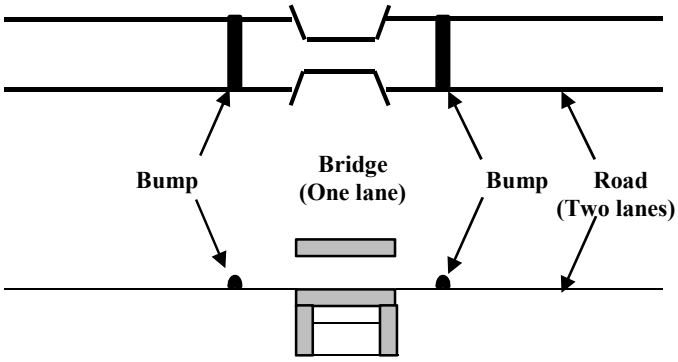


Figure 1-6-7 Suppression Elements of Driving Speed Near Bridges to be Replaced

A primary school exists at each village along N380. Many pupils go to school without crossing a bridge on N380. However, some pupils of the upper grades of some primary schools cross a bridge on foot for going to school in a nearby village. Moreover, few health centers are provided along N380. Therefore, many villagers cross a bridge for going to a health center. People in villages near a bridge also cross a bridge on foot or by bicycle for cultivating and/or gathering firewood.

1) Situation of Crossing Messalo Bridge I & III during floods

Some bridges in Cabo Delgado Province were damaged and collapsed due to the flood occurred in March, 2014. Messalo Bridge I and Bridge III on N380 were also damaged by the flood. For getting information on traffic situation and bridges on N380 during the past rainy season, the study team conducted a hearing to ANE in Maputo and Pemba and villagers near bridges and people catching fish near Messalo Bridge I.

① The Extent of Damage by the Flood

Messalo I Bridge and III on N380 and a part of N380 near Messalo I were damaged by the flood occurred in March, 2014. Other parts of N380 including bridges except the Bridge I and Bridge III, however, had no damage from such as flood, overflow and collapse. It was the first time that N380 including bridges suffered damage from the flood in March, 2014.

Damages that Messalo I Bridge and III suffered from the flood were as follows. A part of concrete slabs of Messalo I Bridge went down at the midpoint of the bridge. Piers on the northern side of Messalo III Bridge were damaged and disappeared and some slabs on the piers collapsed. (See pictures below.)

	
Damage of Slab of Messalo I Bridge	Collapse of Messalo III Bridge

Source: ANE in Pemba

Photo 1-6-12 Damage to Messalo I & III Bridges

② Situation of Recovery and Crossing Bridges

Messalo I Bridge & III bridge had been damaged in March, 2014. Though disaster occurred in the end of the rainy season, the water level of Messalo River was still high. It took about one month for that water level of the river to be low. Therefore, the disaster-relief work of the bridges had started at April, 2014.

Messalo I Bridge did not collapse, but concreate slabs of the bridge became lower than the center of the bridge because of the flood. Therefore, a bailey bridge with one lane roadway was constructed on the bridge. It took about one month for the construction work. People could cross the bridge on foot through the space between an existing bridge and a bailey bridge during the work.

On the other hand, Messalo III Bridge suffered a great deal of damage. Piers of the bridge had been broken and concreate slabs of the bridge collapsed due to the flood. Therefore, a bailey bridge with one lane roadway had been constructed at the same location of the damaged bridge after construction of new piers. It took about seven months for the repair.

For people who want to cross the river as soon as possible, construction of a bypass road near Messalo III Bridge had implemented at the same time with construction of a Bailey bridge on Messalo I Bridge. It took also one month for construction of the road.

Two boats from GOM and one from a private company were provided for no charge during construction of Messalo I Bridge and the road for people living in villages near damaged bridges. Villagers near the bridges also provided boats and carried people for 200 ~ 300 MT per one crossing per person.

Therefore, people could start crossing the river one month later after drawdown of the river. However, vehicle had to wait two months, one month for drawdown of the river and another one month for construction of the road.

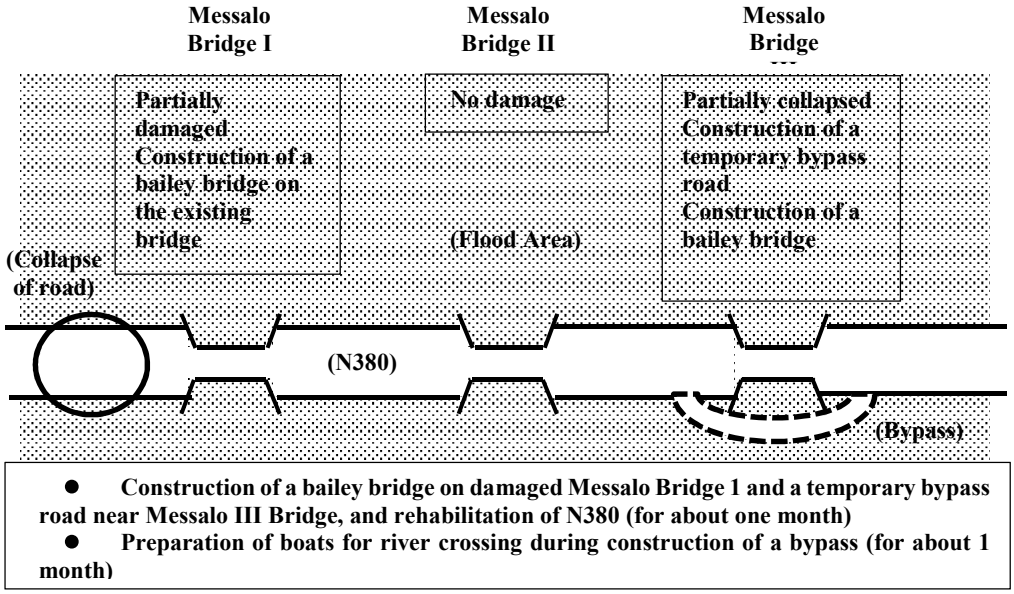


Figure 1-6-8 Recovery Measures

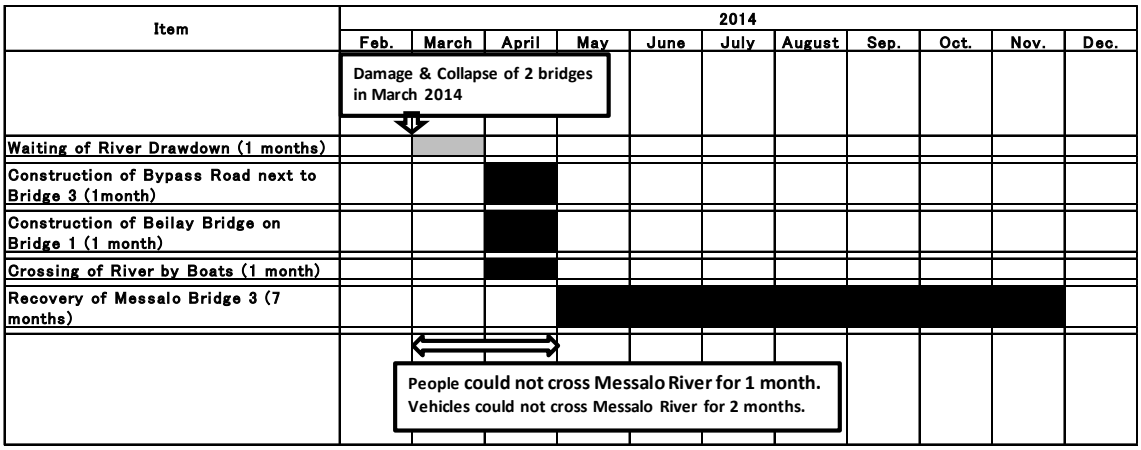


Figure 1-6-9 Bridge Restoration Schedule and Way of River Crossing during Restoration Works

Source: ANE in Pemba

Photo 1-6-13 Construction of Bailey Bridge at Messalo I Bridge

Source: ANE in Pemba

Photo 1-6-14 Construction of Temporary Bypass Road near Messalo III Bridge


Source: ANE in Pemba

Photo 1-6-15 Crossing the River by Boat


Construction of a Pier (1)	Construction of a Pier (2)


Construction of a Bailey Bridge (1)	Construction of a Bailey Bridge (2)

Source: ANE in Pemba

Photo 1-6-16 Construction of Bailey Bridge at Messalo III Bridge

(8) Alternate Route of N380

According to ANE and villagers near bridges, entire interval of N380 including bridges on the road has never been impassable even in rainy seasons except damage and collapse of Messalo I & III Bridge due to the flood in March, 2014. However, almost all target bridges

for replacement are very old and damaged. Damage to the bridges will be accelerated because of increasing traffic volume and heavy vehicles on the road in future. It will increase the risk for collapse of the bridges. Therefore, alternative routes of N380 connecting Pemba and Mocimboa da Prair are examined under the assumption of the risk.

In case that bridges on N380 are collapsed out because of disasters such as floods, following two alternative routes are expected connecting Pemba and Mocimboa da Praia instead of N380 in accordance with the national road network of ANE.

- Alternative 1：Pemba ~ Sunate ~ Montepuez ~ Mueda ~ Oasse ~ Mocimboa da Praia (N1 ~ N14 ~ R698 ~ N380)
- Alternative 2：Pemba ~ Mucojo ~ Mocimboa da Praia (R762)

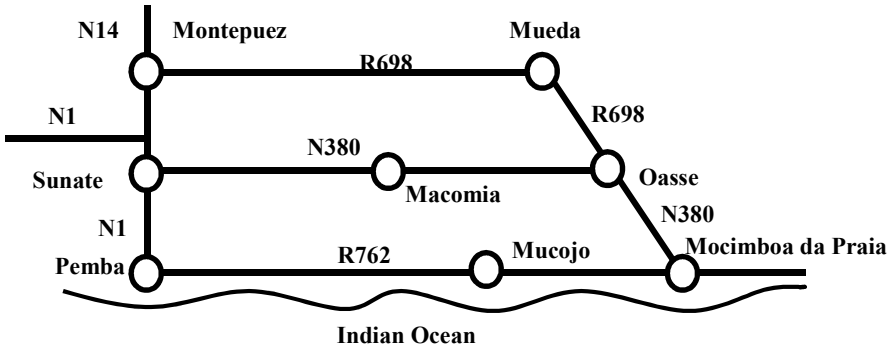


Figure 1-6-10 Alternate Route of N380

Present conditions of N380 and two alternatives are as follows.

Table 1-6-34 Present Conditions of N380 and Two Alternate Routes

Route	Present Conditions
N380	● About 350km length of the route passing through N1 and N380 ● The route passes through in between alternative 1 and 2, and reaches to Nacala Corridor. ● Entire interval of the route has already been paved. ● Vehicles and people can travel on N380 even in rainy seasons. ● Passing through Quirimbas National Par
Alternative 1	● About 500km length of the route passing through 4 roads - N1, N14, R689, and N380 ● The route passing through the inland of Cabo Delgado Province ● About 220km between Montepuez and Mueda is unpaved sand or dirt road. ● Between Montepuez and Mueda is impassable in rainy seasons.
Alternative 2	● About 200km length of the route passing through R762 ● The route running along the coast ● The route is an unpaved sand road. ● No bridge has been constructed in several locations on the route. Therefore, vehicles cannot pass through entire interval of the route even at dry seasons. ● Passing through Quirimbas National Park

Source: The Mozambique Road Network

Alternative 1, which starts from Pemba (N1) and passes through Montepuez (N14) and Mueda (R698) and finally reaches to Mocimboa da Prair (N380), has about 500km length and

passes through the inland of Cabo Delgado Province. N1, N14 and the section between Mueda and Mocimboa da Prair are paved. However, about 220km length between Montepuez and Mueda on R698 is an unpaved sand or dirt road. According to ANE, the situation of the section on R698 gets worse in rainy seasons and driving cars on the section is very difficult.

Alternative 2, which starts from Pemba and reaches to Mocimboa da Prair through R762 that runs from South to North along a coast line, has about 200km length. Except city area of Pemba and Mocimboa da Prair, entire section of R762 has not been paved and is a sand road. According to ANE, vehicles cannot pass through entire interval of the route even at dry seasons because there are some locations where no bridge has been constructed yet on R762.

Judging from present situation on both routes mentioned above, it is very difficult for both routes to replace N380 at present. Furthermore, the study team made a hearing about damage of N380 by the flood occurred in March, 2014 to some drivers transporting equipment for natural gas development. They said they did not transport any equipment for 2 months until completion of bridge rehabilitation.

To avoid a paralysis of regional economy and adverse influence to lives of residents along N380 by damage of N380, replacement of old bridges is very important and should be implemented immediately.

(9) Benefits to National Road N380

Followings will be improved by replacement of bridges on N380.

- Traffic flow around the bridges will be smooth due to widening of the bridges from one lane to two lanes. (no need waiting oncoming vehicles at the bridges)
- Vehicles will not need to reduce traffic speed near and on the bridges due to removal of bumps installed around the bridges.
- Concern about collapse of the bridges will be removed by replacement of a temporally bridge to a permanent one.
- Traffic accidents around the bridges will reduce due to widening of the bridges and removal of bumps.

As benefits to N380, following will be expected due to improvement mentioned above.

① Reduction of Travel Time

For measuring travel time between Sunate and Mocimboa da Pria of N380, the road was divided into two sections, about 120km distance between Sunate and Mocimboa Village and about 150km distance between Mocimboa Village and Mocimboa da Praia.

Though the section between Sunate and Macomia Village of N380 is about 6m-wide road and potholes can be seen on the same section, there was no problem for driving. It took about

80 minutes for driving about 120km distance. Average running speed in the section was about 90km/h.

Driving on the section between Macomia Village and Mocimboa da Praia of N380 was pleasant, because the section has already been widened to 7m and repaved by Portugal Government. It took about 120 minutes for driving about 150km length. Average driving speed at the section was about 75km/h. The average speed of the vehicle in this section was slower than that in the section between Sunate and Macomia Village. The reasons were as follow. There are 7 target bridges to be replaced within the section. Of which, 6 are one-lane bridge. Bumps are installed around these bridges to make vehicles to slow down to 30km/h for securing safety of vehicles crossing the bridges. Moreover, the vehicle which measured travel time had to wait some oncoming vehicles at two bridges.

Table 1-6-35 Results of Travel Time Measurement

Section	Distance (km)	Travel Time (minute)	Average Speed (km/h)
Sunate～Macomia Village	120	80	90
Macomia Village～Mocimboa	150	120	75
Total	270	200	81

All the vehicles driving on N380 will not need to wait oncoming cars crossing bridges because all one lane bridges on N380 will be replaced with two-lane bridge. In addition, drivers will not need to slow down around the bridges due to removal of bumps. If vehicles can be driven on the road of about 150km distance between Macomia Village and Mocimboa da Praia at average speed 90km/h after replacement of the bridges, vehicles will be able to be driven on the road of about 270km distance between Sunate and Mocimboa da Praia in 180 minutes (3 hours). Travel time between Sunate and Mocimboa da Praia will be reduced by about 20 minute after the replacement.

② Maintenance and Strengthening of Logistics Route between Pemba and Mocimboa da Praia

There are two routes connecting Pemba and Mocimboa da Prair. One is the route passing through 4 roads – N1, N14, R689 and N380. Distance of this route is about 500km. Another one is the route passing through R762. Distance of this route is about 200km. However, two roads - R689 and R762 - are an unpaved road. Moreover, there are some locations where no bridge has been constructed yet on R762. Because of these road conditions, travel time of vehicles on these two routes takes more time than the time passing through N380 throughout the year. Therefore, it is very difficult for both routes to substitute for N380 at present. Messalo I & III Bridge on N380 were damaged and destroyed by the flood in March, 2014. It took about two months for re-opening the two bridges. Transport operators who used to go back and forth between Pemba and Mocimboa da Praia stopped operation of trucks between the two cities during the period.

Closure of N380 and shutdown of vehicles passing through the road due to damage and/or collapse of bridges on the road caused by flood will never happen after replacement of the

bridges. It will contribute to improve living condition of people along the road. Furthermore, it will maintain and strengthen the logistic route connecting cities along the coast in northern area of Cabo Delgado Province.

③ Possible Increase in Cash Income

Most villagers living along N380 have a life like self-sufficiency. They mainly eat grain and vegetable grown in their fields. They produce ropes, straw mats and charcoals for their daily lives. However, they buy clothes and oil by cash gotten from selling vegetables, charcoals and timbers to tourists passing through N380.

Due to replacement of temporary bridges on N380, no closure of N380 and no interruption of traffic on the road will occur. Development of natural gas and LNG in Palma will be accelerated. These increase future traffic volume on the road. It means to foresee the increase in customers for the villagers. And opportunity for earning more money from customers will increase for the villagers.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Selling Fruits</td><td>Selling Foods</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Selling Charcoal</td><td>Selling Lumber</td></tr>
</table>

Photo 1-6-17 Roadside Shops or Stands along N380

④ Improvement of Prompt and Smooth Transportation of Patient to Health Facilities

Only 6 health facilities exist along N380 at present. Most villagers go to the facility on foot. Four of six facilities serve only maternity, pediatrics and outpatient care services. Some patients who need operation are sent to the health facility in Meangalewa or Macomia by an ambulance.

Due to replacement of temporary bridges on N380, slowing down of vehicle speed and waiting of oncoming cars at the bridges will be resolved. Therefore, patient will be transported to a health facility by an ambulance promptly and smoothly.

(10) Possible Problems and Issues due to Bridge Improvement

Due to improvement of temporary bridges on N380, transportation capacity on the road will be improved, and traffic volume on the road will increase. Economic development in Pemba, Mocimboa da Praira and Palma will be accelerated. At the same time, there will be a possibility of following problems.

- Increase of number of traffic accidents on N380 due to increase of traffic volume
- Outflow of villagers along N380 to Pemba, Mocimboa da Praia and Palma

Furthermore, immediate improvement of the section between Sunate and Macomia on N380 and bridges in the same section will be necessary for benefit to whole N380.

1-7 Forecasting Future Traffic Volume

1-7-1 Traffic Forecast on N380

Future traffic volume on N380 is forecasted based on existing traffic volume and following parameters.

- 5 years transition of existing traffic volume (2010 – 2014)／Traffic Count Survey (6th April, 2015)
- Future estimated population
- Future estimated GDP, GRDP

(1) 5-year Transition of Existing Traffic Volume (2010 – 2014)

ANE has been implementing annual traffic volume survey on N380 at 7 points from 2010 as shown in Table 1-7-1. Traffic survey was conducted at 2 points in the survey and the ANE's traffic survey data were checked. The location of each section is shown in Figure 1-7-2.

Table 1-7-1 Transition of Existing Traffic Volume (12 hours)

Sec.	Bridge	2010	2011	2012	2013	2014
A	Catipusse	**195 (101)**	**217 (103)**	**271 (94)**	**296 (140)**	**366 (104)**
		51.8%	47.5%	34.8%	47.3%	28.4%
B	—	**234 (124)**	**224 (91)**	**167 (70)**	**204 (88)**	**243 (110)**
		53.0%	40.6%	41.9%	43.1%	45.7%
C	—	—	—	**193 (77)**	**237 (98)**	**280 (121)**
				39.9%	41.4%	43.2%
D	Muagamula	**267(94)**	**165 (41)**	**306 (116)**	**323 (153)**	**310 (81)**
		35.2%	24.8%	37.8%	47.4%	26.1%
E	—	—	—	**402 (174)**	**435 (231)**	**397 (122)**
				43.3%	53.1%	30.7%
F	Messalo 1・3 Mapuede	—	—	**284 (108)**	**215 (59)**	**376 (173)**
				38.0%	27.4%	46.0%
G	Muera 1・2 Mungoe	**255 (162)**	**306 (122)**	**347 (139)**	**314 (120)**	**255 (95)**
		63.5%	39.9%	40.1%	38.2%	37.3%
Average		**238 (97)**	**228 (89)**	**281 (111)**	**289 (127)**	**318 (115)**
		40.7%	39.1%	39.5%	43.9%	36.2%

( )：Heavy vehicle, First line: All Traffic, Second line: Heavy vehicle mix rate

Source: ANE

Each section of all traffic is just what to show it in figure 2-3-1. It is increasing approximately 80 number of the car from 2010 to 2014, and it is thought annual mean growth rate about with approximately 7.5%.

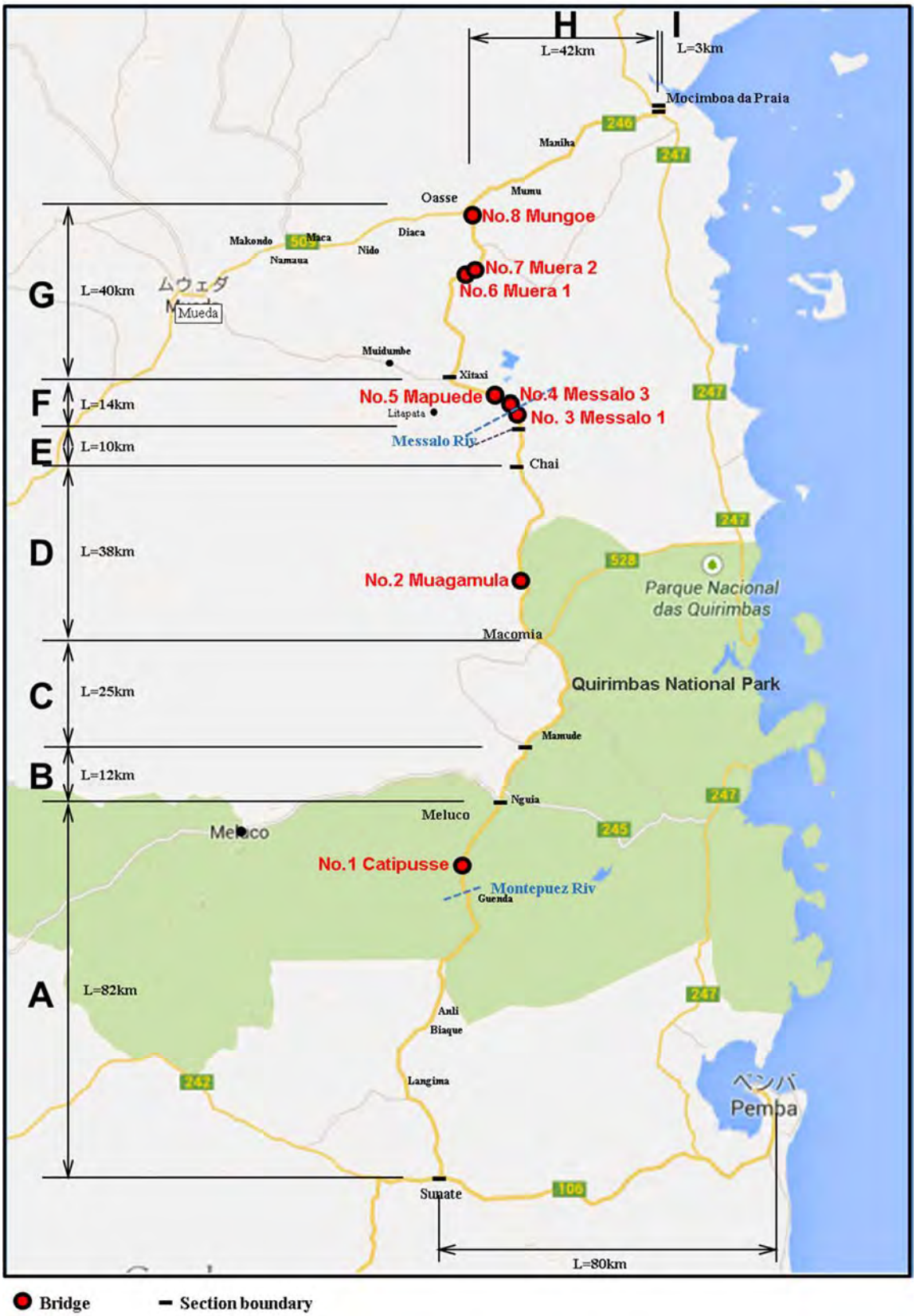


Figure 1-7-1 Location Map of Traffic Survey

Table 1-7-2 Survey Section

Survey Section		Section Length	Project Bridge
A	Sunate — Meluco	82 km	No.1 Catipusse
B	Meluco — Imbanda	12 km	—
C	Imbanda — Macomia	25 km	—
D	Macomia — Chai	38 km	No.2 Muagamula
E	Chai — Litapata	10 km	—
F	Litapata — Chitunda	14 km	No.3 Messalo 1 No.4 Messalo 3 No.5 Mapuede
G	Chitunda — Oasse	40 km	No.6 Muera 1 No.7 Muera 2 No.8 Mungoe

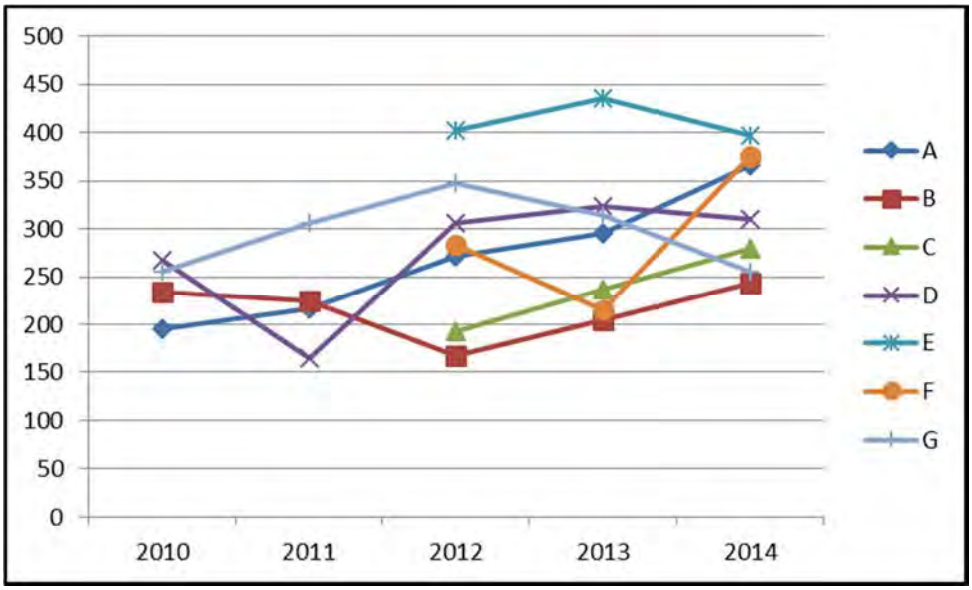


Figure 1-7-2 Transition of Existing Traffic Volume (number/12 hours)

Traffic count survey was implemented as following date and locations.

- Survey Date and Time: 6 April, 2015 (6:00 – 18:00, 12 hours)
- Survey Location: No.1 Catipusse Bridge(Section A)/No.8 Mungoe Bridge(Section G)

Table 1-7-3 Results of Traffic Survey

Survey Location	Passenger Car	Heavy Vehicle	Total	Ratio of Heavy Vehicles
Catipusse Bridge (Section A)	206	109	315	34.6%
Mungoe Bridge (Section G)	150	88	238	37.0%

The survey result is almost the same of ANE's data.

No.1 Catipusse Bridge (Section A)

No.8 Mungoe Bridge (Section G)

Photo 1-7-1 Implementation of Traffic Survey

(2) Estimated Future Population

Future population is estimated in "The Project for Nacala Corridor Economic Development Strategies" shown as follows.

Table 1-7-4 National Estimated Future Population (National Statics Institute: NSI)

Year	2007	2010	2015	2020	2025	2035
Population (1,000)	20,632	22,417	25,728	29,310	33,165	41,554
Increase Ratio (%)	2.53	2.80	2.79	2.64	2.50	2.28

Table1-7-5 National Estimated Future Population (United Nation: UN)

Item	Growth Rate	2000	2005	2010	2015	2020	2025	2030	2035
Population (1,000)	Low	18,201	20,770	23,391	25,946	28,567	31,253	34,046	36,786
	Medium	18,201	20,770	23,391	26,162	29,177	32,439	35,907	39,459
	High	18,201	20,770	23,391	26,378	29,788	33,625	37,772	42,161
Increase Ratio (%)	Low	—	2.6	2.4	2.1	1.9	1.8	1.7	1.6
	Medium	—	2.6	2.4	2.2	2.2	2.1	2.0	1.9
	High	—	2.6	2.4	2.5	2.7	2.8	2.8	2.9

Table1-7-6 National Estimated Future Population (Average)

Item	2010	2015	2020	2025	2030	2035
NSI (1,000)	22,417	25,728	29,310	33,165	37,360	41,554
UN (1,000)	23,391	26,378	29,788	33,625	37,772	42,161
Average (1,000)	22,904	26,053	29,549	33,395	37,566	41,858
Average Increase Rate (%)	—	2.75	2.68	2.60	2.50	2.29

The increase rate since 2010 is 2.5% and the national population in 2035 has been estimated to increase 1.8 times more than that in 2010, over 40 million.

On the contrary, the increase rate of Cabo Delgado province is estimated as 2.2% in 2035, lower than that for whole country.

Table 1-7-7 Estimated Future Population of Cabo Delgado Province

Year	2007	2017	2025	2035
Population (1,000)	1,634	2,046	2,444	3,034
Average Increase Rate (%)	—	2.30	2.20	2.20

The increase rate of Cabo Delgado Province is adopted for the traffic forecast study in the project, because project bridges are located in the province.

(3) Estimated Future GDP/GRDP

GDP is estimated as shown in Table in "The Project for Nacala Corridor Economic Development Strategies".

Table 1-7-8 Transition of GDP

Year	2009	2010	2011	2012	2013	2014
Real GDP (1,000MT)	172,054	183,207	196,826	212,058	228,552	246,112
Annual Growth Rate (%)	6.4	6.5	7.4	7.7	7.8	7.7
Real GDP per Capita (1,000MT)	8.1	8.4	8.9	9.3	9.8	10.3
Nominal GDP (1,000MT)	269,346	323,226	375,170	426,719	485,662	552,264
Annual Growth Rate (%)	12.1	20.0	16.1	13.7	13.8	13.7
Nominal GDP per Capita (1,000MT)	34.8	40.8	46.2	51.3	57.1	63.4

Table 1-7-9 Estimated Future GRDP

Year	GRDP (million MT, 2003 constant price)				Annual Growth Rate (%)	
	2011	2017	2025	2035	2011-2025	2011-2035
Cabo Delgado Province	8,152	12,600	31,300	143,600	10.1%	12.7%
Annual Growth Rate (%)	—	7.5%	12.0%	16.5%		
Nampla Province	26,551	40,700	72,700	148,500	7.5%	7.4%
Annual Growth Rate (%)	—	7.4%	7.5%	7.4%		
Mozambique	177,479	275,300	506,500	1,149,200	7.8%	8.1%
Annual Growth Rate (%)	—	7.6%	7.9%	8.5%		

Table 1-7-10 Estimated Future GRDP per Capita

Year	GRDP (thousand MT, 2003 constant price)				Annual Growth Rate (%)	
	2011	2017	2025	2035	2011-2025	2011-2035
Cabo Delgado Province	4.57	6.16	12.81	47.33	7.6%	10.2%
Annual Growth Rate (%)	—	5.1%	9.6%	14.0%		
Nampla Province	5.76	7.43	10.84	18.0	4.6%	4.9%
Annual Growth Rate (%)	—	4.3%	4.8%	5.2%		
Mozambique	7.70	10.21	15.25	27.66	5.0%	5.5%
Annual Growth Rate (%)	—	4.7%	5.2%	6.1%		

Natural gas development in Indian Ocean that will start from 2018 will have an effect on GDP of Cabo Delgado Province, and increase rate of GDP is 16.5% from 2025.

The project road is located on connection of Palma where natural gas development area and Pemba of provincial capital of Cabo Delgado, and GDP of Cabo Delgado is used for future traffic volume estimation

(4) Results of Future Traffic Volume Estimation

Future traffic volume on the project road in 2022 is estimated as shown in Table 1-7-12.

The growth rate of traffic, population and GRDP becomes 7.5%, 2.5%, 7.6% each, and the growth rate of traffic adopt for the project due to the almost same result by the rate by GRDP.

There are one (1) lane existing bridges on the project road, and future traffic volume does not show any drastic increase by two (2) lanes bridge improvement. GRDP of Cabo Delgado province will shape increase and future traffic volume is estimated for 570 traffic/ 12 hours.

Table 1-7-11 Results of Future Traffic Volume (traffic/12 hours)

Index	2014	2015	2020	2021	2022
Traffic Volume	320	344	494	531	**570**
Increase Rate	—	7.5%	7.5%	7.5%	7.5%

After 2010, nine (9) deep-water tests boring started at the offshore of Palma around the border of Tanzania, and seven (7) natural gas fields were discovered. The stock of natural gas was estimated 32 – 65 trillion cubic feet at the end of November 2010, this is the world' leading product volume. One trillion feet is equivalent to 1 million ton for 20 years of LNG. Such a huge reserve of natural gas is in the same area and boring will be continued in future.

Ten million ton per year of LNG will be produced in this gas field. This volume is equivalent to 10 % of import volume of per year of Japan, and 10 LNG power plants of 1 million kilowatt generation can be operated. The design of LNG plant is implemented to open in 2018 and 50 million ton per year can be produced out in the future.

The scale of LNG plant is approx. 7,000 ha. In addition, 18,000 ha industrial complex that includes factories of ammonium esters chemical fertilizer, methanol ethylene petrochemical and power plant. The number of employee in the area reaches 10,000. The economic condition of Cabo Delgado will be better due to development of these LNG affiliated industries and traffic volume on the National 380 have possibility of increase in the future.

1-7-2 Order of Priority

The Analytic Hierarchy Process is used as one of the resources for compiling the construction plan to determine the order of priority for reconstructing bridges. The AHP, which was developed is a hierarchical analysis technique for determining the order of priority. In this project, the field survey were conducted upon setting six assessment items, 1) degree of damage, 2) record of overflow, 3) scale of the river, 4) traffic volume, 5) environmental and social considerations, 6) population, and the order of priority indicated in Table 1-7-12 was obtained.

The comparison of the bridge examined the bridge group which is closed the each location as for the Messalo group of the Messalo I Bridge, the Messalo III Bridge and, the Mapuede Bridge and for the Muera group of Muera I Bridge, and the Muera II Bridge.

Table 1-7-12 Order of Priority of Bridges

Priority	Bridge name
1	Messalo group
2	Muera group
3	Mungoe bridge
4	Muagamula bridge
5	Catipusse bridge

CHAPTER 2
CONTENTS OF THE PROJECT

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

2-1-1 Project Aim

ANE's Master Plan for the national highway network contains a basic policy for the road maintenance plan which aims at the national development program shown in Table 2-1-1.

The basic policy emphasizes the establishment of a highway network and improvement of existing roads because of their importance for safety and the reinforcement of transportation capacity.

Table 2-1-1 Basic Policy

National Development Goals	National Development Strategy	Policy Direction for Highway Network
Productivity Improvement through Economic Development Capabilities	Development of Human Resources	Minimization of traffic accidents through continuous expansion and management of safety facilities.
		Enhancement of accessibility through the establishment of a systematic highway network.
	Development of Infrastructure	Expansion of traffic infrastructure including the establishment of a systematic highway network.
		Improvement of highway design, construction of new bridges.
		Improvement and expansion of drainage system and facilities.
		Improvement of pavement.
Promotion of Industrialization for Enhancing National Competitiveness	Poverty Reduction and Social Development	Reducing the gap between rich and poor through balanced regional development.
		Improvement of accessibility to regions with potential growth.
	National Integration	Connectivity between regions.
		Promotion of policies related to national development plans.

Source: ANE Master Plan

This project is has a high priority in the Master Plan since it is part of the road network which links the northern part of Mozambique with the Tanzanian border.

Although the asphalt pavement of N380 was rehabilitated, the temporary target bridges were never repaired and problems such as bridges being washed away during disasters, traffic restrictions on heavy trucks, and traffic accidents still remain.

ANE strives to solve these problems and promote economic and social development in the northern region of Mozambique and neighboring countries such as Tanzania, Malawi and Zambia through the improvement of the transportation capacity of N380.

This project aims at contributing to the maintenance of the entire length of N380 through the construction of bridges.

2-1-2 Outline of the Project

The aim of this project is to reconstruct the 8 target bridges on National Road 380 in order to achieve the goals mentioned above.

The successful completion of the project will ensure safe year-round traffic conditions on the route, decrease traffic accidents and eliminate disaster risks. Furthermore, other benefits such as reduced transport time and distance, increased transportation capacity, benefits for the poor and regional development can also be expected.

The scope of this project is to reconstruct the following 3 target bridges and their approach roads.

Table 2-1-2 List of Target Bridges

No.	Bridge Name	Coordination	
		South	East
1	Messalo I	11°50'58.78"S	40° 6'23.07"E
2	Messalo III	11°50'36.11"S	40° 6'14.58"E
3	Mapuede	11°49'46.79"S	40° 4'35.79"E

2-2 Outline Design of the ODA Project

2-2-1 Design Concept

(1) Basic Concept

This is a grant aid project for the reconstruction of bridges along a highway which will make a major contribution to economic development, lifestyle improvement and poverty reduction in Mozambique.

There are numerous bridges on the target route which become inundated during the rainy season and narrow temporary bridges which impair the functions of the highway.

Based on the policies described below, this survey covers the construction of eight bridges with approach roads as requested by the Mozambique government and based on findings of field surveys and discussions with related agencies.

The aim is to rationalize the design, construction and maintenance and reduce costs by preparing a construction plan which uses standardized structures and allows the shared use of temporary materials and equipment.

The approach roads will be connected with existing roads over the shortest possible distance while satisfying the curve radius and longitudinal profile specified in the road standards of Mozambique.

(2) Concept for Natural Environment Conditions

1) Climate

The target area has a tropical savannah climate in the south and a climate with mild winters and light rainfall in the north.

In the northern region, the dry season lasts from May to October while the rainy season begins in November and ends in April.

Since it is possible for the approach roads of the Messalo I, Messalo III and Mapuede bridges to become flooded by river water which makes them impassable, the water level during the rainy season needs to be taken into consideration in the construction plan.

Because temperatures exceed 30℃ on many days during the dry season, measures are also required to ensure the quality of hot weather concreting.

2) Hydrological Conditions

When planning the bridges and roads, the clearance under the girders and abutment locations are decided in accordance with design conditions based on the results of field surveys and hydraulic analyses. The following seven items are most important for the hydrological analysis:

a) Confirmation of the entire river basin

b) Collection of rain data

c) Varied flow calculation (for some bridges)

d) River discharge calculation method

e) Preparation of flood control model (for Messalo River)

f) Calculation of high water level for bridge design

g) Consideration of countermeasures

3) Design Seismic Coefficient

According to the SATCC bridge design standard, the seismic intensity in the target area is estimated to be MM6 (Modified Mercalli Intensity 6) as shown in Figure 2-2-1.

As indicated in Figure 2-2-1, a value of 0.03g is adopted as the maximum ground acceleration. Regarding the design horizontal seismic coefficient for bridges, it is necessary to consider the amplitude caused by structural response.

Therefore, the peak acceleration at the pier tops is approximately twice as large as that on the ground.

Accordingly, the following design seismic coefficient will be used in the project:

kH = 0.03×2 = 0.06 (≒0.10)

Modified Mercalli Intensity at epicentre (MM)	Maximum ground acceleration (A) at epicentre (g)
ii - iii	0.003
iv - v	0.01
vi	0.03
vii - viii	0.1
ix	0.3
x - xi	1.0

Source: Code of Practice for the Design of Road Bridges and Culverts (2001)

Figure 2-2-1 Seismic Intensity

(3) Concept for Social and Economic Conditions

The target area is located in the northern part of the country where poverty levels are high even for Mozambique.

Locally available materials will be utilized to the extent possible in order to contribute to the economic development of local areas.

In addition to providing manual labour opportunities for local residents, relatively simple bridge designs will be adopted so that local workers can also participate in bridge construction work.

The bridge structures will also be standardized in order to help improve the skill level of workers because the same work will be repeated.

Since there are washing places around the target bridges, they are planned to be relocated in order not to endanger the livelihoods of local residents in case they might be affected during the construction stage.

(4) Concept for the Conditions and Special Circumstances in the Construction Sector

1) Material Procurement

Materials available in Mozambique include cement, concrete aggregate, timber for formwork, fuel, etc. Cement additives, reinforcing bars, bitumen and steel guardrails, etc. are usually procured from South Africa, while pre-stressing steel wire, elastic bearings and expansion joints will be procured from Japan.

2) Procurement of Construction Machinery

Although heavy machinery for road construction and general civil engineering work is available from local construction companies, numbers are limited and it is difficult to obtain such machinery on time. Moreover, it is difficult to obtain heavy construction machines such as large cranes and vibrating hammers required for bridge construction in Mozambique. Most of the important construction equipment is therefore planned to be procured from South Africa and special machines for piling works etc. will be procured from Japan.

3) Procurement of Labor

Workers can be procured from local construction companies in Mozambique, but there are few skilled workers who have experience of bridge construction. Because experienced workers tend to be concentrated around the capital Maputo, such workers' pay rates tend to increase as it is necessary to consider additional allowances such as the approximately 4,000 km travel distance to the construction sites. It will also be necessary to comply with the Labor Law (Lei do Trabalho) in Mozambique when recruiting local workers.

(5) Use of Local Contractors

Many of the large construction companies in Mozambique are local affiliates of foreign companies which have their head offices in South Africa, Portugal, Brazil, etc. Such foreign affiliated construction firms have been awarded major public works in the past, have participated as subcontractors in past Japanese ODA bridge construction projects, and can therefore be used again on this Project.

(6) Operation and Maintenance

Since the target bridges will be concrete structures, the bridge structures will not require frequent maintenance work. Required activities mainly consist of periodic inspections of pavement, embankments, bridge handrails, etc. Since such work does not require any special technology, it can be carried out as part of conventional road maintenance work.

(7) Bridge Design Concept

1) Design Criteria

The design of the target bridges will basically comply with the road design criteria in Mozambique (ANE Design Standard) and SATCC. However, any necessary items lacking from these standards shall conform to the specifications for highway bridges stipulated by the Japan Road Association. Table 2-2-1 shows the main design conditions to be applied in the design.

Table 2-2-1 Bridge Design Conditions

Item	Design Condition	Remarks
Design discharge, return period	100 year return period based on hydrological analysis	ANE standard
Vertical clearance under bridge girders	Flood water analysis	Japanese standard
Live load	SATCC (NA, NB-36) B live load	ANE standard SATCC standard Japanese standard
Seismic load	Seismic coefficient = 0.1	SATCC standard
Thermal load	+49° C～0°C	SATCC standard

2) Location of New Bridges

There are three possible locations for the new bridges: the existing location, or on the upstream or downstream side. The following items were compared for each bridge and the bridge locations selected based on an overall perspective.

As a result of the comparison, the bridges shall be constructed at their existing locations.

a) Traffic conditions and safety due to horizontal aliment

b) Existence of any public facilities

c) River channel and soil conditions

Table 2-2-2 Site Conditions and Bridge Locations

No.	Bridge name	Horizontal aliment	Public facilities	River channel	New location at
1	Messalo I	Straight	Telephone line	Reservoir area	Existing bridge
2	Messalo III	Straight	Telephone line	Reservoir area	Existing bridge
3	Mapuede	Straight	Telephone line	Reservoir area	Existing bridge

3) Width of Bridges

The continued use of the approach road width is considered based on present road conditions and the N380 rehabilitation plan, the traffic lane, sidewalk and shoulder widths shown in Table 2-2-3 and Figure 2-2-2 are therefore adopted.

Table 2-2-3 Bridge Width

Item	Width	Remarks
Traffic lane	3.5m	Apply ANE standard for primary roads in consideration of the future upgrading of N380 to N1.
Sidewalk	0.85m	The average sidewalk width of existing bridges on N380 is adopted.
Shoulder	0.25m	To secure space between vehicles and the sidewalks and clearly show the outside line continually with the approach roads.

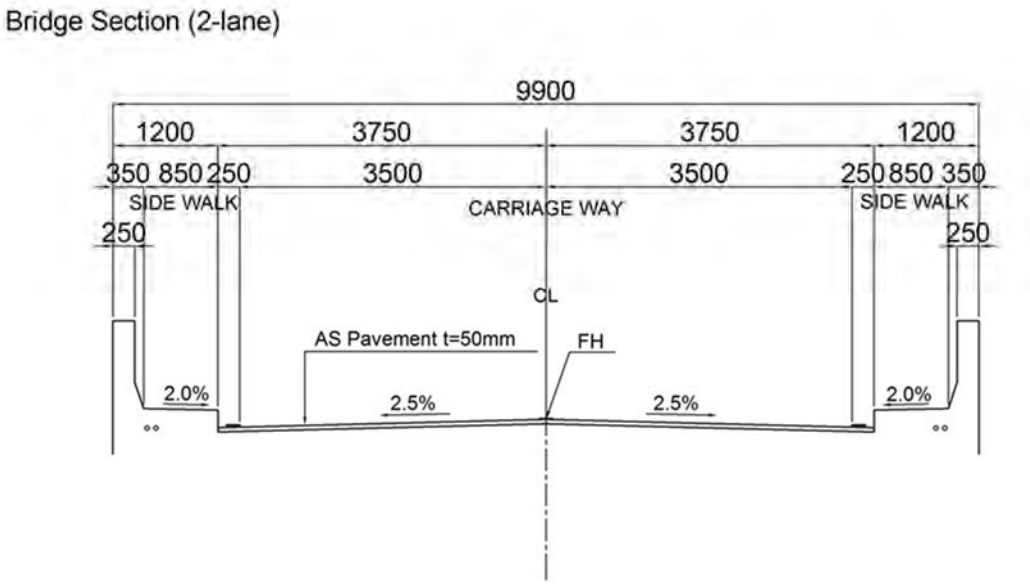


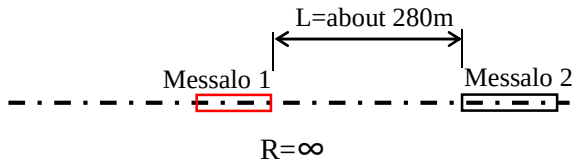
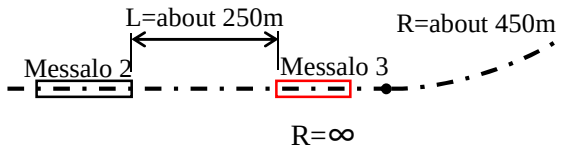
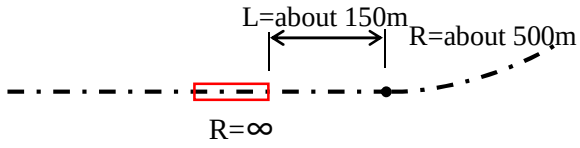
Figure 2-2-2 Bridge Width

(8) Approach Road Design Concept

1) Alignment Plan

The alignment is basically connected to the existing roads with the shortest length in accordance with the bridge design policy and geometric design standard. Schematic drawings of the horizontal alignment and their evaluation are shown in Table 2-2-4. A straight alignment is basically maintained since the new bridges will replace the existing bridges. The new alignment ensures good traffic conditions and the linear shape is superior for visibility.

Table 2-2-4 Horizontal Alignment

Bridge Name	Horizontal alignment	Evaluation	Location
Messalo I		Good traffic conditions and visibility due to straight alignment from Messalo 1 to Messalo 3	Existing bridge
Messalo III		Good traffic conditions and visibility due to straight alignment from Messalo 1 to Messalo 3 and R=450m link	Existing bridge
Mapuede		Good traffic conditions and visibility due to straight alignment and R=500m link	Existing bridge

2) Typical Road Cross-Section

The cross-section of the approach roads is to be as follows: 3.5m traffic lane, 1.0m shoulder, and 0.5m marginal strip based on the current road width and the N380 rehabilitation plan. The approach road cross-section is shown in Figure 2-2-3.

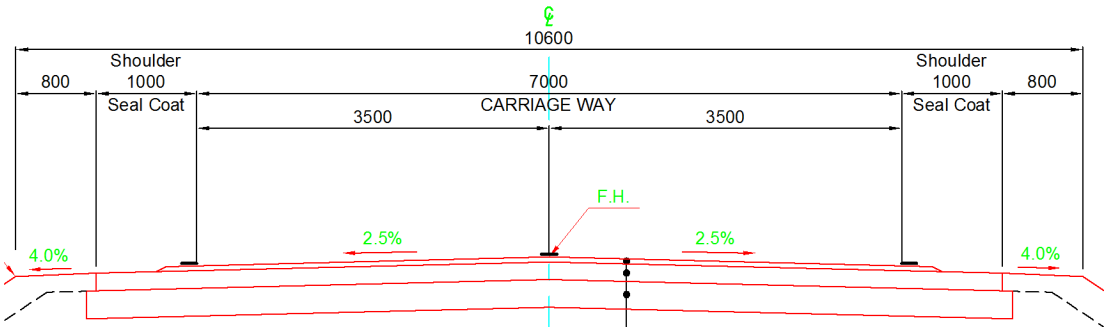


Figure 2-2-3 Typical Road Cross-Section

(9) Concept for Construction Method and Period

1) During the rainy season, it is anticipated that road conditions will deteriorate and it will be difficult to transport equipment, materials and workers around the bridge sites. Therefore, a sufficiently long construction period is planned based on rainfall data and consideration of local conditions and safety issues.

2) Since it is extremely difficult and dangerous to construct foundations and substructures in rivers with high water flow, the construction plan assumes the pier foundations will be completed during the dry season.

2-2-2 Basic Plan

2-2-2-1 Outline of the Plan

The bridge length, super- and substructure type, and the approach road length are shown in Table 2-2-5 as a summary of the bridge plan that is devised by the project.

The aim is to standardize the structures using the same form to the extent possible for the bridge and road plan to be able to procure most of the construction materials and machines from third countries and Japan.

In addition, the plan has been prepared to reduce construction costs, enable workers to learn new skills through cyclic performance of the same construction work, and to improve work efficiency.

Table 2-2-5 Scale of Structures

No.	Bridge name	Length (m)	Super-structure	Sub-structure	Pile	Road length (m)
1	Messalo 1	175	PC T-girder	Abutments (inverted T-type), Piers (wall type)	Cast-in-place piles	545
2	Messalo 3	140	ditto	Abutments (inverted T-type), Piers (wall type)	ditto	520
3	Mapuede	35	ditto	Inverted T-type abutments	ditto	445
	Total	350				1,510

2-2-2-2 Hydrological Analysis

(1) Rainfall Data

The below daily and monthly rainfall data were obtained from two rainfall stations. Since the statistical rainfall data at Mueda and Macomia are not very reliable due to missing records, rainfall intensity was calculated using data from the Montepuez station which has records of the missing data from the missing periods. The rainfall stations and river information are shown in Table 2-2-6 and Table 2-2-7.

Table 2-2-6 Rainfall Data

Station	Observation period	Data	Missing period
Mueda	64 years (1951-2014)	Monthly	34 years
Macomia	63 years (1951-2013)	Monthly	39 years

Montepuez	46 years (1969-2014)	Daily	2 years
Marrupa	46 years (1969-2014)	Daily	12 years

Table 2-2-7 River Information

River name	Catchment area (km^2)	Length (km)	Gradient (%)
Messalo	21,803	460	0.13
Mapuede	137	32	0.57

(2) Return Period

The return period used to calculate spillage varies depending on the structure type, and the design of the return period for bridges and culverts is shown in Table 2-2-8.

A return period with a 20-year discharge was selected for each bridge in accordance with the ANE standard.

Table 2-2-8 Return Period Standard

20-year discharge	Return period	
	Culvert	Bridge
Discharge < $20m^3/s$	10	20
$20m^3/s$ < discharge < $250m^3/s$	20	50
$250m^3/s$ < discharge	30	100

Source: ANE standard

Table 2-2-9 Return Period

River name	20-year discharge (m^3/s)	Return period
Messalo	7,396	100
Mapuede	339	100

(3) Hydraulic Analysis Results

The design discharge, flow velocity, fluid factor and design water level based on hydraulic analysis results are shown in Table 2-2-10.

Table 2-2-10 Hydraulic Analysis Results

No	Bridge name	Design discharge (m^3/s)	Velocity (m/s)	Fluid factor	Water level (m)
1	Messalo I bridge	4,694	4.61	0.63	50.0
2	Messalo III bridge	2,742	4.06	0.61	50.0
3	Mapuede bridge	470	2.16	0.27	45.9

(4) Vertical Clearance

The design of the vertical clearance from the bottom of the girder to the high water level refers to the Japanese standard which is basically 1.0m and 1.5m for Messalo I bridge and Messalo III bridge.

2-2-2-3 Bridge Design Conditions

(1) Live Load

The live load complies with the SATCC standard. According to the SATCC standard, it is stipulated that NA load and NB load should always be considered in the design for highway bridges. Hence this is complied with in the design.

1) Number of notional lanes

According to the SATCC standard, when the carriageway width is 4.8m or more, the number of notional lanes should be as indicated in Table 2-2-11, but when the carriageway is less than 4.8m, the number of notional lanes should be derived by dividing the width by 3. The number of notional lanes in this case can be three lanes.

Table 2-2-11 Carriageway Width and Number of Notional Lanes

Carriageway width (m)	Number of notional lanes*
4.8 up to and including 7.4	2
above 7.4 up to and including 11.1	3
above 11.1 up to and including 14.8	4
above 14.8 up to and including 18.5	5
above 18.5 up to and including 22.2	6
* notional lanes are imaginary lanes for the application of the design loading and should not be confused with traffic lanes on the roadway	

Source: SATCC standard

2) NA load

NA load is a combination of lane load and concentrated load. The lane load intensity Qa (kN/m) is determined from the loaded length as shown in Figure 2-2-4.

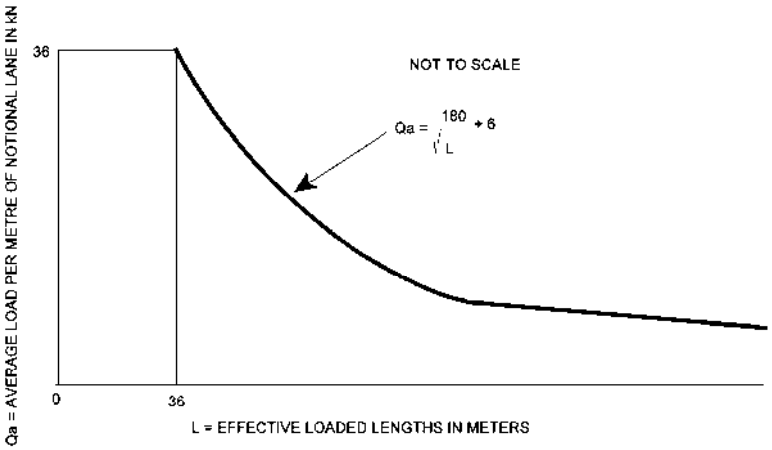


Figure 2-2-4 Relationship between Loaded Length and Lane Load Intensity (NA load)

In cases with multiple design lanes, the load intensity is changed according to each lane based on Qa above.

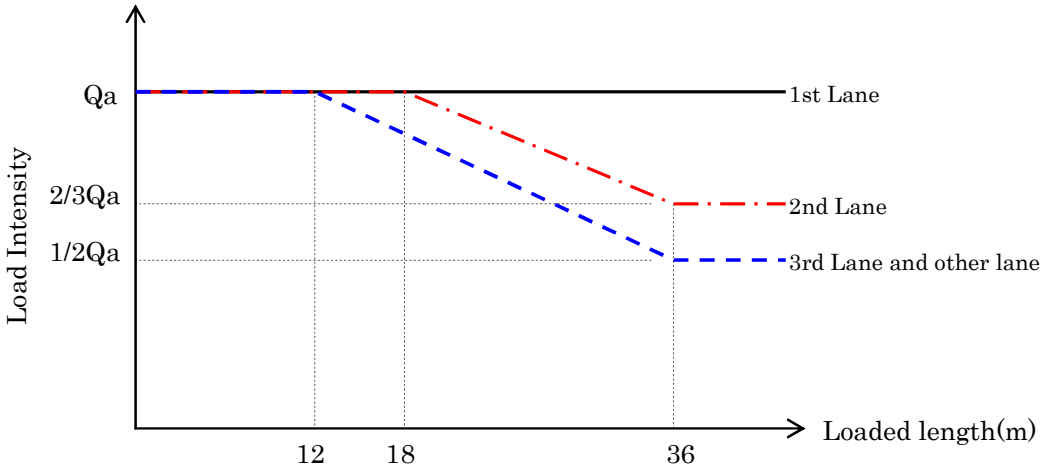


Figure 2-2-5 Load Intensity by Lane

Regarding concentrated load, 144/√(n) is placed in the most critical position for each lane. Incidentally, n indicates the lane number.

Table 2-2-12 Concentrated Load on Each Lane

First lane	144.0 kN
Second lane	144/√2=101.8 kN
Third lane	144/√3= 83.1 kN

3) NB load

Concerning NB load, it is permissible to consider as many vehicles as possible in the perpendicular direction to the bridge axis, however, only one vehicle may be loaded in the bridge axis direction. The basic position for loading in the perpendicular direction is 0.6 m away from the curb, however, in cases where the clearance between the curb and the bridge handrail is more than 0.6 m, the position is 0.15 m from the curb.

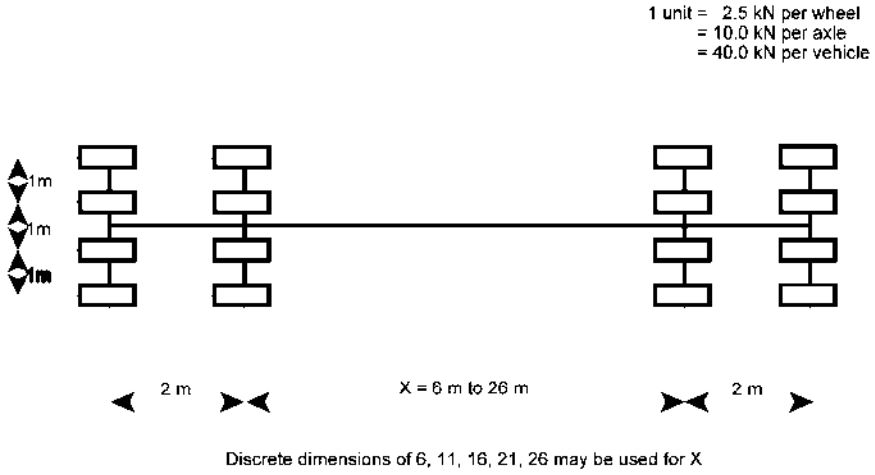


Figure 2-2-6 NB load

Table 2-2-13 NB Loading Conditions

Class	Loaded area/wheel	Wheel load	Weight/vehicle
NB24	0.245m x 0.245m	60kN/wheel	960kN/vehicle
NB36	0.300m x 0.300m	90kN/wheel	1,440kN/vehicle

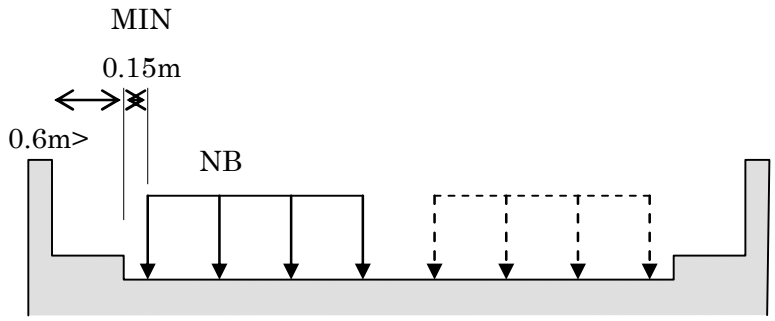


Figure 2-2-7 Wheel Load Arrangement and Load Intensity

4) Sidewalk live load

In cases where the loaded length is less than 25m, the sidewalk live load is 5.0kN/m^2, and when the loaded length is more than 25m, the load is 25/$\sqrt{}$L (where L is loaded length). However, the load must not be less than 1.5kN/m^2.

(2) Material Strength

The design strength of concrete is determined by considering actual performance values from previous projects in Mozambique. Similarly, the strength of reinforcing bars to be used in the project is shown in Table 2-2-15.

Table 2-2-14 Design Strength of Concrete (cylinder)

Member	Design strength (N/mm^2)
Post-tension T-girder	40 (main girder), 30 (cross-beam)
Pier	30
Abutment	24
Cast-in-situ pile	30
Handrail	24
Sidewalk	18

Table 2-2-15 Design Strength of Reinforcing Bars

Member	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Remarks
Post-tension T-girder	More than fy=450	More than 110% of yield strength	SABS920
Abutment, pier	ditto	ditto	ditto
Cast-in-situ pile	ditto	ditto	ditto
Handrail	ditto	ditto	ditto

Table 2-2-16 Design Strength of PC cables

Nominal size (mm)	Nominal area (mm^2)	Specified characteristic force (kN)	Minimum 0.2% proof force (kn)	Cable type
1T12.5	100	182	155	SWPR7B

2-2-2-4 Selection of Bridge Length

It is difficult to determine the river width because the topography around the target bridges is flat.

The scale of flooding has increased and unexpected natural disasters have become more common in Mozambique in recent years.

Bridge length is decided in accordance with the procedure shown in the below figure in consideration of the following conditions such as topography and climatic conditions.

a) Adopt bridge length in excess of existing bridge length

b) Secure sufficient flow area under bridge to allow flood water in the river

c) Consideration of driftwood

d) Standardization by adopting the same length for each span

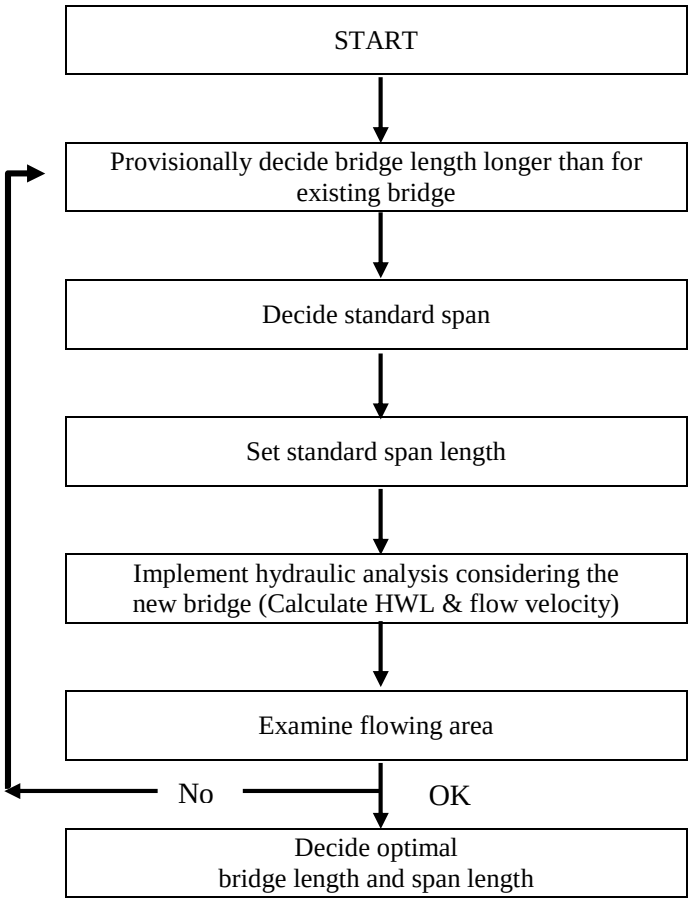


Figure 2-2-8 Selection of Bridge Length

(1) Assumption of Minimum River Width

River width is assumed by investigating existing bridges, conducting interviews on and investigating the flood level, as well as past flood traces. Basically, the river width assumes the length of the existing structure. In case of structures that have been overflowed in the past, the assumed length is that of the Bailey bridge.

(2) Standardization of Span Length

The recent flood damage was concentrated in the northern part of Mozambique, and the superstructures of the target bridges were washed away by flooding in 2014.

The reason for why the structures were washed away is assumed to be the small opening channels, scour, and the large quantity of driftwood which had collided with the piers.

Against this background, possible countermeasures include reducing the number of piers in case of small bridges and securing sufficient span length.

The span length has been standardized in order to reduce construction costs and shorten the construction period by standardization and parallel use and/or reuse of construction facilities, temporary material, and construction machines.

The required span length is approximately 35m in accordance with the standard span length calculation formula and hydraulic analysis results (4,694 m^3/s for Messalo I bridge and 2,742 m^3/s for Messalo III bridge).

Therefore, multiples of the standard 35m span length are used for bridges longer than 35m.

L (span length) = 20+ 0.005Q= 20 +0.005 x (4694+2742)/2 ≒ 35.0m

(3) Design Policy for Bridge Length at Messalo River

The present conditions of the Messalo bridges and the bridge length selection policy are as follows.

1) River width

The flood discharge of Messalo River at the point where it crosses National Highway No. 380 is 10,738 m^3/s. According to the flooding analysis results, the width of the Messalo River becomes approximately 2,500m. Currently, the three existing bridges, Messalo I bridge (50m), Messalo II bridge (150m), and Messalo III bridge (75m), have a total bridge length of 275m. The analysis results clearly show that they have insufficient capacity for water flow.

It is therefore necessary to widen the bridges in order to secure water flow.

2) Flood history of nearby rivers

A flood occurred in Zambezia province in January 2015, and the bridges on the Licungo River were damaged.

Because the Licungo River is a large-scale river in Mozambique similar to the Messalo River, an examination was carried out to determine appropriate countermeasures based on the cause of the damage.

One of the damage causes of Licungo bridge includes scour, and it is necessary to reduce the flow velocity in order to control scour in the bridge plan for the Messalo River.

3) Flood history in the Messalo River

Of the three existing bridges over the Messalo River, the Messalo I and Messalo III bridges have direct foundations without piles, while the Messalo II bridge has a pile foundation.

A velocity of more than 5m/s was estimated based on hydraulic analysis results of the flood which occurred in 2014. The Messalo I and Messalo III bridges sank but there was no damage to Messalo II bridge.

4) Policy for the selection of bridge length

The design policy for the selection of bridge length is based on the present conditions of existing bridges as follows.

a) Shortening of bridge length to the extent possible after having secured necessary water flow for reduction of construction costs
b) Reduction of flow velocity to the extent possible (to about 4m/s or less as a desired value)
c) Reduction of the depth of overflowing on embankment roads to the extent possible (to about 1m or less as a desired value)

5) Selection of bridge length

Based on the selection policy, 4 options are examined as shown in Table 2-2-17. Although the overflow depth suddenly decreases and the water level falls when moving from Option 1 to Option 2, the velocity of Option 2 is over 5m/s. Since Option 3 has an overflow depth of less than 1m and the velocity drops to under about 4m/s, Option 3 is recommended with a 175m length for the Messalo I bridge and a 140m length for the Messalo III bridge.

Table 2-2-17 Bridge Length Options

Item	Option 1	Option 2	Option 3	Option 4
Messalo I bridge (m)	70	105	**175**	210
Messalo III bridge (m)	105	140	**140**	175
Road height (EL: m)	49.2			
Water level (EL: m)	51.3	50.3	50.0	49.9
Overflow depth (m)	2.1	1.1	0.8	0.7
Velocity (m/s)	5.63	5.81	4.61	3.87

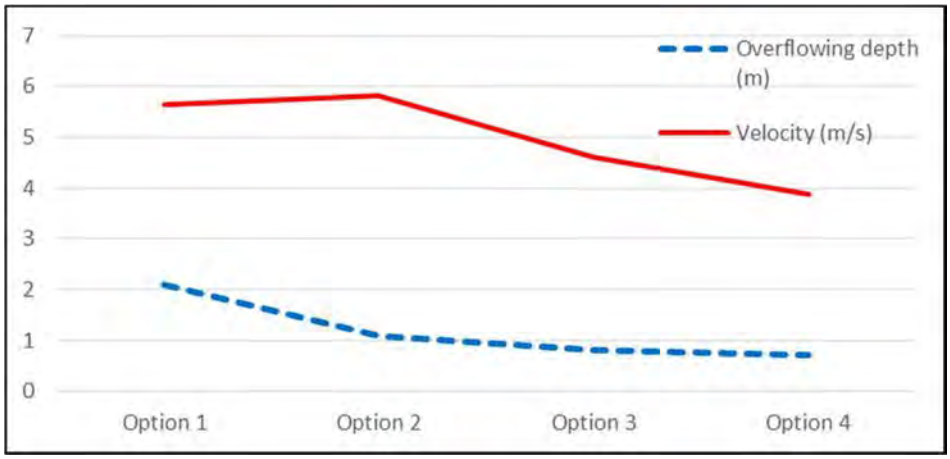


Figure 2-2-9 Velocity Distribution Chart

(4) Determination of Bridge Length

As a result of the examination of the length of Mapuede bridge which assumed a minimum length equal to the width of the existing river, a longer bridge length than that of the existing Bailey bridge was selected due to the insufficient discharge capacity. All bridge and span lengths are shown in Table 2-2-18.

Table 2-2-18 Bridge and Span Lengths

No.	Bridge name	Necessary length (m)	Standard span (m)
1	Messalo I	175.0	5 spans x 35m
2	Messalo III	140.0	4 spans x 35m
3	Mapuede	35.0	1 span x 35m

2-2-2-5 Selection of Superstructure Type

The superstructure is selected from the types that can be adopted based on the span length and then examined from the viewpoints of economy, construction, maintenance, and general structural characteristics.

The superstructure can be selected from the following types: 1) Pretensioned T-Girder, 2) Post-tensioned T-girder, 3) Steel I-section girder as shown in Table 2-2-19. Two types of girder are then selected.

Table 2-2-19 Superstructure Type

Pretensioned T-girder	Typical for PC bridges with small spans. If this type is adopted, the girders need to be transported from Japan or third countries because Mozambique does not have factories for the fabrication of pretensioned girders. This girder type is not selected for this project because the girders are heavy, difficult to transport, and marine shipping costs become very expensive.
Post-tensioned T-girder	Typical for concrete bridges with small and medium sized spans because they can be fabricated at on-site production yards and quality control is easy. This girder type can shorten the work period in the construction yard and there is extensive experience of their use in Mozambique. This girder type is thus selected for the comparison of superstructure.
Steel I-section girder	I-section girders are applicable to a 35m span length. The length of approach roads can be reduced since the girder height is low. This girder type is thus selected for the comparison of superstructure.

Table 2-2-20 shows the results of the comparison of post-tensioned T-girders and steel I-section girders.

Alternative 1: Post-tensioned T-Girder Bridge

Alternative 2: Steel I-section Girder Bridge

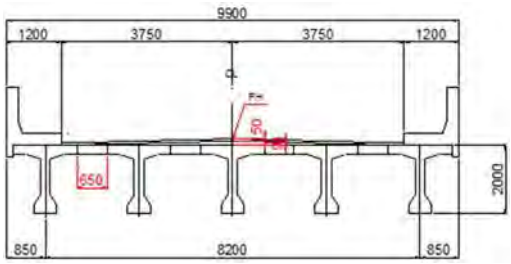
Steel girders are characterized by their light weight which can reduce the burden on the foundations, as well as their easy erection.

On the other hand, steel girders have low overall rigidity, and their resistance against unexpected horizontal loads like flooding is also low. The shipping costs and maintenance costs of painting become higher than for concrete bridges. There is also very little experience of steel girder construction and information on their maintenance in Mozambique, and ensuring appropriate maintenance is therefore assumed to be difficult.

Hence, the survey team recommends the use of post-tensioned T-girders which have low construction and maintenance costs from a technical point of view as well as low lifecycle costs.

A comparison of concrete and steel girders is shown in Table 2-2-20.

Table 2-2-20 Comparison of Superstructure

	Alternative 1:Post-tensioned T-girder bridge		**Alternative 2: Steel I-section girder bridge**	
Cross-section				
Structure	Higher girder height (2.0m) requires longer approach road	○	Lower girder height (1.75m) enables shorter approach road	○
	Extensive construction experience in Mozambique		No construction experience in Mozambique	
	Higher rigidity because of PC cables in deck		Examination of stability is necessary	
Construction	Better stability during erection	○	Longer erection period if many girders	△
	Cable installation requires more work on site		Requires scaffolding for deck work	
	Little scaffolding required for deck work			
	Superior quality control for girder fabrication at yard		Weather affects deck work	
	No impact from weather			
Super-structure	Better stability against flooding	○	Reduced burden on foundation due to light girder weight	○
Maintenance	Lower maintenance costs	○	Requires periodic painting	△
	No cracking of girder due to PC cables			
Economy	Lower construction and maintenance costs	○	Higher cost due to the shipping costs from Japan and maintenance	△

2-2-2-6 Substructure

(1) Soil Modulus

The soil modulus used for the design is determined according to the following considerations.

1) Unit weight of soil or rock γ (kN/m^3):

Concerning sand and soil, the values are set based on laboratory test results and values proposed in the existing literature.

Concerning weathered soft rock and silt rock, the values are estimated using existing literature.

2) Angle of shear resistance φ (degrees):

Concerning sandy soil, weathered soft rock and silt rock, the angles are estimated by the results of SPT and values proposed in the existing literature.

Concerning cohesive soil, the angles are assumed to be zero in order to be on the safe side.

3) Adhesion c (kN/m^2):

Concerning cohesive soil, weathered rock and silt rock, the values are estimated by the results of SPT and values proposed in the existing literature.

Concerning sandy soil, no adhesion is assumed in order to be on the safe side.

4) Elastic modulus Eo (kN/m^2):

The elastic modulus is estimated based on laboratory test results, N-values and values proposed in the existing literature.

Table 2-2-21 Soil Modulus

No.	Bridge name	Unit weight (γ)	Angle of shear resistance (φ)	Adhesion (c)	Elastic modulus (E0)
		(kN/m^3)	(degrees)	(kN/m^2)	(kN/m^2)
1	Messalo I	19.0	38.0	-	141,600
2	Messalo III	19.0	38.0	-	124,100
3	Mapuede	19.0	21.0	170.0	41,100

2-2-2-7 Selection of Pile Type

In selecting the pile type used on this project, the compatibility with soil conditions on each site, the past construction experience in this region and market availability; i.e. the procurement situation and the transportation method and distance, are all taken into consideration. Regarding the compatibility with soil conditions, attention should be given to the soil and silt intermediate layers detected in the geological survey. The bearing level is about 30m below the ground and consists of silt rock as well as soil and silt layers. Regarding the past construction experience in this region and market availability, answers received in interviews conducted as part of this preparatory survey should be reflected in the selection. The evaluation for selecting pile type is based on the above basic conditions. As a result of the selection, it is concluded that cast-in-place piles (all-casing method) are the most appropriate pile type for this project.

2-2-2-8 Selection of Substructure Type

(1) Selection of Abutment Type

In consideration of the bridge sizes and structural heights, the inverted T-type is applicable for the target bridges. The inverted T-type abutment is low cost due to its light weight, keeps its stability with the help of the soil weight, and is easy to construct with backfilling. The abutments have a 15m height in general soil conditions.

(2) Selection of Pier Type

The inverted T-type which is very common is applicable as the pier type for this project.

Moreover, as most of target bridges are located on sections where the rivers suddenly expand and contract as well as converge and curve, the characteristic features of the flows are complicated.

In such cases, oval-shaped piers which have a suitable structure with respect to flow, are applicable in the event of unexpected water flow.

2-2-2-9 Structure Height

(1) Abutments

In cases where the riverbed comprises sediment or weathered soft rock, the top of the abutment footings is planned to be aligned with the estimated deepest riverbed elevation, or to be set at a sufficient height to secure an overlying layer of 1.0m from the current deepest riverbed.

Concerning pile foundations, in case scour is expected at the front of abutments, bank protection works are planned around abutments in areas where there is a risk of piles being exposed by scour.

(2) Piers

In cases where the riverbed comprises sediment or weathered soft rock, the top of the pier footings is planned to be aligned with the estimated deepest riverbed elevation, or to be set at a sufficient height to secure an overlying layer of 2.0m from the current deepest riverbed.

In cases where the estimated scour depth is large and it is difficult to secure sufficient embedding, riverbed protection works around piers are planned to prevent scour.

(3) Piles

The pile lengths are determined according to the policy in Table 2-2-22.

Table 2-2-22 Pile Length

Item	Policy
Embedded length of pile into bearing layer	In cases where the bearing layer is a hard sandy soil layer or a weathered soft rock layer, the minimum embedded length is planned to be the pile diameter or more.
	If the bearing capacity is insufficient, the embedded length is planned to be extended up to three times the pile diameter in consideration of workability.
	In cases where the bearing layer is rock, the embedded length is planned to be the pile diameter.
Embedded length into pile cap	Pile heads are planned to be embedded into the pile cap up to a depth of 0.1m.
Pile length	Pile length, comprising the length that includes the embedded length into the pile cap, is set in units of 0.5m.

(4) Girder Unseating Prevention Equipment

Girder unseating prevention equipment shall be installed due to the unexpected flood levels which occur in northern Mozambique due to the influence of climate change.

Anchor bars and girder unseating prevention walls are installed at the base of bearings as a countermeasure against unexpected force.

2-2-2-10 Road Design Policy

(1) Geometric Design Conditions

Roads will be designed in accordance with ANE's Design Standard which is based on the "Southern Africa Transport and Communications Commission (SATCC)".

The project road belongs to the Main Arterial National Road category. The road category and geometric design standard are shown in Table 2-2-23 and Table 2-2-24.

Table 2-2-23 Road Category (ANE Design Standard)

Item	National Highway			
	Main Arterial Road	Arterial Road	Semi Arterial Road	Provincial Road
Road Category	• Connection between city and city. • Provincial road connecting to main provincial	• Provincial road connection between city and city. • Connecting	• Connecting road from/to main local city and main productive center.	• Connecting road between local cities.

Item	National Highway			
	Main Arterial Road	**Arterial Road**	**Semi Arterial Road**	**Provincial Road**
	road.	road from/to main city and arterial road.		
Traffic Volume (p.c.u.)	500－20,000	100－500	30－100	0－50

Table 2-2-24 Geometric Design Standard

No	Item	Highway
1	General	
	1.1. Design speed	100 km/h
	1.2. Minimum intersection distance	600 m
2	Horizontal alignment	
	2.1. Minimum radius	350 m
	2.2. Crossfall	
	Vertical gradient > 0.5%	2%
	Vertical gradient <= 0.5%	3%
	2.3. Soulder crossfall (unpaved)	4,0%
	2.4. Maximum superelevation	8%
3	Vertical alignment	
	3.1. Maximum gradient	5%
	3.2. Minimum gradient	0.2%
	3.3. Minimum vertical curve radius	
	K value at top	60 m
	K value at bottom	36 m
	3.4. Minimum vertical curve length	180 m
	3.5. Sight distance	205 m
	Minimum stopping sight distance (downhill)	
	-3%	220 m
	-4%	225 m
	-5%	230 m
	Intersection	180 m
4	Lane width	
	4.1. Minimum lane width	3.5 m
	4.2. Minimum shoulder width (paved)	1.5 m

Source: ANE

(2) Road Width

The existing road width is different on the southern Sunate – Macomia section (3.0m) and the northern Macomia – Oasse section (3.5m). Although ANE authorized a 3.0m width in the past, a 3.0m lane width is not suitable for passing heavy vehicles and 3.5m was therefore designated as the minimum lane width. The northern Macomia – Oasse section (102km length) was constructed and completed by a local contractor in August 2014.

The project road National Highway 380 (NH 380) will be upgraded to the NH 1 main arterial road in the future, and the typical cross-section is planned with the following width:

1) Lane width: 3.5m x 2 lanes

2) Paved shoulder width: 1.0m

3) Unpaved shoulder width: 0.5m

4) Cross-fall (carriageway and paved shoulder): 2.5%

5) Cross-fall (unpaved shoulder): 4.0%

6) Figure 2-2-10 shows the typical cross-section

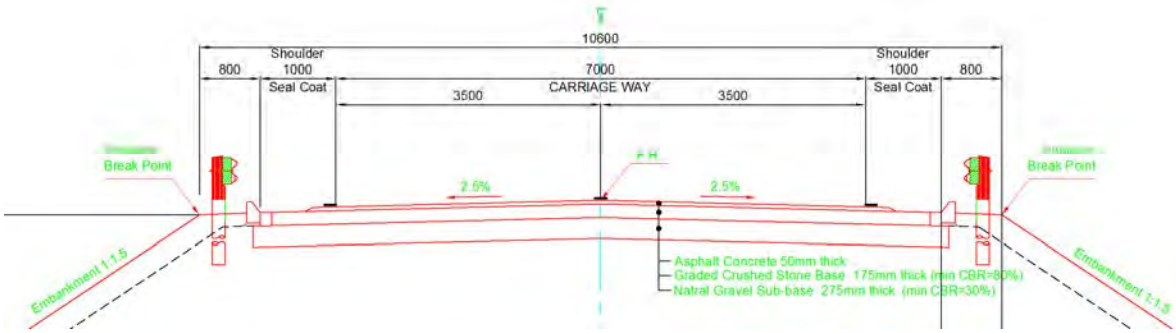


Figure 2-2-10 Typical Cross-Section of the Project Road

(3) Pavement

Asphalt pavement will be provided on project approach roads and pavement constitution in accordance with the STACC standard.

1) Design standard: SATCC Draft Code of Practice for the Design of Road Pavements

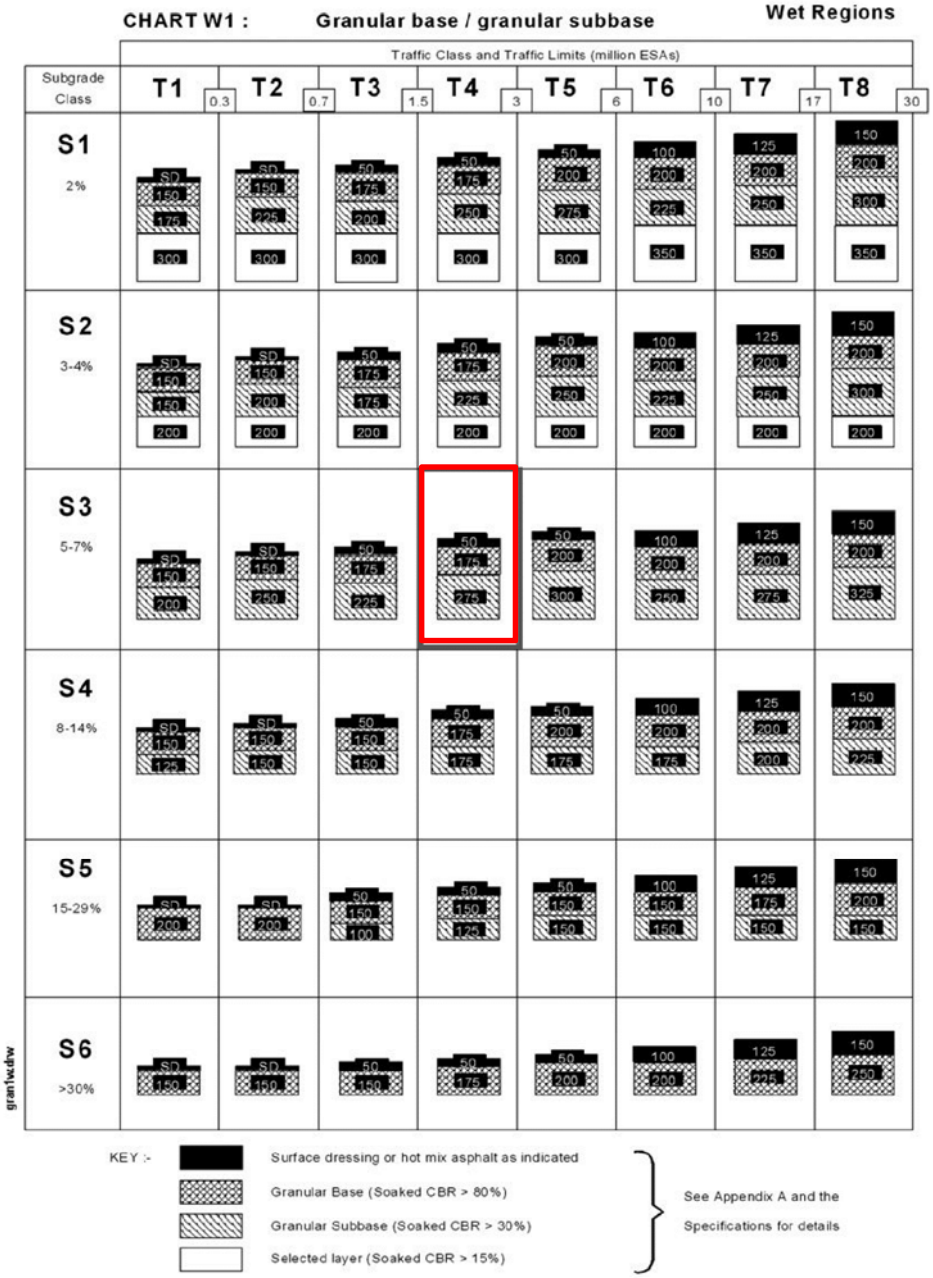
2) Traffic class: ESA=1.66×10^6 (Class T4)

3) Sub-grade class: CBR=5～7% (Class S3)

4) Climate: WET

5) Pavement composition: SATCC chart (Chart W1, Table 3-2-25)

Table 2-2-25 Pavement Content Chart



Source: SATCC

(4) Drainage Facilities

For road surface drainage, a concrete curve will be installed for prevention of erosion on the ground slope in the shoulder and a drainage gutter with a cast-in-place concrete drainage ditch will be installed in front. Drainage facilities will be installed at the bottom of embankment slopes in order to collect rainwater from the road and embankments.

(5) Safety Facilities

Road marking rivets (reflective type) will be installed on the road to help prevent traffic accidents during the night. Road signs to indicate the bridge ahead in advance and curved alignment sections at the front of curve lines on each way will be installed.

2-2-3 Outline Design Drawings

The design drawings are shown in the Appendices.

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

1) By grouping the project construction sites according to the site characteristics and bridge types, each group can work simultaneously and the construction period can be shortened. Moreover, work efficiency is planned to be improved by sharing site offices and concrete plants.
2) The aim is to standardize the superstructure, substructure and foundation types of the target bridges. Moreover, unification of temporary works, girder erection methods and construction equipment sharing are planned in order to reduce costs.
3) Sufficient safety measures are planned since public safety in the region is unstable. For example, security guards are planned to be assigned to the site offices and dormitories.

2-2-4-2 Procurement Policy

(1) Local Contractors

Local contractors headquartered in South Africa, Portugal and Brazil can be utilized as subcontractors for the project since they have experience of general road and bridge construction work in Mozambique and other countries.

It is necessary that the skilled workers in charge of fabrication of PC girders and in-situ piles have enough experience and technique. Depending on the situation, specialists may have to be dispatched from subcontractors in Japan or other neighbouring Asian countries.

(2) Transportation

As a port of discharge, Pemba Port is closest to the construction sites but currently has limited capacity. The use of Nacala Port is thus considered as a port of discharge in the transportation

plan . The transportation route starts at Nacala Port, heading west, then go up north from Namialo on National road 380 through Sunate (See Transportation Route 1 below).


Muagamura Bridge


Catipusse Bridge

Figure 2-2-11 Transportation Route

National Highway No. 380 will basically be used for inland transportation by road (Route 1). Substitute routes are also available (Route 2 or 3) in case of natural disasters etc. There are 2 Bailey bridges (Muagamura Bridge and Catipusse Bridge) on National Highway No. 380 managed by ANE, and heavy vehicles can pass over these bridges. Although Catipusse Bridge is partly damaged due to vehicle collision, it is anticipated to be repaired by ANE until the commencement of construction of the Project.


Photo 2-2-1 Heavy Vehicle


Photo 2-2-2 Damage on Catipusse Bridge

2-2-4-3 Implementation Conditions

(1) Construction Yard

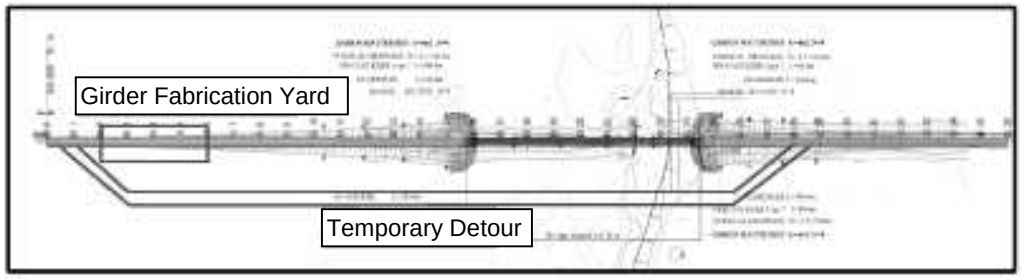
The construction administration office and construction yard should be established on land provided by the Mozambique government.

In case the construction yard is built in the Massalo River basin, it should be built on an appropriate level higher than the planned high water level because the dyke road has overflowed in the rainy season.

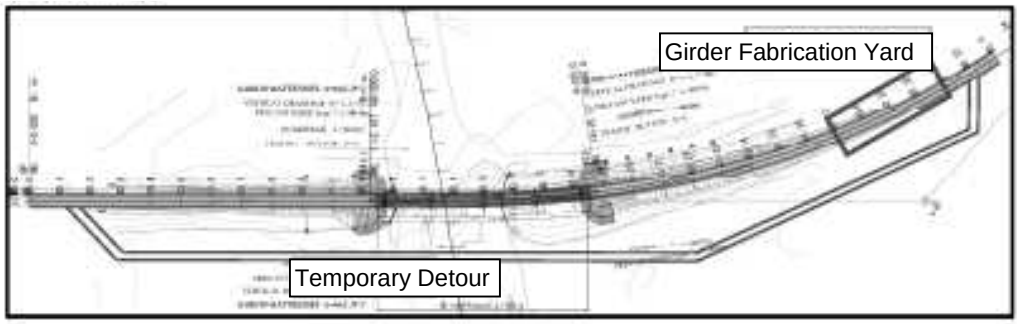
(2) Detour during Construction

Temporary detour during construction will be required, as the targeted existing bridges will be replaced with new ones at the same locations. Construction shall thus be planned so as to maintain the traffic on National Highway No. 380 as a trunk road. The detour in river is basically planned as embankment structure with corrugated pipes for water flow. Bailey bridges used for the existing bridges are also available as temporary bridges for the temporary detour. In that case, the bailey bridges are supposed to be accommodated by ANE, while they will be erected and removed by the contractor of the project.

(1) Mesalo I Bridge



(2) Mesalo III Bridge



(3) Mapuede Bridge

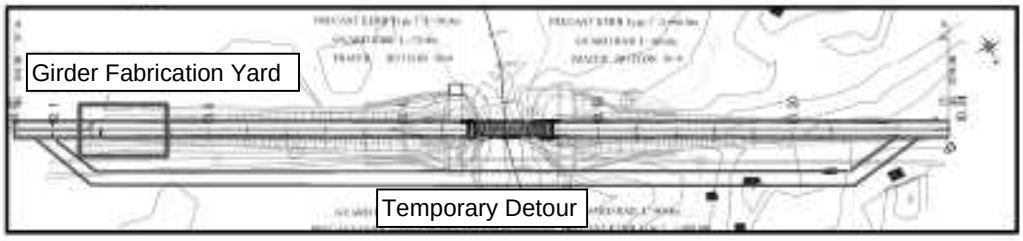


Figure 2-2-12 Plan of Temporary Works

(3) Works in River

Most of the target bridge sites are sometimes damaged by flooding during the rainy season.

Therefore, construction of piling and substructures inside rivers is basically planned to be conducted in the dry season. However, if it is necessary to perform work also during the rainy season, sufficient safety controls such as setting an appropriate water level have to be planned.

Moreover, work efficiency during the rainy season is carefully considered in order to prepare an optimal construction plan.

(4) Securing of Peace and Order

Sufficient safety measures are necessary since the area is not peaceful and stable, and there is a shortage of police officers in the province.

The construction site office shall have a security fence at the gate in order to prevent theft and accidents. A guard should be posted around the clock at the office gate and it is necessary to prevent thefts and ensure the safety of personnel.

(5) Landmines

Detection of landmines at the project site will be carried out by special survey firm contracted with ANE. The detection is anticipated to be completed until the end of February 2017.

(6) Existing Utilities

There exists telecom poles for optical fiber cables adjacent to the targeted bridges, and they need to be relocated prior t the commencement of construction. Their relocation is anticipated to be completed until the end of October 2016.

(7) Customs Clearance and Tax Exemption

The procedures related to customs clearance and tax exemption for importing equipment and materials required for bridge and road construction into Mozambique involves many organizations including the Ministry of Finance, customs authorities, the project owner, contractor and freight forwarder. The following table shows the customs clearance and tax exemption procedures based on information gained from interviews with various contractors. These procedures are subject to change depending on the circumstances in Mozambique.

Table 2-2-26 Customs Clearance and Tax Exemption Procedures

Procedure	Ministry of Finance	Customs authorities	ANE	Contractor	Freight forwarder
Cargo is shipped after undergoing a pre-shipment inspection (PSI).				○	○
The contractor submits copies of the final invoice, bill of lading (B/L), packing list, insurance policy, etc. to the owner (ANE) and the freight forwarder.			○	○	○
ANE confirms the contents of the documents.			○		
The freight forwarder makes an application to the customs authorities through MCNET.		○			○

Once the application has been approved, the freight forwarder submits copies of the final invoice, bill of lading (B/L), packing list, insurance policy, etc. to the customs authorities.		○			○
The customs authorities calculate the customs duties, IVA and other fees and inform the freight forwarder.		○			○
ANE requests the Ministry of Finance (MEF) to issue a tax exemption permit.	○		○		
ANE submits a tax exemption certificate to the customs authorities.		○	○		
The freight forwarder requests approval for customs clearance from the customs authorities by submitting the ANE certificate.		○			○
The cargo arrives in port in Mozambique and a customs inspection is carried out.		○			
The customs authorities approve customs clearance after the inspection and the cargo is transported to the construction site.		○		○	
MEF issues a tax exemption permit and submits it to the customs authorities.	○	○			

The following issues related to the tax exemption procedures were confirmed during the interviews:

1) Any errors in the submitted documents or failure to confirm the contents with each person in charge will delay the document review process and thus also customs clearance. This may also result in additional charges for container storage and lease. According to contractors involved in on-going projects, such storage fees and leases can add up to a significant amount of money.
2) As many organizations are involved in the process, customs clearance is sometimes delayed if some of the persons in charge are absent.

3) The contractor has to pay any container storage fees in advance based on a refund system and can ask the project owner for payment, but repayment often takes a long time. If the delay is partly caused by errors in the contractor's documentation, this may require lengthy negotiations over the payment and it is possible that only part of the money is refunded.
4) According to Ministry of Finance (MEF) staff, it should be possible to issue the tax exemption permit within a few days after ANE has requested MEF to do so. However, according to contractors, this usually take a little longer. Since waiting for the tax exemption permit from MEF is expensive, ANE is usually asked to issue a certificate so that containers can pass customs clearance sooner.

The following table shows the tax rates for materials which are likely to be imported for this project.

Table 2-2-27 Tax Rates for Various Materials

Material	Tax rate (%)
Reinforcement bars	7.5
PC cables	7.5
Bearings	20.0
Expansion devices	7.5
Waterproofing for deck	7.5
Steel H-girders	7.5
Steel sheet piles	7.5
Gabions	7.5
Asphalt material	2.5
Guardrails	7.5

(8) Value Added Tax (VAT)

Claiming a VAT refund involves submitting a refund application to ANE. After checking the application, ANE submits the application to the Road Fund and the VAT amount is then refunded through the Road Fund to the contractor's pre-registered bank account.

According to contractors, one issue with the VAT refund process concerns the Road Fund's insufficient project budget which means that refunds are sometimes not paid until the next fiscal year. As all refunds are paid in local currency, this can result in problems if a large amount is refunded after project completion and there is no way to use the money.

The Ministry of Finance prepares the national budget plan between June and December every year, and the budget is then used during the following fiscal year. In order to make the tax and VAT refund process smoother, the exempted tax amount is estimated before the start of construction and the Road Fund requests MEF to allocate the required funds in the budget.

After signing the contract, the contractor should submit a master list to ANE which details the material and equipment to be imported in order to secure the budget funds. A VAT payment plan should also be submitted in advance to ensure smooth VAT repayments.

(9) Visas

The following documents are required for extended stays in Mozambique:

1) Work permit
2) Work visa
3) Status of residence (DIRE: Documento de Identificação e Residência para Estrangeiros)

Japanese citizens wishing to stay in the country for longer than 90 days require a work visa. Obtaining a work visa involves submitting an application to the Embassy of Mozambique in Japan. This allows the applicant to stay in Mozambique for 30 days, during which it is necessary to obtain a status of residence from the local immigration authorities. The status of residence is renewed every year.

According to contractors, work permits were not required in the past, but in recent years the Ministry of Labor has carried out inspections and some companies have had to pay fines because they did not have the required permits. Still, it is in some cases difficult to obtain the required work permits from the Mozambican authorities.

Contractors who employ Asian engineers have to consider that some Asian countries do not have a Mozambican Embassy. In such cases, the engineers have to obtain a commercial visa at the airport in Mozambique and then apply for a work permit before the visa expires. If a work permit is not issued, the applicant has to visit a neighboring country to reapply for the permit, which contractors say might sometimes take several tries.

According to ANE, Japanese engineers are exempt from work permit application fees because Japan is a provider of grant aid. As for engineers from third countries, it is sometimes necessary to pay 12% of the engineer's salary as the application fee for a 1-year permit. If the Ministry of Labor determines that it is possible to employ Mozambican engineers with the same qualifications as those from third countries, it might not issue work permits. Also, if there is a large number of applicants, the work permits may not be reissued.

Related law:

Labour Law – Law n. °23/2007 of 1 August

2-2-4-4 Scope of Works

The general scope of works for both the Japanese and the Mozambique side on this project is shown in Table 2-2-28.

Table 2-2-28 Scope of Works

Japanese side	Mozambique side
- Reconstruction of target bridges and approach roads connecting with existing roads - Removal of existing structures around the target bridges - Procurement, import, export and transportation of construction equipment & materials - Establishment & removal of temporary facilities such as site offices and work yards, etc. - Traffic safety measures through the construction area during the construction period - Detailed design, tender preparation and construction supervision	- Acquisition of environmental licenses - Bank commissions (opening of bank accounts (B/A), procedures for the authorization to pay (A/P)) - Securing of construction sites and land for construction - Survey and removal of landmines - Provision of quarries and disposal areas - Provision of construction permissions - Relocation of existing utilities such as optical fiber cables - Exemption and refunding of taxes placed on the import and purchase of works equipment and materials in Mozambique - Provision of visas for all parties related to construction - Maintenance of roads for material and equipment procurement - Provision of Bailey bridges - Preparation of Environmental Management Plan and approval - Maintenance of constructed bridges and dyke road in this project

2-2-4-5 Construction Supervision

(1) Detailed Design

A site survey shall be performed before the commencement of detailed design in order to investigate information which has been updated after the basic design or conditions (design standards, etc.) that should be newly reflected in the detailed design. Such information shall be immediately reflected in the design work after the investigation.

(2) Construction Supervision

Resident engineers for each group are planned to be assigned to carry out site management for the project. There is large number of piles and the total length is long. The plan is therefore to dispatch Japanese foundation engineers during piling work because the construction supervision work is assumed to be difficult considering the period and technical aspects.

2-2-4-6 Quality Control Plan

Quality control shall be managed by the items showed in Table 2-2-29 in accordance with relevant standards.

Table 2-2-29 Quality Control Plan

Inspection	Item	Content	Frequency
Materials	Aggregate particles, specific gravity	Aggregate particles, specific gravity	Aggregate particles, specific gravity
	Cement	Particles, specific gravity, strength	Every lot
	Rebar	Strength, bending	Every diameter from each lot
	PC cable	Strength	Every lot
	Asphalt	Needle penetration, viscosity, softening	Every lot
	Embankment soil	Particles, specific gravity, consolidation, moisture content, plastic/liquid limit, CBR	Every 500m^3 at each borrow pit
Products	Fresh concrete	Slump, temperature	Every 5m^3 at site
	Hardened concrete	Compression strength, unit weight	Every 30m^3
	Asphalt mix	Asphalt content, temperature	Every 30t at site
	Base course, sub-base course	Site density, moisture content	Every 20m^3
	Girder	Dimensions, straightness	Every girder
	Pile	Dimensions, straightness	Every pile
	Foundation, substructure	Dimension, location, elevation	Every structure
	Superstructure	Dimension, location, elevation	Every 5m along the alignment
	Asphalt pavement	Thickness, flatness, elevation	Thickness: Every 100m^2, flatness & elevation: every 5m along the alignment

2-2-4-7 Procurement Plan

(1) Construction Material

The procurement source plan for main materials is shown in Table 2-2-28.

Temporary steel products (H-section steel, sheet piles) are planned to be imported from South Africa since they are not manufactured in Mozambique as well as to ensure good quality.

The procurement of bearing and expansion joints is planned to be done from Japan and should therefore consider the transportation period and customs period for each construction item.

Table 2-2-30 Procurement Sources of Major Construction Materials

Material	Mozambique	Japan	Third country	Remarks
Portland cement	○			
Concrete admixture			○	South Africa
Asphalt mix	○			
Reinforcing bars			○	South Africa
Temporary steel			○	ditto
Quarry, sand, soil	○			
Plywood	○			
Scaffolding	○			
PC cables		○		
Joints, bearings		○		
Waterproofing for deck			○	South Africa
Guardrails			○	ditto

(2) Construction Equipment

The procurement source plan for main equipment is shown in Table 2-2-31.

General construction machines such as dump trucks are planned to be procured from local contractors on the project. Tyre rollers, road rollers, motor graders, asphalt plant and asphalt finishers are planned to be procured from contractors in South Africa. Vibration hammers are planned to be procured from Japan. The procurement of bearings and expansion joints is planned from Japan and should therefore consider the transportation period and customs period for each construction item.

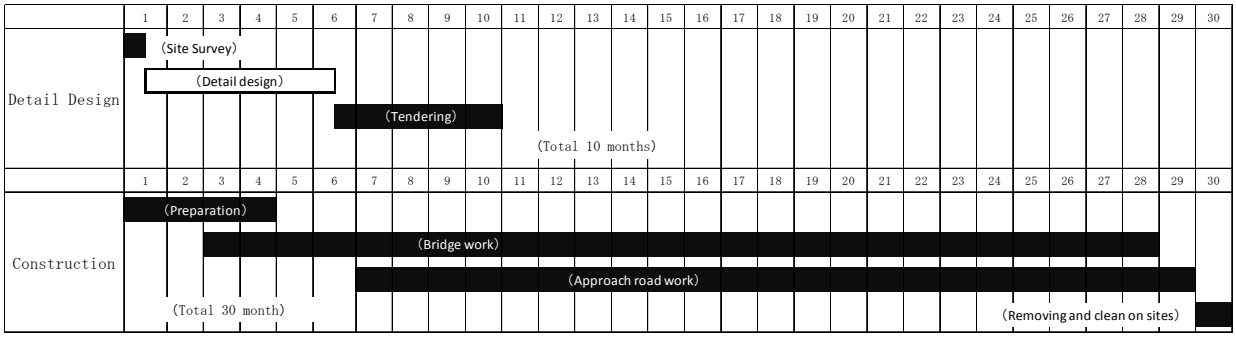
Table 2-2-31 Procurement Sources of Major Construction Equipment

Equipment	Mozambique	Japan	Third country	Remarks
Excavator			○	South Africa
Bulldozer			○	ditto
Tractor shovel			○	ditto
Violator			○	ditto
Tire roller			○	ditto
Road roller			○	ditto
Stabilizer			○	ditto
Motor grader			○	ditto
Vibration hammer		○		
Pile drilling machine		○		
Motor pump	○			
Generator			○	South Africa
Concrete cutter			○	ditto
Asphalt finisher			○	ditto
Concrete plant			○	ditto
Dump truck 10t	○			
Dump truck 2t	○			

2-2-4-8 Implementation Schedule

The tentative implementation schedule is shown in Table 2-2-32.

Table 2-2-32 Tentative Implementation Schedule



2-3 Obligations of the Recipient Country

2-3-1 General Conditions for Japanese Grant Aid

1) To open a bank account in the name of the government of the recipient country in Japan (B/A) and issue the authorization to pay (A/P) and bear the costs thereof,
2) To secure the land necessary for implementation of the Project,
3) To provide construction permission of the Project,
4) To exempt Japan and third countries from customs duties, domestic taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of goods and services under the Project,
5) To provide visa support for Japanese personnel and all parties related to construction in Mozambique

2-3-2 Special Conditions for the Project

1) To obtain environmental licenses for project implementation,
2) To detect and clear UXOs and land mines on the requisite lands for project implementation,
3) To secure sites for borrow pits and disposal areas,
4) To relocate existing utilities such as optical fiber cables,
5) To maintain roads for material and equipment procurement for the Project,
6) To provide existing Bailey bridges,
7) To prepare and approve the Environmental Management Plan,
8) To maintain the constructed bridges in this project,
9) To maintain the dyke road at the Messalo River on N380

2-4 Project Operation Plan

The maintenance work necessary to operate and maintain the facilities constructed in the project are recommended as shown in Table 2-4-1. The structural type of the target bridges and approach roads is not complicated and the methodology and items for the maintenance work are quite general.

Moreover, ANE has already maintained similar types of bridges constructed by Japanese grant aid projects and is familiar with the maintenance work of such bridges.

Table 2-4-1 Maintenance Work for Facilities

Item	Frequency	Member	Maintenance Work
Visual inspection	Often	All facilities	Inspection & maintenance work based on Bridge Maintenance Manual prepared in the project.
Bridge maintenance	Once every six months	Expansion joints	Cleaning of expansion joints. Any damage shall be photographed and recorded.
		Drainage system	Cleaning of drainage clogged with rubbish, soil or sand. Any damage shall be photographed and recorded.
		Bearings	Cleaning of bearings. Checking of displacement and deterioration of bearings.
		Handrails	Checking if there is any damage caused by traffic accidents. Any damage shall be photographed and recorded.
		Main girders	Checking if there is any damage. Any damage shall be photographed and recorded.
	Once every six months (particularly after the rainy season)	Bridge deck and pavement	Checking of deck surface. If there are any potholes or damage they shall be repaired.
	Once every six months (particularly after the rainy season)	Abutments and piers	Checking if there is any scour around structures and structural settlement. Any scour and settlement shall be photographed and recorded.
Access road maintenance	Once every six months (particularly after the rainy season)	Road surface	Checking of road surface. If there are any potholes or damage they shall be repaired.
		Shoulders & slopes	Checking of any deformations and cracks. Weeding and repair of damaged sections.
		Side ditches and catch pits	Cleaning of ditches and pits clogged with rubbish, soil or sand. Any damage shall be photographed and recorded.
	Once every six months (particularly after the rainy season)	Guardrails and traffic signs	Checking if there is any corrosion or damage on guardrails and traffic signs. Any damage shall be photographed and recorded.
Riverbank protection	Once every six months (particularly after the rainy season)	Gabions	Checking if there is any scour around structures and damage to gabions. Any scour and damage shall be photographed and recorded.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

The cost of the project to be borne by the Mozambique side is estimated at 91.95 million MZN as summarized in Table 2-5-1. These costs are estimated under the conditions shown in Table 2-5-2

(1) Project Costs to be Borne by the Mozambique Side

Table 2-5-1 Project Cost to be Borne by the Mozambique Side

Item	Cost (MZN)	Equivalent (Mil. JPY)
1. Land acquisition fee	1,564,000	5
2. Investigation and removal of landmines and UXOs	12,515,000	43
3. Customs duties & value added tax (IVA)	76,704,000	264
4. Payment of bank service charges for bank arrangement (B/A) and authorization to pay (A/P)	1,163,000	4
Total	91,946,000	316

(2) Cost Estimation Conditions

Table 2-5-2 Cost Estimation Conditions

Item	Condition
1. Time of estimate	April 2015
2. Exchange rate	1 USD = 120.55 JPY 1 MZM = 3.44 JPY
3. Construction period	30 months

2-5-2 Operation and Maintenance Cost

The annual operation and maintenance costs after completion of the project are estimated as shown in Table 2-5-3.

Table 2-5-3 Operation and Maintenance Costs

Item	Frequency	Inspection location	Work items	Annual cost (MZN/ year)
Inspection	Once per half year	Surfaces, joints, bearings, drainage, handrails, girders, abutments, piers, guardrails	Inspection and cleaning	250,000
Pavement rehabilitation	Once per 5 years	Surface	Overlay	926,000
Revetment repair	Once per year	River bed in front of abutments	Gabions	1,481,000
Total				2,657,000

CHAPTER 3
PROJECT EVALUATION

CHAPTER 3 PROJECT EVALUATION

Direct and indirect effects have been evaluated to show the benefits expected to come from implementing the Project. PDM and others are utilized for the evaluation and indicators are defined and selected to objectively evaluate the effects of the Project.

3-1 Preconditions for Implementation of the Project

The possible preconditions for implementation of the project are described below.

(1) Cooperation with the Project Implementing Agency (ANE)

The steady and smooth implementation of the project requires close cooperation with ANE, the project implementing agency.

(2) Acquisition of Environmental License

It is necessary to obtain an environmental license from MITADER in order to implement the project. The bridges are classified as category "B" and IEE will be implemented for the bridges. These IEE have to be evaluated and approved by MITADER.

Budgeting is necessary for implementation of IEE, and a budget for implementing IEE should be sufficiently allocated at the right time by the Road Fund.

(3) Land Acquisition

Location of the bridges for replacement and alignment of the roads approach to the bridges are carefully to be planned and designed in a way not to affect private property. Therefore, acquisition of private land and resettlement are not required in this project. However, temporary tenancy of private land may be required to secure yards for construction materials and equipment during the project period. Adequate compensation by the Mozambique government for land and crops in the project areas has to be carried out.

(4) Clearing of UXOs and Landmines

Since there are likely to be UXOs and landmines in the areas surrounding the bridges scheduled for replacement, ANE should conduct surveys in order to find such UXOs and landmines and clear them before the start of bridge construction.

(5) Bridge Construction Licenses

It is necessary to ask ANE to issue bridge construction licenses before the construction work can begin.

(6) Relocation of Existing Utilities

Although there are no existing utilities on the bridges scheduled for reconstruction, power poles and power cables which run parallel to the road exist within the right-of-way of N380. If these have an impact on the bridge reconstruction work, the Mozambique government should prepare adequate countermeasures and compensation before the construction stage.

(7) Exemption of Customs Duties

Since it is necessary to import material and equipment for the bridge construction work from Japan and third countries, ANE and related organizations will need to provide support for the exemption of customs duties.

(8) Exemption of Taxes

ANE will need to provide support for the exemption of value-added tax and other taxes imposed on the procurement of material and equipment in Mozambique.

(9) Visas

Since the construction period for the bridges is approximately 30 months, it is necessary for the staff involved in implementation of the construction work to stay in Mozambique for a long time. ANE will therefore need to provide support in order to obtain visas from the relevant authorities.

(10) Provision of Bailey Bridges (Existing Bridges)

During the construction period, ANE is requested to provide Bailey bridges which can be launched on the existing structures in order to ensure the passage of general vehicles.

(11) Agreement of Residents

Because there are no houses or villages near the bridges, the bridge construction work will likely have no negative impact on the residents of nearby areas. The residents living along the road expect to see a significant improvement in their basic living conditions by the replacement of the existing 1-lane bridges with 2-lane bridges equipped with pedestrian lanes. It is important to explain the impact and positive effects of the project to the residents living along N380 in order to obtain their agreement before the project is implemented and guarantee the smooth implementation of the project.

3-2 Input from the Mozambique Side

(1) Participation of Counterpart Personnel

ANE is the agency responsible for implementation of the project in Mozambique. An appropriate number of counterpart personnel is necessary for implementing the project without problems.

(2) Securement of Budget for Road and Bridge Maintenance

Maintenance of roads and bridges is necessary to keep the replaced bridges and improved roads in good condition and to maintain the transport capacity on N380. Therefore, it is very important to constantly secure enough budget funds for maintenance work.

3-3 Important Assumptions for Achieving the Overall Plan of the Project

(1) Important Assumptions for Achieving the Overall Goal of the Project

The overall goal of the project is “To facilitate economic and social development in Northern Mozambique and surrounding countries (Tanzania, Malawi, and Zambia) by improvement of transportation capacity on N380” and cannot be achieved only by rehabilitating N380. Development of N381 from Negomane near the border with Tanzania to N380 through Mueda

is also necessary to achieve the overall goal. The whole section between Maputo and Negomane will become N1 in the future. Therefore, not only development of N380 but also the early development of N381 are very important.

The following are prerequisites for achieving the overall goal of the project.

1) Continuous Development of Roads listed in Mozambique's Road Plan Prepared by ANE

ANE is responsible for preparing the road plan and road development. Steady and continuous road development is an important prerequisite for achieving the overall goal of the project.

2) Continuous Support from Other Donors for Road Development in Mozambique

It is very difficult to construct all roads planned by ANE only with the national budget of Mozambique. Road development through continuous support from Japan and other donors is important to achieve the goal of the project in the future.

3) Proper Maintenance of Roads and Bridges by the Mozambique Government

Maintenance of the transportation capacity of N380 through proper maintenance of roads and bridges developed by ANE is necessary to achieve the goal of the project.

(2) Important Assumptions for Achieving the Project Purpose

To achieve the project purpose which is "to contribute to development of N380 in accordance with replacement of targeted bridges", the following may be necessary.

1) Social and Political Stability in the Vicinity of N380

The social and political stability in Cabo Delgado Province, especially in the vicinity of N380 should be secure in order to achieve the project purpose.

2) Early Rehabilitation of the Section between Sunate and Macomia of N380 including Bridges

There are bridges on N380 which have to be replaced with new ones, because they have not been maintained properly and still exist on the section between Sunate and Macomia of N380 which is operated as a two-lane road. The lanes are about 3m wide and the road pavement conditions are not good.

Early rehabilitation of the section between Sunate and Macomia of N380 including the bridges on the section is therefore required, which will improve not only traffic flow but also

safety and security on every section. Therefore, early rehabilitation of the road and the bridges on the section is important to achieve the project purpose.

3-4 Project Evaluation

Direct and indirect effects have been evaluated to show the benefits expected to come from implementing the Project. PDM and others are utilized for the evaluation and indicators are defined and selected to objectively evaluate the effects of the Project.

Table 3-4-1 Tentative PDM Evaluation Items

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goals: To facilitate economic and social development in Northern Mozambique and surrounding countries (Tanzania, Malawi, Zambia) by improvement of transportation capacity on N380	・Increase of paved road length ・Increase of large cargo traffic ・Improvement of traffic ability on N380	・Road plan ・Survey result of traffic volume by type of vehicles (at the completion of bridge construction and defects inspection) ・Record on customs and immigration at the border with Tanzania	・Continuous implementation of road plan in Mozambique ・Continuous support by other donors ・Proper maintenance of roads and bridges by Mozambique side
Project Purpose: To contribute to development of area of Nacala coridor in accordance with replacement of targeted bridges	・Increase of traffic volume on N380 ・Reduction of travel time on N380 ・Shortening of traffic closure period caused by flooding	・Survey result of traffic volume by type of vehicle (at the completion of bridge construction and defects inspection) ・Travel time survey (at the completion of bridge construction) ・ANE's report on the bridge replacement works	・Social and political stability in the vicinity of N380 ・Early improvement of the road section between Sunate and Macomia of N380 including bridges
Output: Targeted bridges on N380 are replaced.	・Bridges are constructed as per schedule. ・Bridges are constructed as applicable.	・Monthly report of construction work ・Result of final completion examination ・Result of defects inspection	・Execution of E/N and G/A
Activities: 1) Implementation of plan, design and construction work of bridges	**Inputs: Japanese side** ・Implementation of the project including the survey on basic and detailed design of target bridges and approach roads and construction of bridges and roads ・Technical transfer to ANE	**Mozambique side** ・Participation of counterparts ・Implementation of the project covered by the partner country (land rent, relocation of items affecting the works, securement of maintenance budget, etc.)	**Pre-conditions:** ・Environmental approval ・Land rent ・Tax exemption ・Landmine survey ・Relocation of public utilities ・Visas for engineers ・Provision of Bailey bridges

3-4-1 Appropriateness

As a grant aid project, the bridge replacement project is appropriate from the viewpoint of poverty reduction and human security as mentioned below.

(1) Vitalization of Agriculture

About 80% of the population in Mozambique is engaged in agriculture, with most living in poverty. It is therefore necessary to vitalize the agriculture in order to reduce the poverty in Mozambique. It is thus important to develop the road network and construct access roads which provide connections to farms and markets.

The project will contribute to the development of the road network of N1 which is the longest road in Mozambique. The project will not only improve the transport capacity for agriproducts to cover all parts of the country, but will also have a significant impact on poverty reduction.

(2) Safe River Crossings

Concentrated rainfall in a short period of time often causes flooding in the project areas, damaging roads and bridges.

Two of the bridges on N380 were swept downstream by a flood in 2014. Inhabitants around the bridges and users of N380 had to cross the river on foot until a bypass road near the bridge was completed. Dangerous animals live in and around the river, and flooding spreads diseases such as malaria and leads to epidemics. The Mozambique government has requested the temporary bridges to be replaced with permanent structures as soon as possible also from the viewpoint of human security.

(3) Road Development Plan

ANE has prepared a master plan on the development of roads with the Ministry of Public Works and Housing and the Road Fund. Formulation of a trunk road network has a high priority in the plan. Especially development of longitudinal high-standard roads from north to south such as N1 is given higher priority. N380 and its surrounding roads will become part of N1 in the near future. A smooth delivery system from South Africa to Tanzania through Mozambique can therefore be secured by improvement of N380 and its surrounding roads. Development of the trunk roads may bring much beneficial effects to the whole region of the country.

Constructing the north-south longitudinal roads including N380 to a high standard is given highest priority in the short and middle term plan. Therefore, the project corresponds to the road development policy in Mozambique.

(4) Japan's Aid Policy

In accordance with the action plan provided by the Government of Japan (GOJ) for poverty reduction in Mozambique, GOJ has focused on the vitalization of the regional economy including corridor development to achieve poverty reduction by realizing sustainable economic growth using Mozambique's high potential.

Mozambique has some international ports which can be used also by landlocked countries such as Zambia and Malawi. Utilizing geographic characteristics is the most effective way to develop the infrastructure in corridors leading from ports to landlocked countries, and GOJ thus actively supports this.

Nacala Corridor which leads to the landlocked countries Zambia and Malawi from Nacala Port in Mozambique is recognized as a very important transportation route for rich minerals and energy in Mozambique and also has a high potential for agricultural development. Therefore, GOJ has supported the development of infrastructure such as roads which connect the corridor with surrounding areas and bridges in the corridor.

Since the project is located within the area surrounding the corridor, implementation of the project is in alignment with Japan's aid policy.

3-4-2 Effectiveness

(1) Quantitative Outputs

The following tangible effects are expected after the project has been implemented and an international and domestic logistics network has been developed.

1) Increase of Annual Average Daily Traffic (AADT)

The traffic volume has been increasing by around 7.5% every year according to the traffic survey which ANE carried out between 2010 and 2014. The percentage of heavy vehicle traffic exceeds 60% on some sections of N380, and tends to be higher compared with other provincial roads. N380 is therefore recognized as an industrial road and the cost-effectiveness for road rehabilitation is high.

According to estimates of future traffic volume, the mean traffic on N380 will increase to 570 /12hours in 2022 from 344 /12 hours in 2015.

2) Reduction of Bridge Crossing Time

As all the existing bridges are one-lane bridges, vehicles have to stop in front of them and wait for on-coming cars to cross. Furthermore, there are bumps on each side of the bridges in order to prevent accidents because the road width on the bridges becomes narrow and changes from two lanes on the access roads to only one lane on the bridges. Vehicles therefore have to slow down to under 30km/h before crossing the bridges.

Once the bridges have been replaced by two-lane bridges, vehicles will not need to stop at the bridges to wait for on-coming cars and do not need to slow down before crossing. The time required to cross the bridges will thus undoubtedly be reduced.

3) Reduction of Road Closures during the Rainy Season

Two bridges on N380 – Messalo I Bridge and Messalo III Bridge – were damaged due to a flood in March 2014, and it took about 9 months to reconstruct the bridges. Vehicle traffic over both bridges had to be stopped during that period. When the targeted bridges and approach roads are replaced based on the development policy, only the roads between the bridges are likely to suffer damage if a flood similar to that in 2014 occurs again. In such a case, vehicle traffic will have to be closed only for the time it takes to rehabilitate the damaged roads which is less than one month.

4) Reduction of Travel Time

The bridges to be replaced are located on the Macomia – Oasse section of National Highway No. 380. If a bridge collapses due to flooding, heavy vehicles must use a detour route which goes from Macomoa to the shore road. It currently takes about 80 minutes to drive on N380 from Macomia to Oasse, but if the Macomia – Mucojo – Oasse route is used as a detour, the trip may take as long as 300 minutes.

Table 4-4-2 Quantitative Outputs

Index	Initial value (2015)	Target value (2022) [3 years after completion]
Traffic volume (traffic/12 hours)	344	570
Road closure period	9 months (2014) *1	0 months *2
Travel time for heavy vehicles	300 minutes	80 minutes

Notes: *1 The road closure period indicates the time required for repairs after the bridge collapsed in 2014.

*2 In case there are no road closures.

(2) Qualitative Outputs

In addition to the quantitative outputs mentioned above, the following qualitative outputs are also expected.

1) Acceleration of Surrounding Area Development by Enhancement of the Road Network

Since N380 connects Nacala Corridor in Mozambique with Mtwara Corridor that runs through Tanzania, Malawi and Mozambique via N381, it is a very important national road from the viewpoint of the development strategy of Mozambique. There are natural gas development projects in offshore Rovuma and LNG projects are now being implemented in Palma in Cabo Delgado Province. N380 forms a very important part of the infrastructure also for these developments.

The expected benefits from replacement of the targeted bridges on N380 include reduction of travel time, mitigation of disaster risk and a decrease in traffic accidents near the bridges. These benefits will also enhance the road network in the northern region of Mozambique. Accelerated development not only in surrounding countries such as Tanzania and Malawi but also in the northern area of Cabo Delgado Province is to be expected.

2) Improvement of Fundamental Living Conditions

The transport conditions on N380 will be substantially improved because the risk of bridge collapse will decrease and N380 will become a two-lane road. Therefore, healthcare for the people living along N380 will be significantly improved because it will become easier to transport severely ill patients and to urgently procure medicine. Furthermore, the safety of upper grade elementary school students who cross the bridges on foot in order to go to neighboring schools will also be improved since the replacements for the targeted bridges are to be equipped with pedestrian lanes.

3) Reduction of Transportation Costs

Replacement of the bridges is expected to lead to a reduction of transportation costs since working hours can be decreased due to the increase in average vehicle speed and reduction of travel time.

4) Decrease in Traffic Accidents near the Bridges

According to people living near the one-lane bridges, there have in the past been some accidents where vehicles have fallen into the river because drivers often do not realize that the road width changes from 2 lanes on the approach roads to only one lane before the bridges. Such car accidents can be prevented by replacing the existing bridges with new two-lane bridges.

5) Mitigation of Disaster Risk

The existing bridges are temporary Bailey bridges. Although they were constructed only for temporary use, they have already been used for many years. The risk of a bridge collapse has increased because the bridge superstructures have been damaged due to the increase in traffic volume of heavy vehicles and the soil around the bridge foundations has also been eroded due to the increased streamflow during the rainy season.

The risk of a bridge collapse can be mitigated by replacing the bridges with stronger permanent structures.

6) Benefits for Impoverished People

Except for the people living in villages with markets such as Sunate and Macomia, almost all people living along N380 are self-sufficient and satisfy their own needs. They cultivate crops, make charcoal and timber and sell these at the sides of N380 to get money.

The traffic volume on N380 will increase once the bridges have been replaced.

With the increase in traffic volume on N380, sales of goods at the sides of the road is also expected to increase.

As described in the sections above, the implementation of the project is highly meaningful, appropriate and effective.

Appendices

1. Member List of the Survey Team

(1) 1st Site Survey (21 February, 2015～12 May, 2015)

	Position	Nambe	Organization	Period
(1)	Leader	Nobuyuki TSUNEOKA	JICA	2/21 - 3/4
(2)	Project Coordinator	Yosuke KAZAMA	JICA	2/21 - 3/4
(3)	Chief Consultant/ Bridge Designer I	Haruki AKIYAMA	Chodai Co., Ltd.	3/7 - 4/5
(4)	Co-chief Consultant/ Bridge Designer II	Jun MORISHITA	Chodai Co., Ltd.	2/21 - 3/21
(5)	Road designer I/ Transport planning	Nobuo MONOE	Chodai Co., Ltd. (LANDTEC)	3/7 - 4/5
(6)	Social Condition Survey	Yasunori NAGASE	Chodai Co., Ltd. (PACET)	3/7 - 4/5
(7)	Natural Condition Survey I	Nobukazu SUGIYAMA	Chodai Co., Ltd. (Kiso-Jiban)	4/11 - 5/12
(8)	Natural Condition Survey II	Young Su PARK	Chodai Co., Ltd.	2/21 - 3/7
(9)	Environmental & Social Consideration	Takanori HAYASHIDA	Chodai Co., Ltd. (IDCJ)	3/17 - 4/5
(10)	Construction & Procurement Planning/ Cost Estimation	Tatsumune HAYASHI	Chodai Co., Ltd.	3/7- 4/5
(11)	Road Designer II	Yoshiyuki TASHIRO	Chodai Co., Ltd.	2/21 - 4/5
(12)	Bridge Designer III	Takashi MATSUO	Chodai Co., Ltd.	2/21 - 3/10

(2) 2nd Site Survey (30 November, 2015～14 December, 2015)

	Position	Nambe	Organization	Period
(1)	Construction & Procurement Planning/ Cost Estimation	Tatsumune HAYASHI	Chodai Co., Ltd.	11/30- 12/14

(2) 2nd Site Survey (14 May, 2016～24 May, 2016)

	Position	Nambe	Organization	Period
(1)	Leader	Tomoki KANENAWA	JICA	5/15 – 5/22
(2)	Project Coordinator	Tatsuhito KONDO	JICA	5/15 – 5/22
(3)	Chief Consultant/ Bridge Designer I	Haruki AKIYAMA	Chodai Co., Ltd.	5/15 – 5/24
(4)	Co-chief Consultant/ Bridge Designer II	Jun MORISHITA	Chodai Co., Ltd.	5/14 – 5/23

2. Survey Schedule

2.1 First Site Survey

Date		Leader	Project Coordinator	Chief Consultant/ Bridge DesignerI	Co-chief Consultant/ Bridge Designer II	Road designer I/ Transport planning	Social Condition Survey	Natural Condition Survey I	Natural Condition Survey II	Environmental & Social Consideration	Construction & Procurement Planning/ Cost Estimation	Road Designer II	Bridge Designer III
21-Feb	Sat	Travel to Mozambique			Travel to Mozambique				Travel to Mozambique			Travel to Mozambique	
22-Feb	Sun												
23-Feb	Mon	Visit to JICA, ANE											
24-Feb	Tue	Meeting with ANE			Same schedule with Leader				Same schedule with Leader			Tender arrangement	
25-Feb	Wed												
26-Feb	Thu	Travel to Pemba											
27-Feb	Fri	Site Survey											
28-Feb	Sat												
1-Mar	Sun	Travel to Maputo											
2-Mar	Mon	Meeting with							Data collection				
3-Mar	Tue	Travel to Japan			Opening tender							Opening tender	
4-Mar	Wed				Data collection							Data collection	Contract
5-Mar	Thu												
6-Mar	Fri								Travel to Japan				
7-Mar	Sat			Travel to Mozambique	Data analysis	Travel to Mozambique					Travel to Mozambique		
8-Mar	Sun												
9-Mar	Mon			Meeting with ANE		Data collection					ANE		Travel to Japan
10-Mar	Tue										Price investigation		
11-Mar	Wed												
12-Mar	Thu												
13-Mar	Fri			Travel to Pemba							Travel to Pemba		
14-Mar	Sat			Site Survey	Site Survey	Site Survey					Site Survey		
15-Mar	Sun												
16-Mar	Mon												
17-Mar	Tue				Travel to Maputo					Travel to Mozambique	Travel to Maputo	Site Survey	
18-Mar	Wed				Price investigation						Price investigation		
19-Mar	Thu									Site Survey			
20-Mar	Fri												
21-Mar	Sat				Travel to Japan								
22-Mar	Sun			Travel to Maputo		Travel to Maputo				Travel to Maputo		Travel to Maputo	
23-Mar	Mon			Meeting with ANE		Data collection				Data collection		Data collection	
24-Mar	Tue												
25-Mar	Wed			Travel to Querimane								Travel to Querimane	
26-Mar	Thu			Site Survey								Site Survey	
27-Mar	Fri			Travel to Maputo								Travel to Maputo	
28-Mar	Sat			Data analysis		Data analysis				Data analysis			
29-Mar	Sun												
30-Mar	Mon			Meeting for technical notes		Data collection				Meeting with relevant authority	Price investigation	Data collection	
31-Mar	Tue												
1-Apr	Wed												
2-Apr	Thu												
3-Apr	Fri												
4-Apr	Sat			Travel to Japan		Travel to Japan				Travel to Japan			
5-Apr	Sun												
6-Apr	Mon												
7-Apr	Tue												
8-Apr	Wed												
9-Apr	Thu												
10-Apr	Fri												
11-Apr	Sat							Travel to Mozambique					
12-Apr	Sun												
13-Apr	Mon												
14-Apr	Tue												
15-Apr	Wed												
16-Apr	Thu												
17-Apr	Fri												
18-Apr	Sat												
19-Apr	Sun												
20-Apr	Mon												
21-Apr	Tue												
22-Apr	Wed												
23-Apr	Thu												
24-Apr	Fri												
25-Apr	Sat												
26-Apr	Sun												
27-Apr	Mon							Site Survey					
28-Apr	Tue												
29-Apr	Wed												
30-Apr	Thu												
1-May	Fri												
2-May	Sat												
3-May	Sun												
4-May	Mon												
5-May	Tue												
6-May	Wed												
7-May	Thu												
8-May	Fri												
9-May	Sat												
10-May	Sun							Travel to Japan					
11-May	Mon												
12-May	Tue												

2.2 Second Site Survey

Procurement Survey		Construction & Procurement Planning/ Cost Estimation	2nd Site Survey		Leader	Project Coordinator	Chief Consultant/ Bridge Designer I	Co-chief Consultant/ Bridge Designer II
2015			2016					
30-Nov	Mon	Travel to Mozambique	14-May	Sat				Travel to Mozambique
1-Dec	Tue	Meeting with JICA, ANE	15-May	Sun	Travel to Mozambique			Data analysis
2-Dec	Wed	Meeting with ANE	16-May	Mon	Meeting with JICA, ANE,RF,MEF			
3-Dec	Thu	Meeting with Construction company	17-May	Tue				
4-Dec	Fri	Meeting with ANE	18-May	Wed				
5-Dec	Sat	Data analysis	19-May	Thu				
6-Dec	Sun		20-May	Fri	Signing of MD			
7-Dec	Mon	Meeting with MEF	21-May	Sat	Travel to Japan		Data analysis	Data analysis
8-Dec	Tue	Meeting with Road Fund	22-May	Sun				Travel to Japan
9-Dec	Wed	Meeting with ANE	23-May	Mon			Travel to Japan	
10-Dec	Thu		24-May	Tue				
11-Dec	Fri	Meeting with JICA						
12-Dec	Sat	Data analysis						
13-Dec	Sun	Travel to Japan						
14-Dec	Mon							

3. List of Parties Concerned in the Recipient Country

Organization	Position/ Ocuupation	Name
National Roads Administration (ANE)	Director General	Mr. Atanasio Mugunhe
	Project Director	Mr. Aderito Guilamba
	Civil Engineer	Mr. Agostinho V. Notece
	Civil Engineer	Mr. Evaristo Mussupai
	Civil Engineer	Ms. Violeta Ngale
	PLANNING DEPARTMENT	Mr. Jose carlos Lichucha
	GIS engineer	Mr. Manuel Tangune
	Head of Crosscutting Issues	Ms. Emilia Tembe
	Projects concessions	Mr. Rafik Mamad
	Head of road division	Mr. Paulo Bauque
	Department of road safety	Mr. Adelind Serage
ANE Pemba office	Deputy	Mr. Afonso Abilio Uamusse
	Civil Engineer	Mr. Atanacio Majimoto
	Civil Engineer	Mr. Claudio Bento Joao
Institute Nacional de Meteorology (INAM)	Meteorologist of Research & Application Department	Mr. Gonzalves Junior
	Technician	Mr. Celio Matuele
	TECHICIAN	Mr. Pedro Miguel Mahomed Couto
National Directorate of Water Department of Water Resources (Ministry of Public Works and Housing)	Hydro-Geologist	Mr. Egidio Lucas Govate
	Geophysics Engineer	Mr. Cristovao Cavier
	Engineer	Mr Carlos Bemzaue
National Institute of Disaster Management (INGC)	Vice - director	Ms. Rita Almado
	Monitoring officer	Mr. Igor Honwana
Fews Net	Manager	Mr. Antonio Mavie
	secretary	Ms. Anabela
ARA-Norte	Director	Mr. Toao da Judacle Macombe
Government of Cabo Delgado Province	clerk	Mr. Arune Momade Issufo
Minister of Land, Environment and Rural Development -Maputo (MITADER)	Director of DINAIA	Ms Rosa Cesaltina
Minister of Land, Environment and Rural Development –Pemba (MITADER)	Environmental Superior Technician	Mr. Angelo Francisco
Tourism-Pemba	MITUR Regional Officer	Mr. Saide Seifo
	MITUR Regional Officer	Ms Lucia D. M. M.
Caminhos de Ferro de Moçambique-CFM	Administration Department: Finance	Mr. Baptista Duarte Napeio
Senhor Cabo Delgado de Portos de Pemba	Ad. Financas	Mr.Baptista Duarte Napeio
WWF Mozambique	Country Director,	Ms Anabela Rodrigues
Road Fund	Chairman	Mr. Cecilio Grachane
	Department of planning	Mr. Gune Abilio

4. Minutes of Discussions

(1) 1st Site Survey

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY ON
THE PROJECT FOR CONSTRUCTION OF BRIDGES ON N380
IN CABO DELGADO PROVINCE
IN THE REPUBLIC OF MOZAMBIQUE

In response to a request from the Government of the Republic of Mozambique, Japan International Cooperation Agency (hereinafter referred to as "JICA") in consultation with the Government of Japan had decided to conduct a Preparatory Survey for Outline Design on the Project for Construction of Bridges on N380 in Cabo Delgado Province (hereinafter referred to as "the Project"), and sent a Preparatory Survey Team (hereinafter referred to as "the Team") to Mozambique.

The Team is headed by Mr. Nobuyuki TSUNEOKA, Senior Advisor, JICA, and is scheduled to stay in the Republic of Mozambique from 22 February to 2 May 2015.

The Team held a series of discussions with officials concerned of the Government of the Republic of Mozambique and conducted field surveys in the Project area. In the course of discussions and field surveys, both sides have confirmed the main items described in the attached sheets. The team will proceed to further studies and prepare a Preparatory Survey Report.

Maputo, 2 March 2015

Nobuyuki TSUNEOKA
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Atanásio Mugunhe
General Manager
Administração Nacional de Estradas
Republic of Mozambique

1

ATTACHMENT

1. Title of the Project

Both sides confirmed that the title of the Project shall be "The Project for Construction of Bridges on N380 in Cabo Delgado Province".

2. Objective of the Project

Both sides confirmed that the objective of the Project is to secure smooth and safe connectivity as the whole of N380 by reconstructing eight bridges, which are shown in Annex 1.

3. Project Site

The Project site is located on N380 in Cabo Delgado Province, Mozambique, which is shown in Annex 1.

4. Objective of the Preparatory Survey

Both sides confirmed the objective of the Survey as follows:

4-1. To understand the background and objective of the Project and examine its impacts and appropriateness;

4-2. To identify the components, and conduct outline design and cost estimation of the Project, based on the data and information collected from and the results of discussions with the Mozambican side; and

4-3. To study the issues of environmental and social considerations through the Survey.

5. Responsible and Implementing Organization

The Responsible Organization of the Project is Ministério das Obras Públicas, Habitação e Recursos Hídricos, and the Implementing Organization of the Project is Administração Nacional de Estradas (hereinafter referred to as "ANE"). The organization charts are shown in Annex 2.

6. Items requested by the Government of the Republic of Mozambique

6-1. It is written on the application form that the Mozambican side requests reconstruction of the eight bridges with approach roads. JICA will assess the appropriateness of the request that would be examined in accordance with the further studies and analysis in Japan and the final components of the Project would be decided by the Japanese side mainly from the viewpoints of necessity, technical and financial viability, sustainability and cost-effectiveness.

6-2. Both sides confirmed that there was no duplication for the Project to be conducted by

other development partners or private enterprises.

7. Japan's Grant Aid Scheme

7-1. The Mozambican side understands the Japan's Grant Aid scheme explained by the Team, as described in Annex 3 and Annex 4.

7-2. The Mozambican side will take the necessary measures, as described in Annex 5, to facilitate the smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented.

8. Environmental and Social Considerations

8-1. The Team explained that environmental and social considerations for the Project is categorized as "Category B" according to the JICA Guidelines for Environmental and Social Considerations, since the Project is constructing the eight bridges whose impact on the environment may be limited.

8-2. Both sides confirmed that the Mozambican side shall conduct the necessary procedures concerning the environmental assessment (including stakeholder meetings, Initial Environmental Examination (IEE) etc.) and make IEE report of the Project. The IEE approval shall be received from the responsible authorities and submitted to JICA Mozambique office by end of February, 2016.

8-3. The Mozambican side agreed to arrange the budget allocation for IEE study, land acquisition, resettlement and compensation for the Project Affected Persons (PAPs) or Indigenous People's Plan (IPP) and secure the land before the implementation of the Project.

9. Operation and Maintenance

9-1. The Mozambican side will take every necessary action including secure enough budget and personnel for the operation and maintenance of the facilities implemented by the Project.

The Mozambican side also understands to avoid clogging which could cause overflowing and damages to the road, is one of the most important concerns for maintenance and explains to take the necessary protection measures for the Project bridges.

9-2. The Team explained and the Mozambican side agreed that taking necessary actions to let the road users respect traffic regulations are fundamental regarding the following three issues to maintain the facilities and to ensure road safety.

9-2-1. Although the project includes some facilities to ensure traffic safety such as guardrails increasing traffic will inevitably raise the risks of accidents.

9-2-2. Overloading trucks which would exceed designed live load would cause earlier

rehabilitation and shorter life.

9-2-3. Proper asset management will impact greatly to maintenance cost and lifespan.

10. Safety Measures

10-1. To avoid accidents on site during the implementation of the Project, the Mozambican side agreed to make the consultant and the contractor take safety measures such as setting safety assurance to the site, providing information for security control to the public, and deploying adequate security personnel, based on "The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects" which has been published on JICA's URL below.
http://www.jica.go.jp/activities/schemes/oda_safety/ku57pq00001nz4eu-att/guidance_en.pdf

10-2. The Team recommended ANE to explain to the site citizens about the Project (necessity and significance, construction period, sites, impact etc.), so that wide support of them can be obtained for the smooth implementation of the Project.

11. Misconduct

Both sides confirmed that if there is any suspicion of corruption or fraudulent practices in the implementation of the Project, ANE and relevant organizations shall provide JICA with related information reasonably requested by JICA, including information of any concerned official of the government and/or public organizations of the Mozambique.

ANE and relevant organizations shall not treat unfairly or unfavorably the person and/or company which provided the information related to suspected corrupt or fraudulent practices in the implementation of the Project.

12. Schedule of the Survey

Both sides confirmed the schedule of the Survey as follows. The schedule may be subject to change during the preparation and the course of the Survey.

12-1. The Team will continue further studies in the Republic of Mozambique until 2 May 2015.

12-2. JICA will prepare the Draft Final Report and send a mission team to explain the details of the Project including the final components and cost estimation to the Mozambican side around September 2015.

12-3. JICA will finalize the Final Report and send it to the Mozambican side around December 2015.

13. Other Relevant Issues

13-1. Provision of Conveniences to the Team by the Mozambican Side

The Mozambican side shall, at its own expenses, provide the Team with the following items in cooperation with ANE and other organizations concerned.

(1) Security-related information as well as measures to ensure the safety of the Team members;
(2) Information as well as support in obtaining medical service;
(3) Data and information related to the Preparatory Survey;
(4) Counterpart personnel;
(5) Suitable office space with necessary equipment and services;
(6) Credentials or identification cards;
(7) Entry permits necessary for the survey team members to conduct field surveys; and
(8) Support in obtaining other privileges and benefits if necessary.

13-2. Provision of Conveniences to the Project by the Mozambican Side

The Mozambican side confirmed that undertakings described in Annex 6 should be taken by the Mozambican side at its own expenses if implementation of the Project is approved by the Government of Japan.

13-3. Both sides agreed that the eight bridges should be reconstructed at the positions in reference to results of this preparatory survey, and the Team will inform about the best candidate positions of each bridge by the end of April, 2015 in the technical notes. After agreement by the Mozambican side, the Team commences the outline design of the bridges along the lines of the technical notes. And the Mozambican side recognized a possibility that the Mozambican side should be responsible for the removal of the current bridges within three years after the completion of the Project, if the new bridges are constructed on the new locations.

13-4. The Team prioritizes eight bridges respectively based on the data and information collected from and the results of discussions with the Mozambican side, and the Government of Japan identify the components based on the prioritization.

13-5. During the site survey from 26 to 28 February, 2015, the Team found that some rivers where the eight bridges are located need careful consideration of their river training. The team should conduct further survey and analysis on those rivers which might affect the above- mentioned schedule of the Survey.

13-6. Inspection on damaged condition of three bridges constructed by former projects

Due to flood of January 2015, three bridges, named Namilate, Licungo 2 and Licungo 3, constructed by Japan's Grant Aid Projects, namely 'The Project for

Reconstruction of Bridges on Main Roads' and 'The Project for Construction on Rural Roads of Bridges in Zambezia and Tete Provinces' were severely damaged. ANE and the Team examine the damaged condition in order to reflect the lessons learnt to the Project.

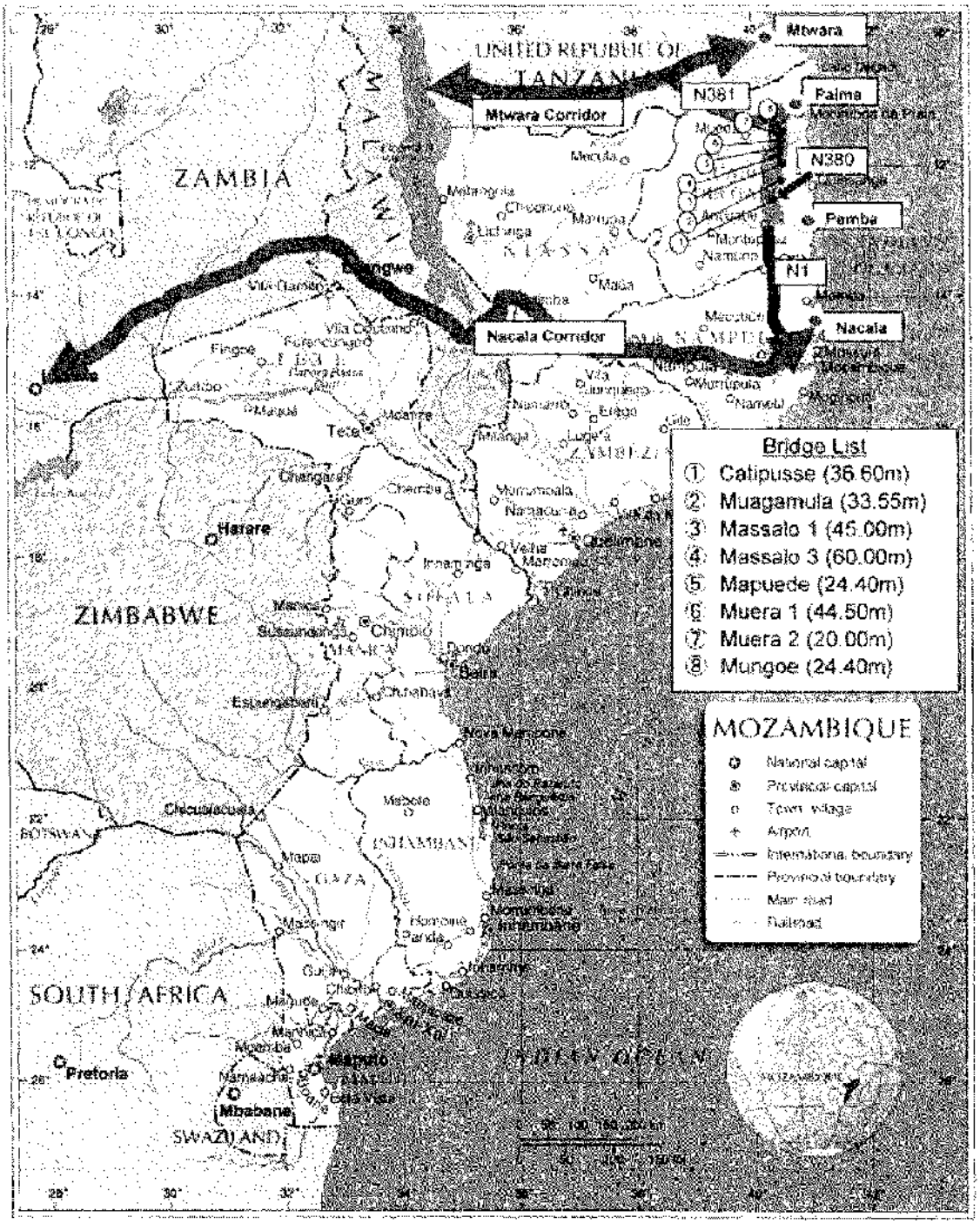
13-7. Mozambican side shall detect discriminate and clear UXOs (Unexpected Objects) in the Project site no later than the commencement of the geological survey (approximately the second week of April, 2015).

13-8. Issuance of Work Permit and VISA

The Mozambican side agreed that ANE shall facilitate with concerned agencies including the Ministério do Trabalho, Emprego e Segurança Social and assist Japanese nationals/others from third countries who are involved in the Project to obtain VISA and work permit smoothly so that they can enter and stay in Mozambique without any hindrance at the Study and the Project implementation stage.

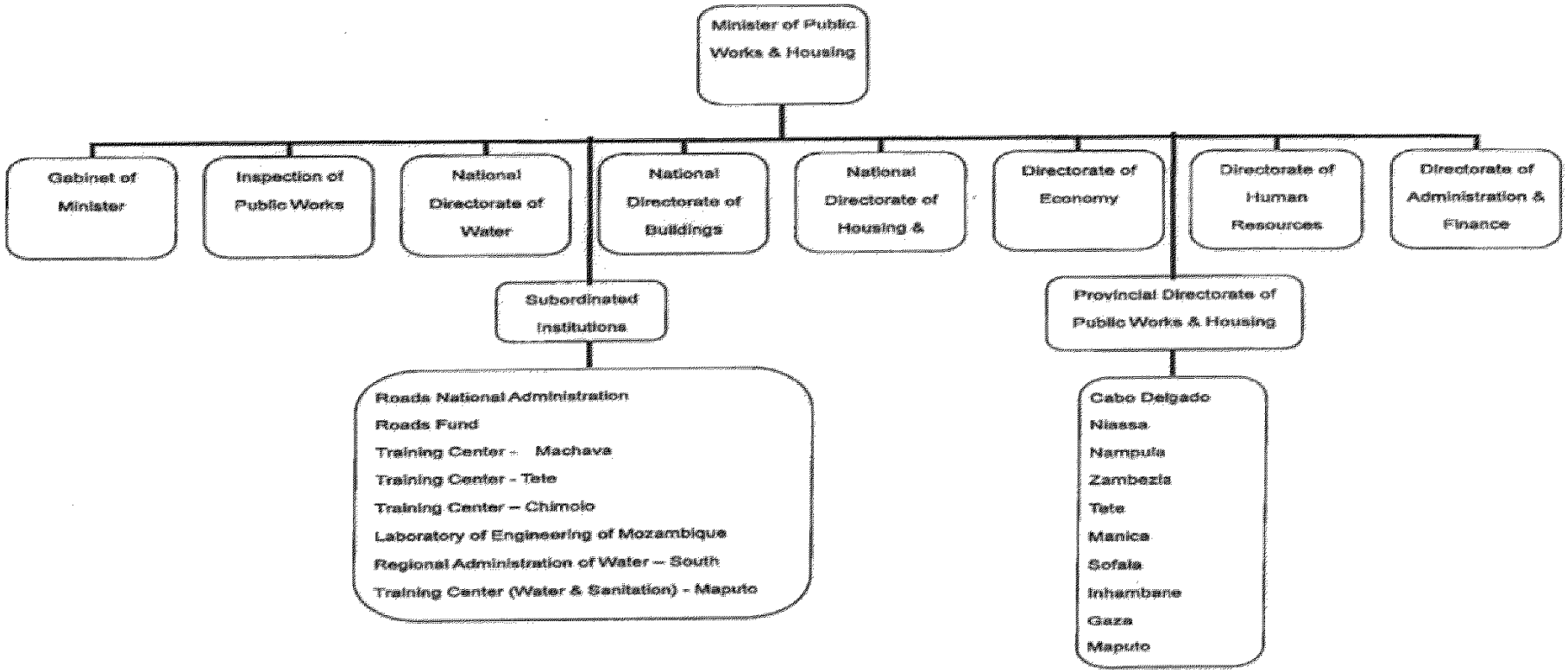
Annex 1: Project Site
Annex 2: Organization Charts of ANE
Annex 3: Japan's Grant Aid
Annex 4: Flow Chart of Japan's Grant Aid Procedures
Annex 5: Major Undertakings to be taken by Each Government as a condition for the Japan's Grant Aid to be implemented
Annex 6: Major Undertakings to be taken by Each Government after an approval of Project implementation

Project Site

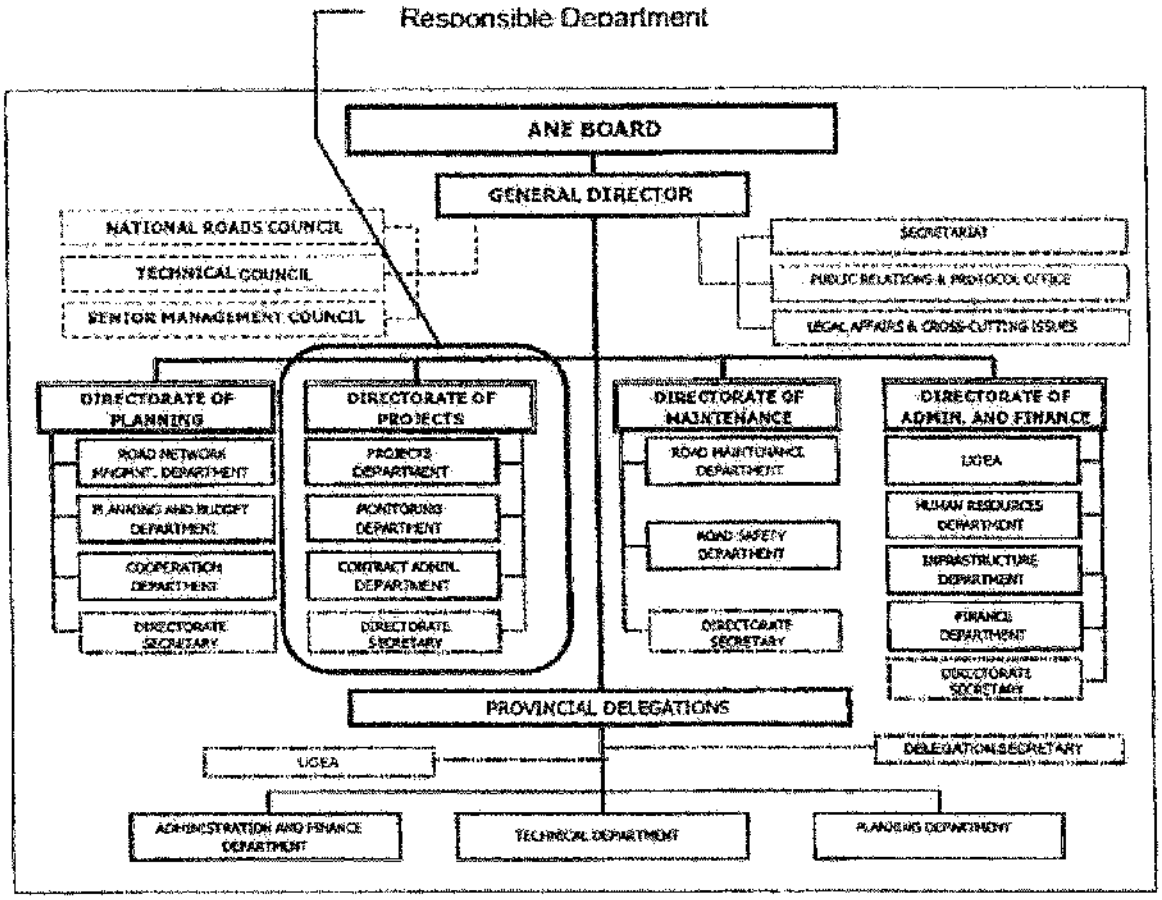


Organization Charts

1. Ministério das Obras Públicas, Habitação e Recursos Hídricos



2. Administração Nacional de Estradas



Japan's Grant Aid

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

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

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures:

a) Preparatory Survey
   - The Survey conducted by JICA

b) Appraisal and Approval
   - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet

c) Authority for Determining Implementation
   - The Notes exchanged between the GOJ and a recipient country

d) Grant Agreement (hereinafter referred to as "the G/A")
   - Agreement concluded between JICA and a recipient country

e) Implementation
   - Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.

- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

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

Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

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

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex 6.

(6) "Proper Use"

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

(7) "Export and Re-export"

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

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

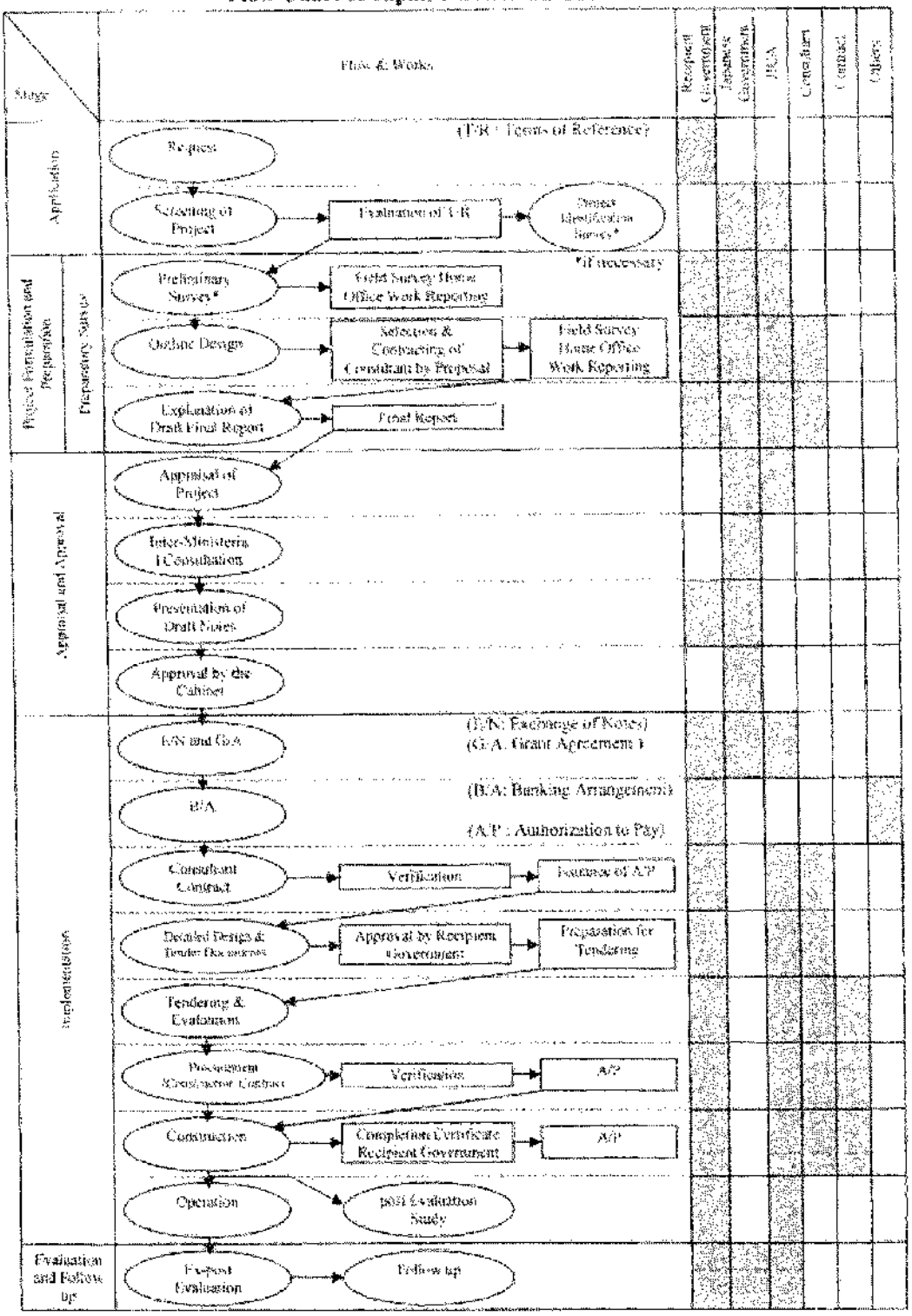
The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

Annex 4

Flow Chart of Japan's Grant Aid Procedures



Annex 5

Major Undertakings to be taken by Each Government as a condition for the Japan Grant Aid to be implemented

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side	Remarks
1	To confirm land registration and its property, and permission for the implementation of the Project and to clear the site		●	
2	To bear the following commissions paid to the Japanese bank for banking services based upon the Banking Arrangement (B/A)		●	
	1) Advising commission of Authorization to pay (A/P)		●	
	2) Payment commission		●	
3	To ensure prompt unloading and customs clearance at the port(s) of disembarkation, and internal transportation in the recipient country			
	1) Marine or Air transportation of the components from Japan and/or third countries to the recipient country	●		
	2) Tax exemption and customs clearance of the equipment and components at the port(s) of disembarkation in the recipient country		●	
	3) Internal transportation of the equipment and components from the port(s) of disembarkation to the project site in the recipient country	●		
4	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted/be borne by the Authority without using the Grant		●	
5	To accord Japanese physical persons and / or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●	
6	To maintain and use properly and effectively the facilities constructed and the equipment provided under the Grant Aid		●	
7	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●	
8	To give due environmental and social consideration in the implementation of the Project		●	

●: denote the side responsible for the work

Annex 6

Major Undertakings to be taken by Each Government after an approval of Project implementation

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side	Remarks
1	To secure lots of land necessary for the implementation of the Project and to clear the sites		•	
2	To secure sites for material storing yard, temporary construction yard and waste disposal		•	
3	To relocate existing utilities within the Project site to designated area or Project affected area		•	
4	To arrange issuance of license, permission and other necessary procedures for the Project		•	
5	To secure enough budget and personnel necessary for the operation and maintenance of the facilities implemented under the Grant Aid, including the periodical maintenance work after the completion of the Project		•	

•: denote the side responsible for the work

(2) 2rd Site Survey

Minutes of Discussions
on the Preparatory Survey for
The Project for Construction of Bridges on N380 in Cabo Delgado Province
(Explanation on Draft Preparatory Survey Report)

On the basis of the discussions and field survey in the Republic of Mozambique (hereinafter referred to as " Mozambique ") in March, 2015, and the subsequent technical examination of the results in Japan, the Japan International Cooperation Agency (hereinafter referred to as "JICA") prepared a draft Preparatory Survey Report on the Project for Construction of Bridges on N380 in Cabo Delgado Province (hereinafter referred to as "the Draft Report").

In order to explain the Draft Report and to consult with the concerned officials of the Government of Mozambique on its contents, JICA sent to Mozambique the Preparatory Survey Team for the explanation of the Draft Report (hereinafter referred to as "the Team"), headed by Mr. Tomoki Kanenawa, Director, Infrastructure and Peacebuilding Department, JICA, and the Team is scheduled to stay in the country from 16 May to 20 May, 2016.

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

Maputo, 20 May 2016

Tomoki Kanenawa
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Atanásio Mugunhe
General Manager
Administração Nacional de Estradas
Republic of Mozambique

Witness

Cecílio Grachane
Chairman
Road Fund Board
Republic of Mozambique

ATTACHEMENT

1. Objective of the Project

   The objective of the Project is to secure smooth and safe connectivity at the whole of N380 (Sunate - Oasse) by/through reconstructing the target bridges, thereby contributing to facilitate the economy of Cabo Delgado and neighboring countries.

2. Title of the Preparatory Survey

   Both sides confirmed the title of the Preparatory Survey as "the Preparatory Survey for the Project for Construction of Bridges on N380 in Cabo Delgado Province".

3. Project Site

   Both sides confirmed that the site of the Project is on N380 in Cabo Delgado Province, which is shown in Annex 1. The locations for each bridge are as follows;

   - Messalo I Bridge: Reconstruct at the existing location
   - Messalo III Bridge: Reconstruct at the existing location
   - Mapuede Bridge: Reconstruct at the existing location

4. Line Agency and Executing Agency

   Both sides confirmed the line agency and executing agency as follows:

   4-1. The line agency is Ministério das Obras Públicas, Habitação e Recursos Hídricos, which would be the agency to supervise the executing agency.

   4-2. The executing agency is Administração Nacional de Estradas (hereinafter referred to as "ANE"). The executing agency shall coordinate with all the relevant agencies to ensure smooth implementation of the Project and ensure that the Undertakings are taken by relevant agencies properly and on time. The organization charts are shown in Annex 2.

5. Contents of the Draft Report

   After the explanation of the contents of the Draft Report by the Team, the Mozambique side agreed in principle to its contents.

6. Cost Estimation

   Both sides confirmed that the Project cost estimation described in Annex3 was provisional and would be examined further by the Government of Japan for its final approval.

7. Confidentiality of the Cost Estimation and Specifications

Both sides confirmed that the Project cost estimation and technical specifications in the Draft Report should never be duplicated or disclosed to any third parties until all the contracts of the Project are concluded.

8. Japanese Grant Scheme

The Mozambique side understands the Japanese Grant Scheme and its procedures as described in Annex 4, Annex 5 and Annex 6, and necessary measures to be taken by the Government of Mozambique.

9. Project Implementation Schedule

The Team explained to the Mozambique side that the expected implementation schedule is as attached in Annex 7.

10. Expected outcomes and Indicators

Both sides agreed that key indicators for expected outcomes are as follows. The Mozambique side has responsibility to monitor the progress of the indicators and achieve the target in year 2022

.

[Quantitative Effect]

- Increase in Daily Traffic Volume
- Reduction of Bridge Crossing Time
- Reduction of Road Closures during the Rainy Season
- Reduction of Travel Time

[Qualitative Effect]

- Acceleration of Surrounding Area Development by Enhancement of the Road Network
- Improvement of Fundamental Living Conditions
- Reduction of Transportation Costs
- Decrease in Traffic Accidents near the Bridges
- Mitigation of Disaster Risk
- Benefits for Impoverished People

11. Undertakings Taken by Both Sides

Both sides confirmed undertakings described in Annex 8. The Mozambique side assured to take the necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project.Annex8 will be attached to the Grant Agreement. It is further agreed that the costs are indicative, i.e. at Outline Design level. More accurate costs will be calculated at the Detailed Design stage.

12. Monitoring during the Implementation

The Project will be monitored every 6 months by the executing agency using the Project Monitoring Report (PMR) described in Annex 9.

13. Ex-Post Evaluation

JICA will conduct ex-post evaluation three (3) years after the project completion with respect to five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact, Sustainability) of the Project. Result of the evaluation will be publicized. The Mozambique side is required to provide necessary support for them.

14. Issues to be Considered for the Smooth Implementation of the Project

Both sides confirmed the issues to be considered and necessary measures to be taken for the smooth implementation of the Project described in Annex 8 .

Issues	Deadline for smooth implementation
Acquisition of Environmental License	End of October,2016
Clearing UXO's and Landmines	End of February,2017
Provision of VISA for all the parties concerned of the construction	During the construction
Relocation of existing utilities such as optical fiber cable	End of June,2017
Securing of construction sites and land forthe construction	End of June,2017
Permission of Bridge Construction	End of June,2017
Provision of quarries and disposal areas	End of June,2017
Maintenance of the roads for material and equipment procurements (including bailey bridges)	During the construction
Provision of the bailey bridges	During the construction

15. Schedule of the Study

JICA will complete the Final Report of the Preparatory Survey in accordance with the confirmed items and send it to the Mozambique side around August, 2016.

16. Environmental and Social Considerations

16-1 General Issues

16-1-1 Environmental Guidelines and Environmental Category

The JICA mission explained that 'JICA Guidelines for Environmental and Social Considerations (April 2010)' (hereinafter referred to as 'the Guidelines') is applicable for the Project. The Project is categorized as B because the Project, when the remaining five bridges included, is constructing the eight bridges whose impact on the environment may be limited.

16-1-2 Environmental Checklist

The environmental and social considerations including major impacts and mitigation measures for the Project are summarized in the Environmental Checklist attached as Annex 10. Both sides confirmed that in case of major modification of the content of the Environmental Checklist, the Mozambique side shall submit the modified version to JICA in a timely manner.

16-2 Environmental Issues

16-2-1 Environmental Impact Assessment (EIA)

Both sides confirmed the EIA report is not required for the Project in the country's legal system; however, a Simplified Environmental Impact Assessment(SEIA) is needed. Mozambique side will obtain the environmental license until the end of October, 2016.

16-2-2 Environmental Management Plan and Environmental Monitoring Plan

Both sides confirmed Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) of the Project is as Annex 11 and 12, respectively. Both side agreed that environmental mitigation measures and monitoring shall be conducted based on the EMP and EMoP, which may be updated during the detailed design stage.

16-3 Social Environment

16-3-1 Land Acquisition and Resettlement

Both sides confirmed there are no land acquisition and resettlement in the Project.

16-4 Environmental and Social Monitoring

16-4-1 Environmental Monitoring

Both sides agreed that the Mozambique side will submit results of environmental monitoring to JICA by using the monitoring form attached as Annex 12.

16-4-2 Information Disclosure of Monitoring Results

Both sides confirmed that the Mozambique side will disclose results of environmental and social monitoring to local stakeholders [through their website / in their field offices].

The Mozambique side agreed JICA will disclose results of environmental and social monitoring submitted by the Mozambique side as the monitoring forms attached as Annex 10 on its website.

17. Other Relevant Issues

17-1. Operation and Maintenance of the Facilities(Equipment)

The team explained the importance of operation and maintenance of the facilities constructed by the Project considering that proper asset management impacts greatly on life-span of the facilities and its maintenance cost. The Mozambique side shall secure enough staff and budgets necessary for appropriate operation and maintenance of the facilities. The annual operation and maintenance costs are estimated and shown as follows.

Item	Frequency	Inspection location	Work contents	Annual cost (MZN/ year)
Inspection	One per half year	Surface, Joint, bearing, drainage, handrail, girder, abut, pier, guardrail	Inspection and cleaning	250.000
Pavement rehabilitation	Once per 5 years	Surface	Overlay	926.000
Revetment repair	Once per year	River bed front of Abutment	Gabion	1.481.000
Total				2.657.000

17-2. Quality Management Meeting

Both sides confirmed that JICA, ANE, consultant and contractor shall have quality management meetings approximately once in a half year during the implementation stage. The meetings should be convened by ANE before the commencement of construction works and during the construction to solve serious problems such as delay of utility relocation, resettlement exercise, construction works, etc.

17-3. Safety Measures

To avoid accidents on site during the implementation of the Project, the Mozambique side agreed to cause the consultant and the contractor to enforce safety measures such as setting safety assurance to the site, providing information for security control to public, and deploying adequate security personnel, based on "The Guidance for the Management of Safety for

Construction Works in Japanese ODA Projects" which has been published on JICA's URL below.
http://www.jica.go.jp/activities/schemes/oda_safety/ku57pq00001nz4eu-att/guidance_en.pdf

17-4. Misconduct

If JICA receives information related to suspected corrupt or fraudulent practices in the implementation of the Project, ANE and relevant organizations shall provide JICA with additional such information as JICA may reasonably request, including information related to any concerned official of the government and/or public organizations in Mozambique.

ANE and relevant organizations shall not, unfairly or unfavourably treat the person(s) and/or company which provided the information related to suspected corrupt or fraudulent practices in the implementation of the Project.

17-5. Cooperation among Relevant Organizations

ANE promised to work closely with relevant organizations, such as the Ministério das Obras Públicas, Road Fund(RF), Ministry of Economy and Finance(MEF), JICA and Embassy of Japan with mutual common understanding and cooperation for the Project.

17-6. Issuance of Work Permit and Visa

The Mozambique side agreed that ANE shall facilitate with concerned agencies including the Ministério do Trabalho, Emprego e Segurança Social and assist Japanese nationals/others from third countries who are involved in the Project to obtain VISA and work permit smoothly so that they can enter and stay in Mozambique without any hindrance at the Study and the Project implementation stage.

17-7. Project Component

Both side confirmed that the target site of the project is 3 bridges which are shown annex1. JICA will convey to Government of Japan that ANE strongly requested construction of remaining 5 bridges(Catipusse bridge, Muagamura bridge, Muera I bridge, Muera II bridge, Mungoe bridge) by Japanese Grant Aid.

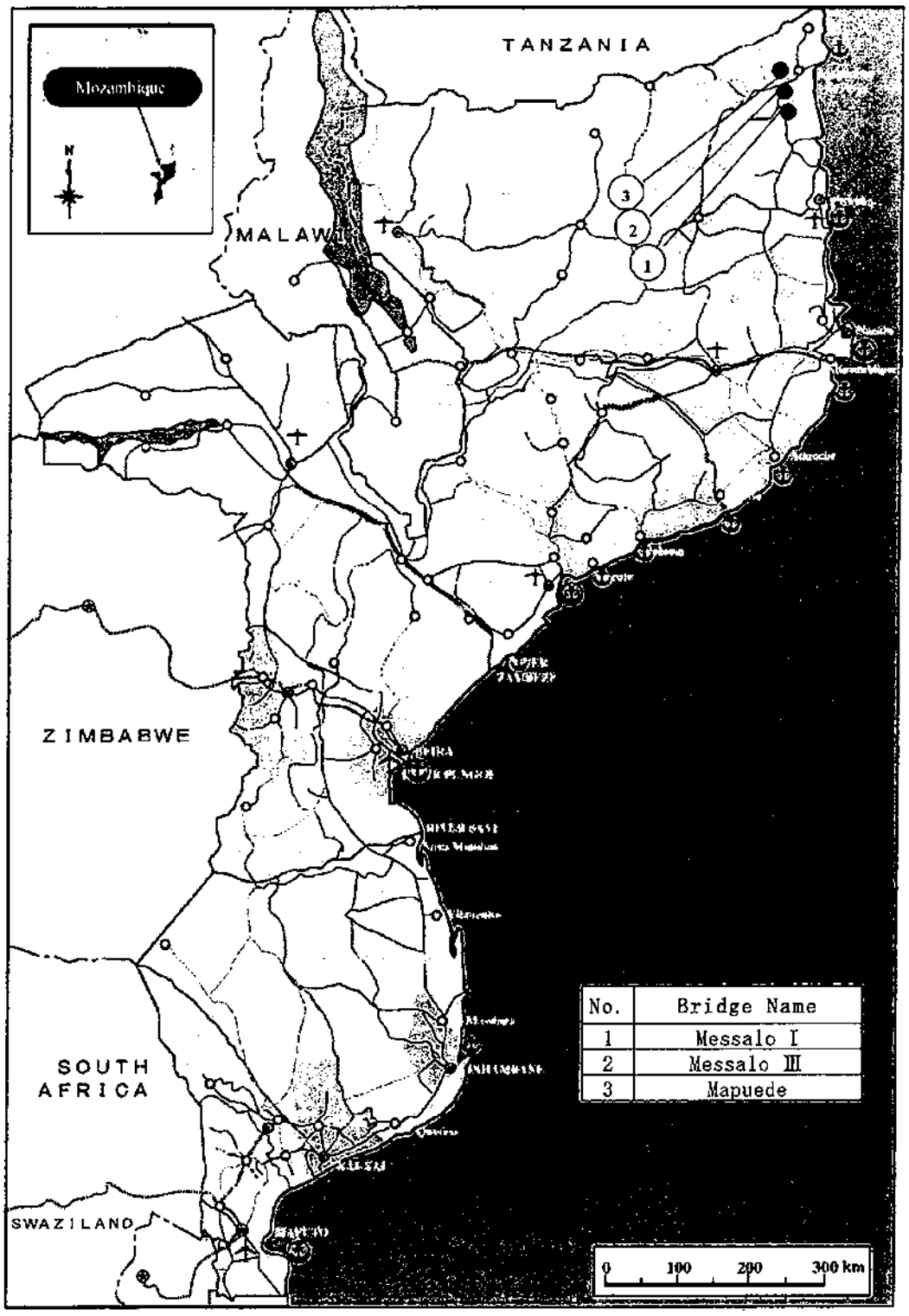
17-8. Repair of Catipusse Baily Bridge

Catipusse Baily Bridge will be used as the access road to the construction sites in the project. Catipusse Baily Bridge has a damage of a steel truss. ANE should repair the damage of this Baily Bridge before the start of construction works.

Annex 1 Project Site
Annex 2 Organization Chart
Annex 3 Project Cost Estimation
Annex 4 Japanese Grant
Annex 5 Flow Chart of Japanese Grant Procedures
Annex 6 Financial Flow of Japanese Grant
Annex 7 Project Implementation Schedule
Annex 8 Major Undertakings to be taken by Each Government
Annex 9 Project Monitoring Report
Annex 10 Environmental Check List
Annex 11 Environmental Management Plan/Environmental Monitoring Plan
Annex 12 Environmental and Social Monitoring Form

Annex 1 Project Site

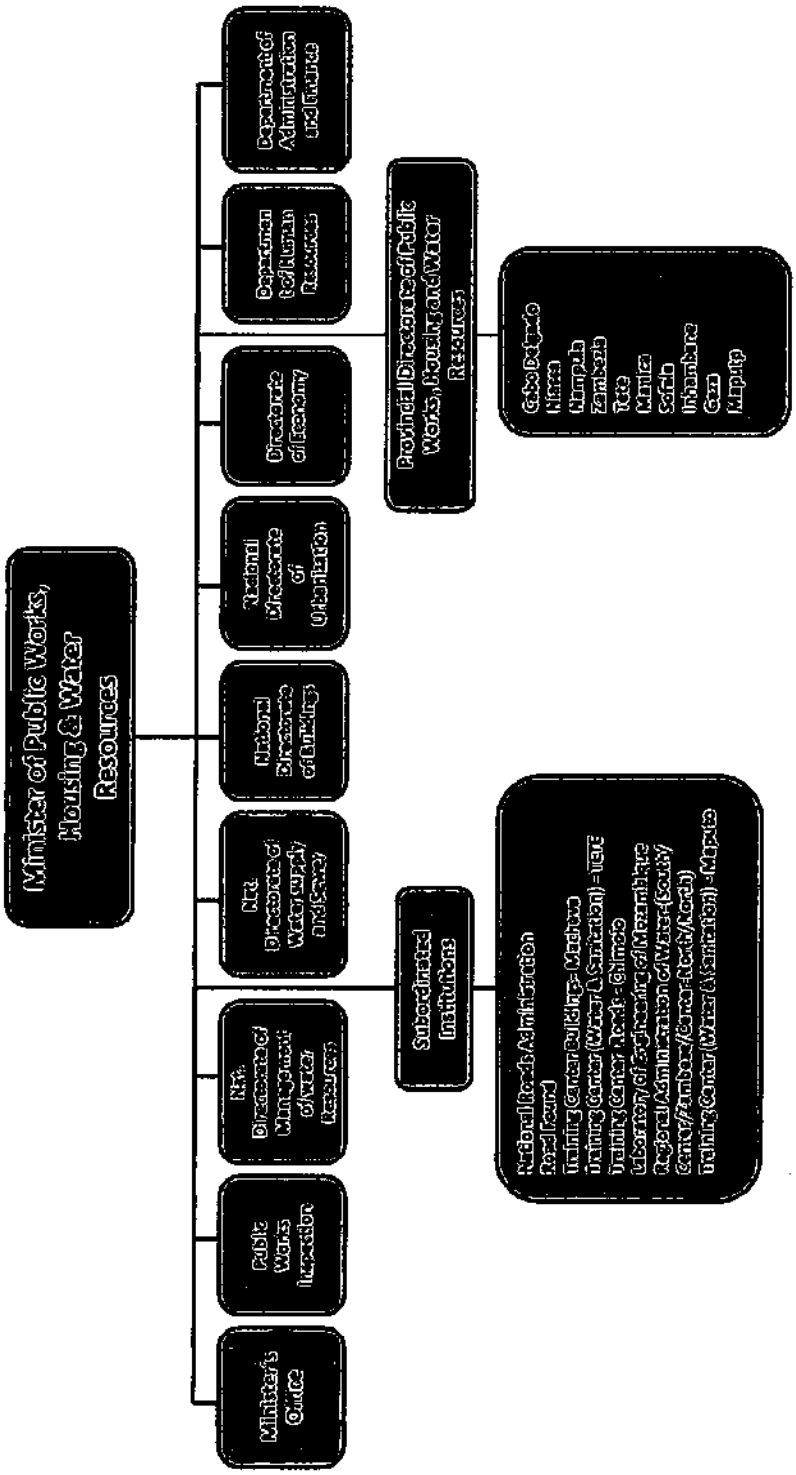
Location Map



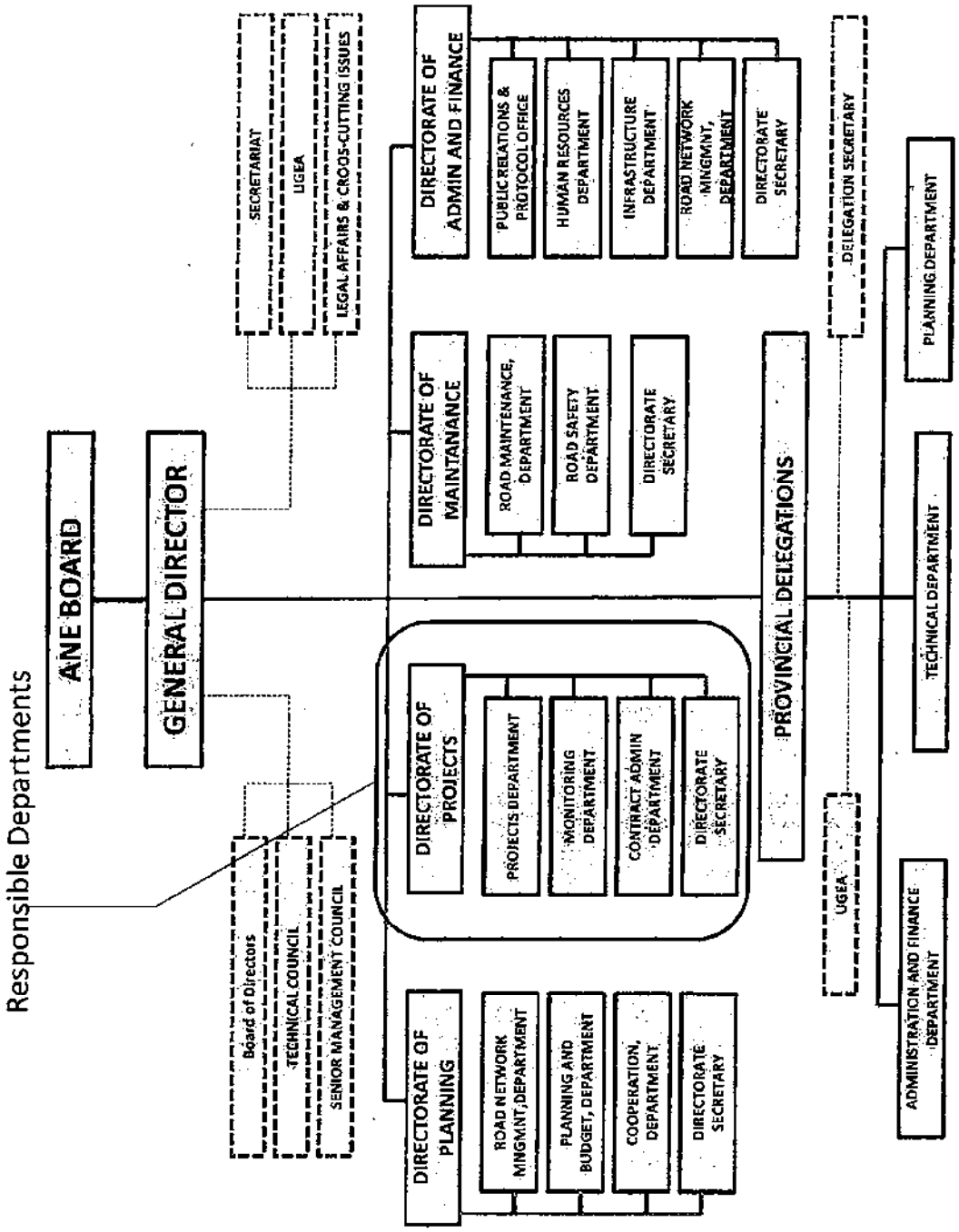
Annex 2 Organization Chart

Organization Charts

1. Ministério das Obras Públicas, Habitação e Recursos Hídricos



2. Administração Nacional de Estradas



Annex 3 Project Cost Estimation

2. Payment of Mozambique Side

Items	Cost (MZM)	Equivalent (JPY)
1. Land acquisition fee	1,564,000	5,380,160
2. Investigation and removal of landmine and UXO's	12,515,000	43,051,600
3. Custom duty & Value added tax (IVA)	76,704,000	263,861,760
4. Payment of bank service charges for bank arrangement (B/A) and Authorization to pay (A/P)	1,163,000	4,000,720
Total	91,946,000	316,294,240

3. Rate

Items	Condition
1. Estimate time	April, 2015
2. Exchange Rate	1 USD = 120.55 JPY 1 MZM = 3.44 JPY
3. Construction Period	30 months

Annex 4 Japanese Grant

JAPANESE GRANT

The Japanese Grant (hereinafter referred to as the "Grant") is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant is not supplied through the donation of materials as such.

Based on a JICA law which was entered into effect on October 1, 2008 and the decision of the GOJ, JICA has become the executing agency of the Japanese Grant for Projects for construction of facilities, purchase of equipment, etc.

1. Grant Procedures

The Grant is supplied through following procedures :

- Preparatory Survey
  - The Survey conducted by JICA
- Appraisal &Approval
  - -Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
  - -The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  - -Agreement concluded between JICA and a recipient country
- Implementation
  - -Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.

accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Project, the recipient country is required to undertake such necessary measures as Annex. The Japanese Government requests the Government of the recipient country to exempt all customs duties, internal taxes and other fiscal levies such as VAT, commercial tax, income tax, corporate tax, resident tax, fuel tax, but not limited, which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract, since the Grant fund comes from the Japanese taxpayers.

(6) "Proper Use"

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

(7) "Export and Re-export"

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

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"), in principle. JICA will execute the Grant by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

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

(10) Environmental and Social Considerations

The Government of the recipient country must carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the recipient country and JICA Guidelines for Environmental and Social Consideration (April, 2010).

(11) Monitoring

The Government of the recipient country must take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and must regularly report to JICA about its status by

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant project. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japanese Grant Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes(hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles, in accordance with the E/N, to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. The Grant may be used for the purchase of the products or services of a third country, if necessary, taking into account the quality, competitiveness and economic rationality of products and services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals", in principle.

(4) Necessity of "Verification"

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

using the Project Monitoring Report (PMR).

(12) Safety Measures

The Government of the recipient country must ensure that the safety is highly observed during the implementation of the Project.

(13) Construction Quality Control Meeting

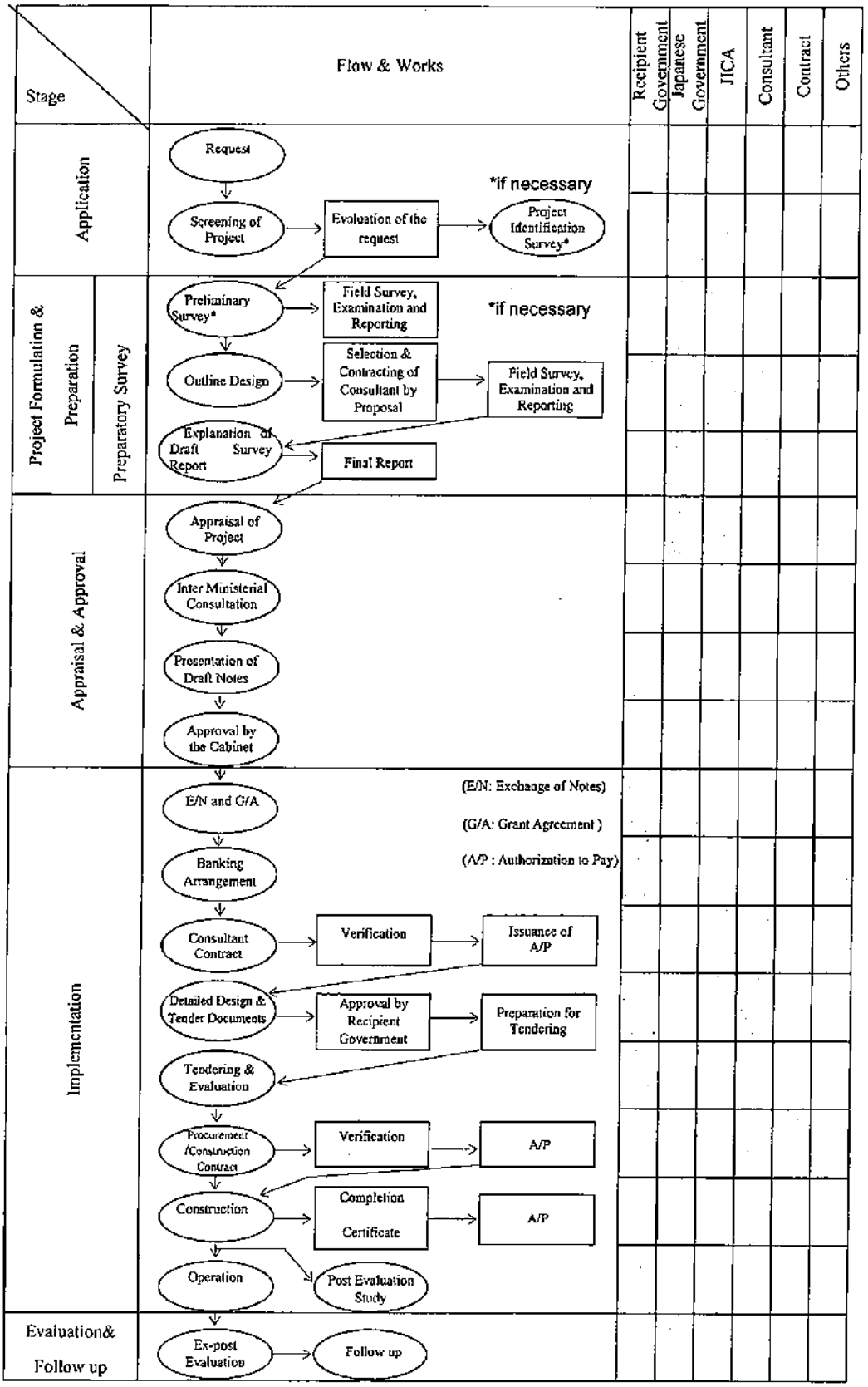
Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Client, the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

a) Sharing information on the objective, concept and conditions of design, before start of construction.

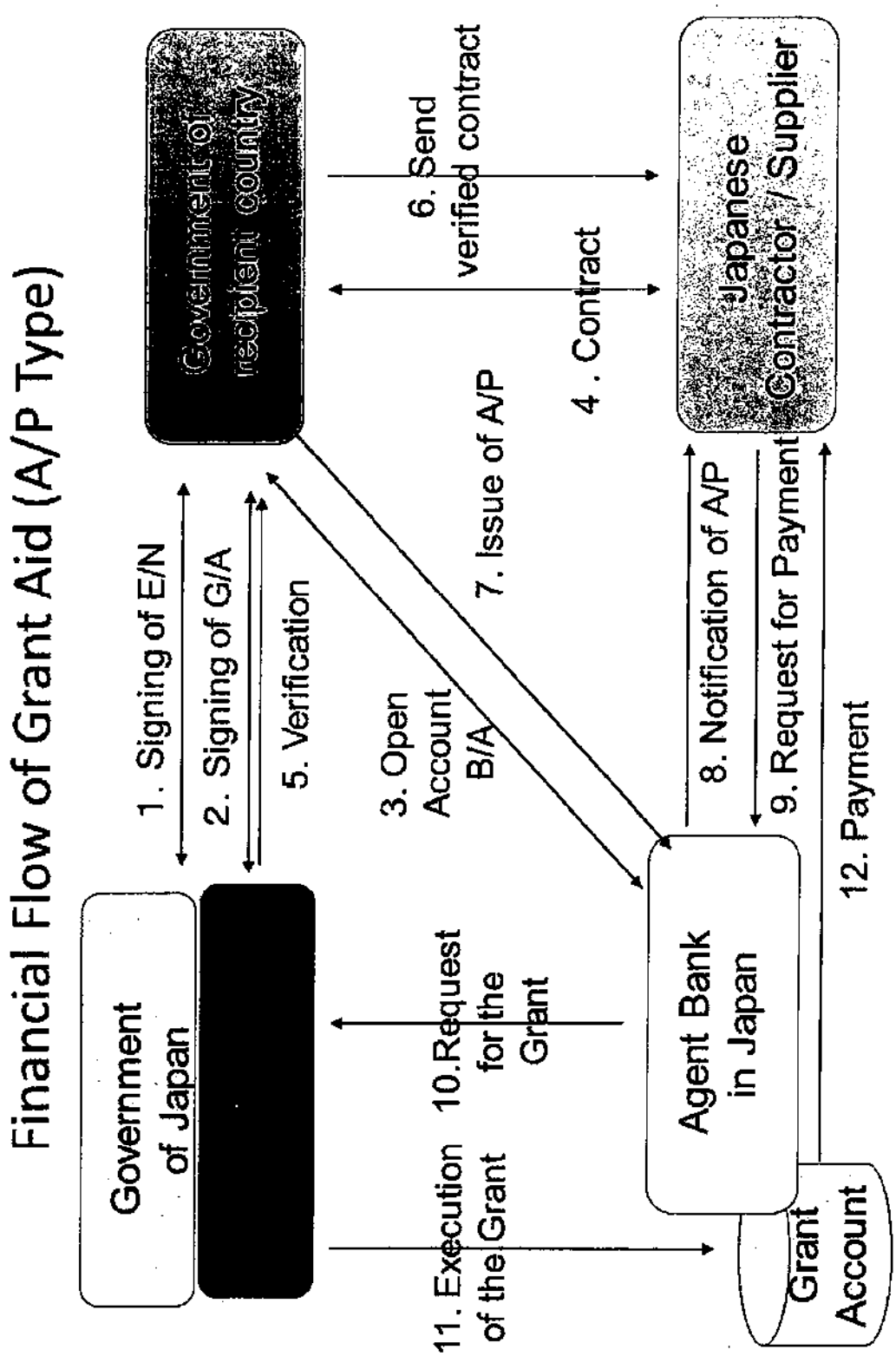
b) Discussing the issues affecting Works such as construction progress, modification of the design, test, inspection, safety control and the Client's obligation progress, during of construction.

Annex 5 Flow Chart of Japanese Grant Procedures

FLOW CHART OF JAPANESE GRANT PROCEDURES

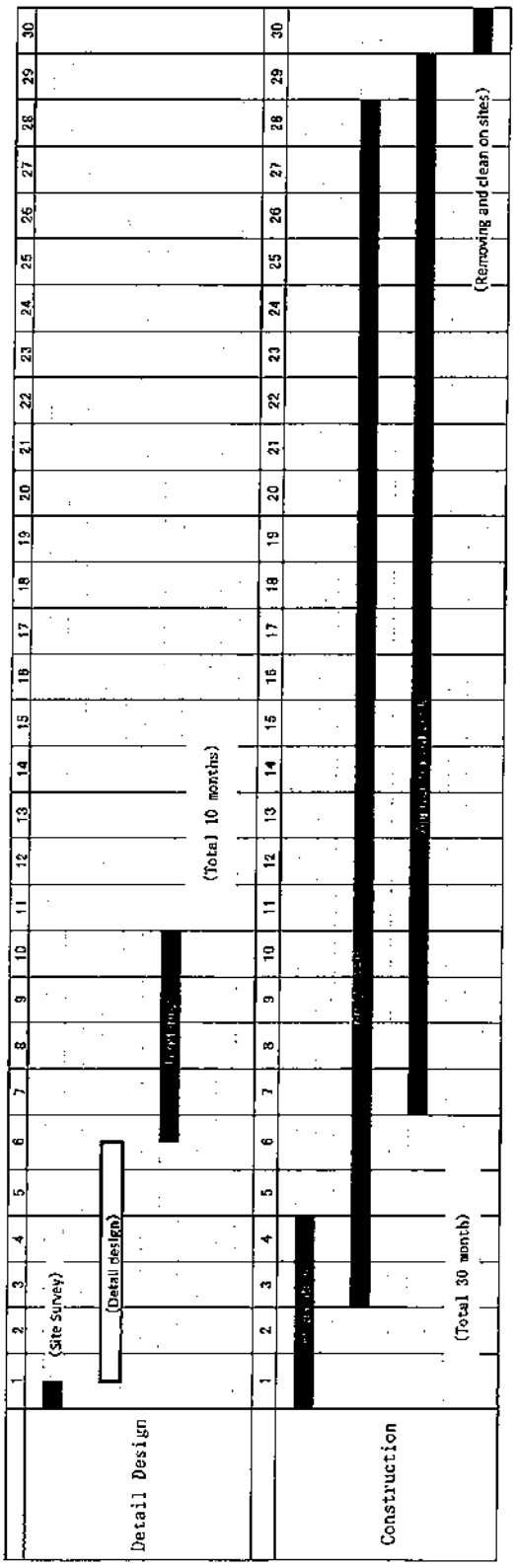


Annex 6 Financial Flow of Japanese Grant

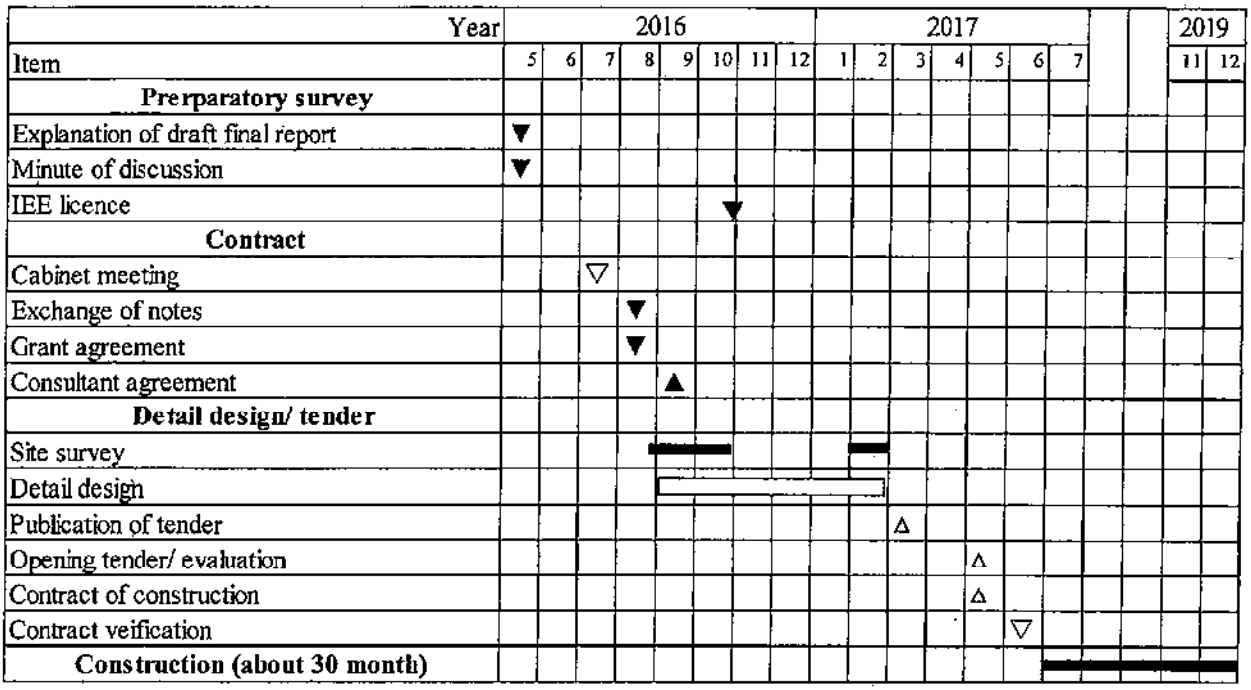


Annex 7 Project Implementation Schedule

1. Schedule



2. Project Implementation Schedule (tentative)



Annex 8 Major Undertakings to be taken by Each Government

1. Before the Tender

NO	Items	Deadline	In charge	Cost(MZN)	Financial year			Ref.
					2017	2018	2019	
1	To open Bank Account (Banking Arrangement (B/A))	within 1 month after G/A	MEF	-				
2	To approve IEE license	End of October,2016	MITADER	-				
3	To secure the following lands 1) right of way for 3 bridges 2) project sites (148,800m2 for 3 bridges) for investigation and demine of landmine at Project sites	before notice of the tender document	ANE	1,564,000 12,515,000	1,564,000 12,515,000			
4	To obtain the planning, zoning, building permit	before notice of the tender document	ANE	-				
5	To clear, level and reclaim the following sites 1) remove utilities (OPC fiber cable at Messalo I, III and Mapuede bridge)	before notice of the tender document	ANE	1,776,000	1,776,000			

3. After the project

NO	Items	Deadline	In charge	Cost (MZN)	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the construction	ANE	2,657,000 per annual	
2	To implement EMP and EMoP	for a period based on EMP and EMoP	ANE	-	
3	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between ANE and JICA.	for three years after the Project	ANE	-	
4	To maintain and rehabilitate the dyke road in Messalo river	After completion of the construction	ANE	-	

G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX
20XX, Month

Organization Information

Authority (Signer of the G/A)	Person in Charge _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Executing Agency	Person in Charge _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Line Agency	Person in Charge _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____

Outline of Grant Agreement:

Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____
Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:

1: Project Description

1-1 Project Objective

1-2 Necessity and Priority of the Project

- Consistency with development policy, sector plan, national/regional development plans and demand of target group and the recipient country.

1-3 Effectiveness and the indicators

- Effectiveness by the project

Quantitative Effect (Operation and Effect indicators)		
Indicators	Original (Yr)	Target (Yr)
Qualitative Effect		

2: Project Implementation

2-1 Project Scope

Table 2-1-1a: Comparison of Original and Actual Location

Location	**Original:** *(M/D)* **Attachment(s):Map**	**Actual:** *(PMR)* **Attachment(s):Map**

Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
(M/D)	*(M/D)*	*(PMR)* Please state not only th e most updated schedul e but also other past re visions chronologically.

'Soft component' shall be included in 'Items'.		All change of design shal I be recorded regardless of its degree.

(Sample)Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
1. Upgrading of the Kukum Highway	length 20km, single lane (3.47m*2), path(1.25m*2) Concrete Pavement 200mm (motor lane only)	length 20km, single lane (3.47m*2), path(1.00m*2) C oncrete Pavement 200mm (motor lane only)
2. Replacement of Old Matariko Bridge	Bridge length 40m, Width 9.5m, path(1.00m*2), compound steel box-girder bridge, Inverted T type-abutment spread foundation	Ditto

(Sample)Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
1. Outpatient Department	RC, Double Storey Ground floor: Consultation room 6 Reception Satellite Lab. Pharmacy, etc 1st floor: Consultation room 5 Dental Clinic 2	RC, Double Storey Ground floor: Consultation room 5 ditto
2. Operation Theatre, Casualty Unit, Maternity Ward	RC, Double Storey Ground Floor: Operation room 2 Casualty Unit 1st Floor: Maternity Ward 50 beds	 ditto Maternity Ward 60 beds

(Sample)Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
1. Primary and Secondary Surveillance Radars at Chittagong Int'l Airport	i) OSR/SSR 1 set ii) RDP 1 set iii) VHF Transmitters 2 sets	Ditto
2. Access Control System for Dhaka Int'l Airport	1 set	Ditto
3. Doppler VOR/DME at Saidpur Airport	1 set	Ditto
4. Aerodrome Simulator for Civil Aviation Training Center	1 set	Ditto

5. Baggage Inspection System for Dhaka Int'l Airport	i) Hold Baggage Xray Inspectin system 7sets ii) Hold Baggage Explosive Trace Detecting System 7sets iii) Cabin Baggage Xray Inspection System 2sets	Ditto
6. Airport Fire Fighting Vehicles for Dhaka Int'l Airport	2 sets	3 sets

2-1-2 Reason(s) for the modification if there have been any.

(PMR)

2-2 Implementation Schedule

2-2-1 Implementation Schedule

Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
[M/D]	*(M/D)*		*(PMR)* As of (Date of Revision)
'Soft component' shall be stated in the column of 'Items'.			Please state not only the most updated schedule but also other past revisions chronologically.
Project Completion Date*			

*Project Completion was defined as _____ at the time of G/A.

(Sample)Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
Cabinet Approval	11/2015	-	-
E/N	12/2015	1/2016	24/1/2016
G/A	12/2015	1/2016	24/1/2016 Amended 13/3/2017
Detailed Design	12/2015-4/2016	1/2016-5/2016	1/2016-5/2016
Tender Notice	5/2016	5/2016	1/6/2016
Tender	6/2016	6/2016	15/7/2016
(Lot1) Construction Period	7/2016-11/2018	7/2016-11/2018	8/8/2016-30/11/2018
(Lot2) Installarion of Equipement	7/2016-6/2018	7/2016-6/2018	6/8/2016-30/60/2017

Project Completion Date	11/2018	11/2018	30/11/2018
Defect Liability Period	11/2019	11/2019	30/11/2019

*Project Completion was defined as Check-out of Construction work at the time of G/A.

2-2-2 Reasons for any changes of the schedule, and their effects on the project.

2-3 Undertakings by each Government

2-3-1 Major Undertakings

See Attachment 2.

2-3-2 Activities

See Attachment 3.

2-3-3 Report on RD

See Attachment 4.

2-4 Project Cost

2-4-1 Project Cost

Table 2-4-1a Comparison of Original and Actual Cost by the Government of Japan
(Confidential until the Tender)

Items			Cost (Million Yen)	
	Original	Actual	Original	Actual
Construction Facilities (or Equipment)	'Soft component' shall be included in 'Items'.			Please state not only the most updated schedule but also other past revisions chronologically.
Consulting Services	- Detailed design -Procurement Management -Construction Supervision			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

Table 2-4-1b Comparison of Original and Actual Cost by the Government of XX

Items			Cost (Million USD)	
	Original	Actual	Original	Actual
				Please state not only the most

				updated schedule but also other past revisions chronologically.
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = (local currency)

(Sample)Table 2-4-1a Comparison of Original and Actual Cost by the Government of Japan
(Confidential until the Tender)

Items			Cost (Million Yen)	
	Original	Actual	Original[1),2)]	Actual
Construction Facilities	1. Outpatient Department 2. Operation Theatre, Casualty Unit, Maternity Ward	Ditto Ditto	1,169.5	1,035.0
Equipment	1) Primary and Secondary Surveillance Radars at Chittagong Int'l Airport 2) Access Control System for Dhaka Int'l Airport 3) Doppler VOR/DME at Saidpur Airport 4) Aerodrome Simulator for Civil Aviation Training Center 5) Baggage Inspection System for Dhaka Int'l Airport 6) Airport Fire Fighting Vehicles for Dhaka Int'l Airport	Ditto	2,374.6	2,110.0
Consulting Services	- Detailed design -Procurement Management -Construction Supervision -Soft Component	Ditto	0.87	0.87
Total			3544.97	3145.87

Note: 1) Date of estimation: October, 2014
2) Exchange rate: 1 US Dollar = 99.93 Yen

(Sample)Table 2-4-1b Comparison of Original and Actual Cost by the Government of Bangladesh

Items			Cost (1,000 Taka)	
	Original	Actual	Original[1),2)]	Actual
Dhaka International Airport	Modification of software of existing Rader Data Processing System	Ditto	8,000	9,240
	Provision of a partition, lighting, air conditioning and electric power supply at transfer hold baggage check point	Ditto	5,000	2,453

6

	Replacement of five doors in the international passenger terminal building	Ditto	4,000	5,340
Chittagong Int'l Airport	Preparation of the radar site including felling of trees, clearing and grabbing	Ditto	5,000	3,400
Total			22,000	20,433

Note: 1) Date of estimation: October, 2014
2) Exchange rate: 1 US Dollar = 0.887 Bangladesh Taka (local currency)

2-4-2 Reason(s) for the wide gap between the original and actual, if there have been any, the remedies you have taken, and their results.

(PMR)

2-5 **Organizations for Implementation**

2-5-1 **Executing Agency:**

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original: *(M/D)*

Actual, if changed: *(PMR)*

2-6 **Environmental and Social Impacts**

- The results of environmental monitoring as attached in [redacted] in accordance with Schedule 4 of the Grant Agreement.
- The results of social monitoring as attached [redacted] in accordance with Schedule 4 of the Grant Agreement.
- Information on the disclosed results of environmental and social monitoring to local stakeholders, whenever applicable.

3: Operation and Maintenance (O&M)

3-1 O&M and Management

- Organization chart of O&M
- Operational and maintenance system (structure and the number ,qualification and skill of staff or other conditions necessary to maintain the outputs and benefits of the project soundly, such as manuals, facilities and equipment for maintenance, and spare part stocks etc)

Original: *(M/D)*
Actual: *(PMR)*

3-2 **O&M Cost and Budget**
- The actual annual O&M cost for the duration of the project up to today, as well as the annual O&M budget.

Original: *(M/D)*

4: Precautions (Risk Management)

- Risks and issues, if any, which may affect the project implementation, outcome, sustainability and planned countermeasures to be adapted are below.

Original Issues and Countermeasure(s): *(M/D)*	
Potential Project Risks	Assessment
1.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
2.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):

3.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
Actual issues and Countermeasure(s)	
(PMR)	

5: Evaluation at Project Completion and Monitoring Plan

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan for the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
2. Undertakings to be taken by each Government
3. Monthly Report
4. Report on RD
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (Final Report Only)

Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C−D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st ●month, 2015	2nd ●month, 2015	3rd ●month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

-
-
-

Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

Annex 10 Environmental Check List

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) - (d) N	(a)ANE informed that IEE report will be made by the end of October, 2016 (at the time of discussion of May, 2016). (b)ANE informed that IEE license from MITADER are acquired in the end of October, 2016 (at the time of discussion of May, 2016). (c)The detailed content is unclear because approval is necessary after the making of the IEE report. (d) The authorization except the IEE license does not need it.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a)The JICA survey team carried out an individual interview. The inhabitants around the bridge almost welcome you about a plan to replace the permanent bridge because an existing bridge is a temporary solution. ANE is going to hold the Stake holder meeting in about September, 2016 (at the time of discussion of May, 2016). (b) The system of the formal objection that compensation requires is going to be secured. When there is an objection, the person concerned states an objection to a local leader, and report to the county from village leader, and discuss it, and the effectiveness of the objection is considered.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a)As a result of having compared with the zero option, The alternative is concluded that the project should secure a function as National highway No. 1 for economic development.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that air pollutants emitted from the project related sources, such as vehicles traffic will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? Are any mitigating measures taken? (b) If air quality already exceed country's standards near the route, is there a possibility that the project will make air pollution worse?	(a) Y (b) N	(a)During works, the outbreak of the dust is assumed by the operation of the construction machine. There is a little number of the construction machines. It is expected that the outbreak gross weight of the dust in the Cabo delgado province are not big effectiveness after project completed. Periodical monitoring is going to carry out during works. (b)The neighboring environment has good atmosphere environment without a factory. The pollutant occurring from a construction machine has decreased atmospheric pollutant density by an advection and diffusion to the lee in a river basin. It is assumed these decrement effects that there is few it the influence. In the estimating traffic volume, traffic volume in 2015 was 344, in 2022 may become 570 in the future. The influence of air pollution is not assumed because there is little traffic.
	(2) Water Quality	(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? (b) Is there a possibility that the project will contaminate water sources, such as well water?	(a) N (b) N	(a)During a construction period, a method of construction will be adopted by coffer dam and the piers are constructed in the dry season. By these methods are prevented quality of the water aggravation. The embankment works sets a sandbag and prevents soil and sand outflow. (b)There is not the well around a project. The digging during pile works minimizes the influence to the outskirts by the coffer dam method.
	(3) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country 's standards? (b) Do low frequency sound from the vehicle and train traffic comply with the country's standards?	(a) Y (b) Y	(a)The noise and the vibration have a small influence to pass a bridge in comparison with a road run. It is expected that there is not the influence around the bridge because there are not a house and facilities. (b) The influence of the low frequency vibration is not assumed around a bridge because there are not a house and facilities,.
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a)There is no protected area at the surrounding area of bridges.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock? (e) Is there a possibility that installation of bridges and access roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered?	(a) N (b) N (c) N (d) N (e) N	(a)The project enforcement area is not a habitat important for primeval forests, tropical rain forests, ecologically valuable habitats. (b)The existence of the precious species is not reported. (c)In the project enforcement area, the existence of large wildlife and the domestic animal is not confirmed. (d)The same as above (e)It is not expected to cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to replace the bridge only. The NGO is concerned about increase of the poaching with road development. NGO suggest night traffic prohibition of National highway No. 380 to the government at the national park section. Patrol around the bridge should be carried out. When an unidentified vehicle passed on bridge, should report to the police to prevent a poacher.
	(3) Hydrology	(a) Is there a possibility that hydrologic changes due to the installation of structures will adversely affect surface water and groundwater flows?	(a)N	(a)The length of bridge become longer in comparison with existing bridge in result of hydrological analysis and the passing water of the river becomes smooth. It is not assumed to affects surface water and a flow of the groundwater.
	(4) Topography and Geology	(a) Is there any soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(a) N (b) N (c) N	(a)No serious impact is anticipated. (b)Possibility of landslide is few case due to not large-scale embankment and excavation on the sites. (c)The embankment works assumes a plan to prevent the outflow of soil and sand by a large sandbag

4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) N (b) N/A (c) N/A (d) N/A (e) N/A (f) N/A (g) N/A (h) N/A (i) N/A (j) N/A	(a)No resettlement is associated to the project. (b)No replacement is associated to the project. (c)The same as above (d)The same as above (e)The same as above (f)The same as above (g)The same as above (h)The same as above (i)The same as above (j)The same as above
	(2) Living and Livelihood	(a) Where bridges and access roads are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts? (b) Is there any possibility that the project will adversely affect the living conditions of the inhabitants other than the target population? Are adequate measures considered to reduce the impacts, if necessary? (c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., increase of traffic congestion and traffic accidents)? (e) Is there any possibility that project will impede the movement of inhabitants? (f) Is there any possibility that bridges will cause a sun shading and radio interference?	(a) N (b) N (c) Y (d) N (e) N (f) N	(a)It is not assumed to impact for the residents (b)The same as above (c)A risk might be enhanced by the emigration of the worker during a construction period temporarily but various seminars and enlightenment activity will be held regularly and reduce a risk (d)Influence on some traffic is expected during the construction and after the construction. (e)No serious negative impact is anticipated. (f)No serious negative impact is anticipated.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a)Not applicable
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a)The change of landscape with the present conditions is not assumed the influence due to the project of bridge replacement.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N (b) Y	(a)Ethnic minorities and indigenous peoples are not confirmed around a project conformance area. (b)The rights of ethnic minorities and indigenous peoples respect.
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) The working condition of the country is going to be followed. (b) The construction at the high place work sets up the fence and performs safety management. The contractor submits a work safety management plan before a construction start and approved by ANE. (c) The contractor submits a safety management plan and, carries out a periodical safety seminar during construction. (d) Traffic control staff and a guard are plan to post in the spot office during construction.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a) Y (b) Y (c) Y	(a) The mitigation measure for air pollution assumes the periodical check and maintenance of the construction machine, and to sprinkle the road with water. The mitigation measure of the water pollution adopt the method of coffer dam, and construct in the dry season, and embankment work uses a large sandbag. The mitigation measure of the waste carry the waste materials to the appropriate area, and perform the patrol around the construction site. (b) Observation with the animals and plants around the bridge shall be carried out routinely in the habits situation. (c) Infectious disease, and labor circumstances, and the accident are possible during works. A seminar about the infectious disease prevention should be held regularly. The high place work sets up a fence and carries out safe construction. A periodical safety management seminar should be held to manage the driving speed during the material transportation,
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a)Monitoring of air quality, the quality of the water, waste, soil pollution, ecosystem will be conducted (b)It is going to be established based on a scale of construction scale, the experience in the country and past JICA project. (c) It is possible because the plan was considered based on the similar project in the country. (d)Contractor make the result of monitoring and report every month.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Roads, Railways and Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation). (b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities)	(a) N (b) N/A	(a)The large-scale deforestation is not assumed due to bridge replacement project only. (b)Not applicable
	Note on Using Environmental Checklist	(a) If necessary, the impacts to trans boundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as trans boundary waste treatment, acid rain, destruction of the ozone layer, or global warming)	(a) N	(a)The influence is not assumed because it is small scale project.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards,

Annex 11 Environmental Management Plan/Environmental Monitoring Plan

Environmental Management Plan (tentative)

Item	Monitoring	Method	Expected schedule	Responsible organization
Planning phase				
Environmental License	Situation of obtaining the license	Handing in relevant documents to JICA office (copy of licenc, application documents)	End of October, 2016	ANE
Information to the Local residents	Information about the results of preparatory survey	Repoeting to JICA office about the results of activities	June, 2016	ANE
Item	**Monitoring**	**Location**	**Frequency**	**Responsible organization**
During works				
Air quality	Visual monitoring	Around the bridge sites	Every month	Contractor
Water quality	pH, turbidity(Use by simple equipment and visual monitoring)	Upstream and downstream from the bridge	Every month	Contractor
Waste	Visual monitoring	Around the bridge sites	Every month	Contractor
Soil pollution	Patrol (leaking oil from construction equipment or storage yard to ground)	Around the bridge sites	Every month	Contractor
Ecosystems	Monitoring if there is wild animal from Quirimbus National park	Around the bridge sites	Every month	Contractor
In service				
Water quality	pH, turbidity(Use by simple equipment and visual monitoring)	Upstream and downstream	Every month (until 6 month	ANE
Ecosystems	The patrol for unidentified vehicle of the poaching should be carried out during road maintenance periodically.	Around the bridge sites	Every month	ANE

Annex 12 Environmental and Social Monitoring Form

Monitoring Form

The latest results of the below monitoring items shall be submitted to the lenders as part of Quarterly Progress Report throughout the construction phase.

1 Construction Phase

1.1 Response/Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
Number and contents of formal comments made by the public	
Number and contents of responses from Government agencies	

1.2 Pollution

(1) Water Quality

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency
pH	-			6.5-8.5			Upstream and downstream sites	Monthly
COD	mg/l			-		50		

(2) Air Quality (Ambient Air Quality)

Monitoring Item	Monitoring Results during Report Period
The change of fauna and the flora shall be observed by visual survey and confirm abnormality of the air quality at near the construction site every monthly	Details of survey results, such as findings.

(3) Waste and soil pollution

Monitoring Item	Monitoring Results during Report Period
Waste: Monthly patrol should be carried out for prevention of illegal dumping.	Details of survey results, such as findings.
Soil pollution: Monthly patrol should be carried out for checking the leaking from construction equipment.	Details of survey results, such as findings.

1.3 Natural Environment

Ecosystem

Monitoring Item	Monitoring Results during Report Period
Number of unusual death of wildlife, fish and aquatic fauna around project sites When an unidentified vehicle passed on the construction sites, should be report to the police due to prevent a poacher.	Details of survey results, such as findings.

1.4 Social Environment

HIV/AIDS and other STDs

Monitoring Item	Monitoring Results during Report Period
HIV/AIDS and other STDs	Incidences per 1000 inhabitants

2 Operation Phase

The latest results of the below monitoring items shall be conducted by ANE based on sampling on monthly basis for the first 6 month of operation and submitted to JICA.

2.1 Response/Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period	Frequency
Number and contents of formal comments made by the public	To be counted and reviewed through the Grievance Redress Mechanism to be established within this project.	Monthly basis.
Number and contents of responses from Government agencies	To be responded based on review of comments, to be collected through GRM, mentioned above.	

2.2 Pollution

(1) Water Quality

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Measurement Point	Frequency
pH	-			6.5-8.5			Upstream and downstream sites	Monthly
COD	mg/l					50		

2.3 Natural Environment

(1) Ecosystem

Monitoring Item	Monitoring Results during Report Period
Number of unusual death of wildlife, fish and aquatic fauna around project sites. When an unidentified vehicle passed during the periodic road maintenance monitoring, ANE shall report to the police due to prevent a poacher.	Details of survey results, such as findings.

5. Technical Notes

TECHNICAL NOTES

ON THE PREPARATORY SURVEY ON
THE PROJECT FOR CONSTRUCTION OF BRIDGES ON N380
IN CABO DELGADO PROVINCE
IN THE REPUBLIC OF MOZAMBIQUE

The Preparatory Survey Team (hereinafter referred to as "the Team") has conducted a series of site surveys holding meetings with the National Road Administration (ANE) and the officials concerned of the Government of the Republic of Mozambique. ANE and the TEAM reviewed the survey results obtained by the end of March and confirmed the main items of the Project for Construction of Bridges on N380 in Cabo Delgado Province in the Republic of Mozambique (hereinafter referred to as "the Project) on the 2nd of April 2015 as shown in the following.

Technical Notes

On the basis of discussions and field surveys done up to now, the Team and ANE have confirmed the following main items of the Project in accordance with Article 13-3 of the Minutes of Discussions of the 2nd March 2015.

1. Bridge Width

The width of bridges is 9.6 m with two traffic lanes including the sidewalks on both sides as shown in Figure 1.

2. Location of new bridges

New bridge locations are determined based on the alignment of approach roads and natural conditions as shown Table 1.

3. Bridge Length

The lengths of the bridges are determined considering the flood flow of each river and the construction cost. The lengths of bridges are shown in Table 1.

4. Standard of the bridge design

The Team shall design the new bridges based on the ANE's design standard, and supplement with Japanese design standards and relevant manual as below.

1) ANEs design standards , SATCC
2) Design specification of highway bridges issued by Japan Road Association (JRA)
3) Drainage Manual by the South African National Roads Agency Ltd. 2006

5. Prioritization of the bridges

The eight bridges are prioritized based on the importance and emergency checked in this study. The result is shown in Table 1.

6. Environmental Issues

The items ANE shall undertake to implement the environmental preparation are as shown in Table 2. The Budget allocation for Relevant Environmental Studies (i.e., IEE and/or EIA Study) shall be

arranged by ANE before the implementation of Project.

7. Other Relevant Issues

The Team recommended ANE to take urgent countermeasure for some damaged bridges, such as Muaguide Bridge and Messalo 2 Bridge.

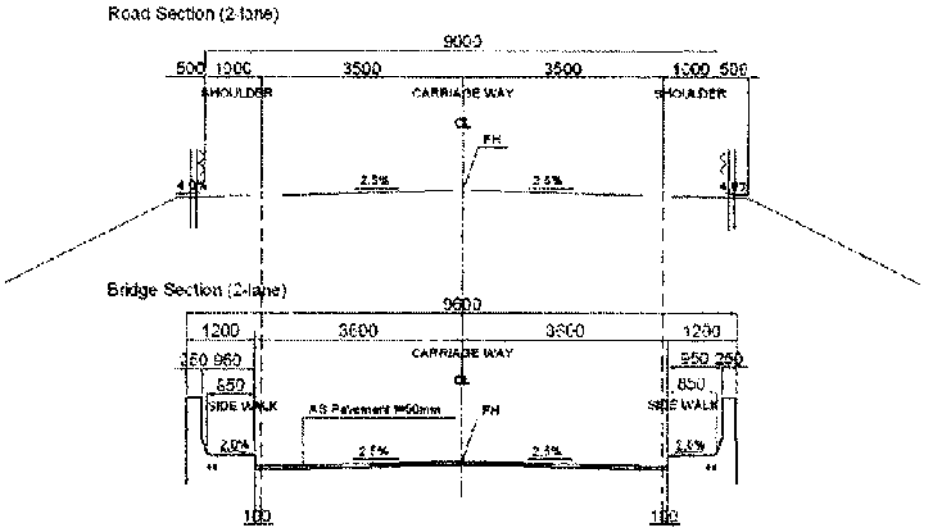


Figure 1. Road and Bridge Width

Table 1. Bridge List

No.	Bridge Name	Length of Existing Bridge(m)	Planning of Bridge Length(m)	Span	Location of the New Bridge	priority
1	Catipusse	30.0	35		Existing bridge	I
2	Muagamula	33.5	35		Down stream	II
3	Messalo 1	49.4	50	2@25m	Existing bridge	I
4	Messalo 3	74.4	75	3@25m	Existing bridge	I
5	Mapuede	24.4	25		Existing bridge	II
6	Muera 1	44.5	50	2@25m	Existing bridge	I
7	Muera 2	20.0	25		Existing bridge	I
8	Mungoe	15.5	25		Existing bridge	II

Table 2. List of ANE's Undertaking

Item	Deadline
Preliminary Discussions between ANE and MICOA.	End of May, 2015
Budget allocation of Relevant Environmental Studies (i.e., IEE and/or EIA Study), tender process, and the selection of qualified environmental consulting firm by ANE.	End of May, 2015
Relevant Environmental Studies (i.e., IEE and/or EIA Study) satisfying both relevant EIA codes of Mozambique and JICA Guideline.	End of February, 2016
Approval letter of Relevant Environmental Studies (IEE and/or EIA), and Environmental License.	End of February, 2016
Stakeholder Meetings, required by JICA Guidelines	During IEE and/or EIA study
Land acquisition	Before the implementation of the Project
Resettlement and compensation	Before the implementation of the Project

The survey will be continued until May and if any special condition change is recognized necessary, some items may be revised accordingly with beforehand notice from the Team to ANE.

Haruki AKIYAMA
Consultant Leader
Preparatory Survey Team
CHODAI Co., Ltd.

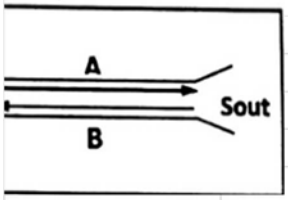
Atanasio Muguinhe
General Manager
National Roads Administration
Republic of Mozambique

6. References

6-1. Traffic volume survey

(1) Catipusse bridge

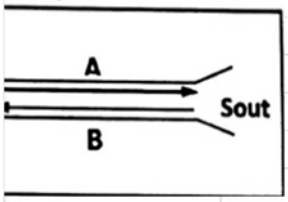
ion Map



BRIDGE NAME CATIPUSSE (BRIDGE NO. 1)
DATE APRIL 6, 2015
SURVEYOR ANTIPHOP CHAISRISUK
DIRECTION A (to South)

				Pedestrian and Bicycle	Total
	1	1		4	6
	6	4	3	5	18
	5	2	6	4	17
2	2	4		3	11
2	6	3		1	12
	7	5		6	18
	2	5			7
	3	3	2	4	12
	4	2		2	8
	6	2		3	11
	6	2	1	13	22
	3	4		4	11
4	51	37	12	49	153

ion Map

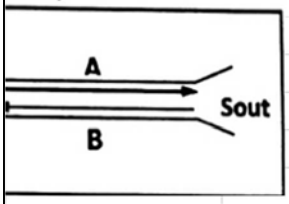


BRIDGE NAME CATIPUSSE (BRIDGE NO. 1)
DATE APRIL 6, 2015
SURVEYOR BOONLIANG WONGKOTE
DIRECTION B (to North)

				Pedestrian and Bicycle	Total
	4	5	3	10	22
1	5	1	6	16	29
2	8	3	6	5	24
	35		2	3	40
	25	5	5	2	37
	18	4	2		24
	12	2	2	1	17
	8	3			11
	9		3	2	14
	14	2			16
1	11	3	1		16
	6	2		1	9
4	155	30	30	40	259

(2) Mungoe bridge

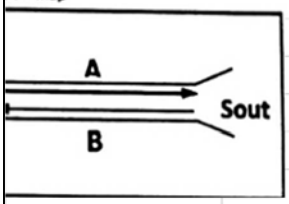
ion Map



BRIDGE NAME MUNGOE (BRIDGE NO. 8)
DATE APRIL 6, 2015
SURVEYOR MAN SIDAM
DIRECTION A (to South)

				Pedestrian and Bicycle	Total
1	1	1		48	51
		1		31	32
	1	3		24	28
	1	3		28	32
1	2	1	1	38	43
	6	3		6	15
	2	3			5
	4	1		10	15
2	3	2	1	6	14
1		2	2	15	20
		2		15	17
	3	1		10	14
5	23	23	4	231	286

ion Map



BRIDGE NAME MUNGOE (BRIDGE NO. 8)
DATE APRIL 6, 2015
SURVEYOR TELEX FREDERICO CUNA
DIRECTION B (to North)

				Pedestrian and Bicycle	Total
1		1		5	7
1	4	6	1	10	22
	2	3	2	5	12
	2	5	3	11	21
1	7		3	13	24
	33	3	3	11	50
1	22	3	3	7	36
	15	6	6	15	42
	16	2	4	23	45
1	7	2	1	10	21
3	7	2		17	29
2	12	2		13	29
10	127	35	26	140	338

6-2. Geological survey

The coordination shows as below. BH3, BH4, and BH5 is for Messalo I, Messalo III, and Mapuede respectively.

	Easting (X)	Northing (Y)	Elevation (Z)
BH1-A1	610 432.205	8 606 525.118	125.880
BH1-A2	610 433.845	8 606 579.479	125.980
BH2-A1	621 955.565	8 658 026.713	143.165
BH2-A2	621 929.353	8 658 074.110	144.136
BH3-A1	620 536.070	8 689 804.794	46.387
BH3-A2	620 488.000	8 689 862.844	46.700
BH4-A1	620 293.180	8 690 490.373	47.309
BH4-A2	620 265.756	8 690 576.296	46.540
BH4-P1	620 279.650	8 690 518.930	45.846
BH5-A1	617 299.474	8 692 056.371	43.627
BH5-A2	617 256.901	8 692 053.140	45.765
BH6-A1	610 658.134	8 713 456.960	89.646
BH6-A2	610 720.463	8 713 486.473	89.563
BH7-A1	610 900.101	8 713 507.888	87.311
BH7-A2	610 941.958	8 713 536.087	90.326
BH8-A1	612 525.757	8 724 730.665	151.064
BH8-A2	612 512.381	8 724 763.662	151.368

(1) Messalo I bridge

BORING LOG

BOREHOLE BH3-A1
SHEET 1 OF 2

PROJECT: Bridge Construction on N380, Cabo Delgado
LOCATION: Messalo 1 (Bridge 3) @ South Abutment
CLIENT: Chodai Co., Ltd.

Coordinates S: 8669804.7940 E: 620536.0700
Ground Elevation (m-MSL): 46.3870 m
Max.Drilling Depth: 27.44 m

Water Level: -0.600 m
Starting Date: 7-10/4/2015
Finishing Date: 20-21/5/2015

DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Ton/m³) 1.6 1.8 2.0	Plastic Limit / Natural Water Content / Liquid Limit (%) 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
0		0.0-7.0 m, CL, silty CLAY, 10% silt, low-medium plasticity, medium stiff-stiff, dark brownish gray-dark gray, *Alluvium*	WO						
			WO						
1			SS	1	26				5
			WO						
2			SS	2	45				5
			WO						
3			SS	3	45				8
			WO						
4			SS	4	Loss				7
			WO						
5			SS	5	45				9
			WO						
6			SS	6	43				9
			WO						
7		7.0-9.0 m, ML, SILT, medium dense, non plasticity, rather clean, brownish gray-gray, *Alluvium*	SS	7	34				12
			WO						
8			SS	8	39				10
			WO						
9		9.0-12.0 m, SM, silty SAND, 20-30% silt, very fine-fine subangular sand, with little clay, clean, loose-medium dense, brownish gray-gray, *Alluvium*	SS	9	45				17
			WO						
10			SS	10	42				17
			WO						
11			SS	11	41				14
			WO						
12		12.0-13.0 m, SP, SAND, fine subangular sand, rather clean, poorly graded, medium dense, greenish gray, *Alluvium*	SS	12	37				15
			WO						
13		13.0-17.0 m, SM, silty SAND, very fine subangular sand-silt, nil-5% clay, very random presence of highly weathered granite gneiss subangular-subeound gravel of 1 cm max sized, medium dense, greenish gray with random brown mottled, *Alluvium*	SS	13	40				22
			WO						
14			SS	14	45				15
			WO						
15			SS	15	45				15
			WO						
16			SS	16	43				16
			WO						
17		17.0-20.0 m, SM, silty SAND, 15% silt, fine subangular sand, medium dense, brown, *Alluvium*	SS	17	45				21
			WO						
18		23.0-23.5 m, SP, SAND, fine subangular sand, clean, poorly graded, dense, light brown, *Alluvium*	SS	18	40				32
			WO						
19		19.0-20.0 m, SM, silty SAND, very fine subangular sand-silt, dense, brown with greenish gray mottled, *Alluvium*	SS	19	43				32
			WO						
20		20.0-21.0 m, ML, SILT, slight plasticity, medium dense, light brown with gray mottled, *Alluvium*	SS	20	44				21
			WO						
21		21.0-23.0 m, SM, silty SAND, 15-50% silt, very fine subangular-subround sand, rather clean, dense, brown with gray mottled-brownish gray, *Alluvium*	SS	21	45				30
			WO						
22			SS	22	45				31
		23.0-27.0 m, SP, SAND, fine subangular-subround sand, clean, poorly graded, very dense mostly, brownish gray-grayish brown-greenish gray, *Alluvium*	WO						
23			SS	23	45				35
			WO						
24			SS	24	29				50/24
			WO						
25			SS	25	28				50/27

BORING LOG

BOREHOLE BH3-A1

SHEET 2 OF 2

PROJECT:	Bridge Construction on N380, Cabo Delgado	Coordinates: N: 8689804.7940 E: 620536.0700		Water Level	-0.40 m
LOCATION:	Messalo 1 (Bridge 3) @ South Abutment	Ground Elevation (m-MSL)	46.3870 m	Starting Date	7-10/4/2015
CLIENT:	Chodai Co., Ltd.	Max.Drilling Depth	27.44 m	Finishing Date:	20-21/5/2015

DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO	RECOVERY (cm)	Organic Content (%) 1.0 2.0 3.0	Plastic Limit / Natural Water Content / Liquid Limit (%) 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40	
26		23.0-27.0 m, SP, SAND, fine subangular-subround sand, clean, poorly graded, very dense mostly, brownish gray-grayish brown-greenish gray, *Alluvium*	SS	25	28					
			WO							
			SS	26	45					50//30
			WO							
27		27.0-27.29 m, SW, SAND, fine-coarse sand, *Alluvium*	SS	27	33					50/29
		End of hole @ 27.44 m								

Loss

Lab, WO - Wash out, SS-Split Spoon Sampling

BORING LOG

BOREHOLE BH3-A2

SHEET 1 OF 2

PROJECT: Bridge Construction on N380, Cabo Delgado

LOCATION: Messalo 1 (Bridge 3) @ North Abutment

CLIENT: Chodai Co., Ltd.

Coordinates: S: 8689864.0000 E: 620490.0000

Ground Elevation (m-MSL): 44 (GPS) m

Max.Drilling Depth: 27.00 m

Water Level: -0.900 m

Starting Date: 11/5/2015

Finishing Date: 14/5/2015

DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Ton/m³) 1.6 1.8 2.0	Plastic Limit / Natural Water Content / Liquid Limit (%) 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
0		0.0-4.0 m, CL, silty CLAY, 20% silt, medium plasticity, medium stiff, dark brownish gra, *Alluvium*	WO						
			WO						
1			SS	1	38				8
			WO						
2			SS	2	45				8
			WO						
3			SS	3	45				11
			WO						
4		4.0-5.0 m, SM, silty SAND, 15% silt, fine subangular sand, loose, gray with random brown stripe, *Alluvium*	SS	4	45				7
			WO						
5		5.0-6.0 m, CL, silty CLAY, 30% silt, medium plasticity, stiff, dark brownish gra, *Alluvium*	SS	5	45				10
			WO						
6		6.0-7.0 m, SM, silty SAND, very fine subangular sand-silt, non plasticity, loose, gray, *Alluvium*	SS	6	45				8
			WO						
7		7.0-8.0 m, ML, SILT, non plasticity, loose, greenish-brownish gray, *Alluvium*	SS	7	45				8
			WO						
8		8.0-12.0 m, SP, SAND, fine-medium subangular-subround sand with little coarse, clean, poorly graded, loose-medium dense, greenish-brownish gray, *Alluvium*	SS	8	43				9
			WO						
9			SS	9	45				12
			WO						
10			SS	10	42				17
			WO						
11			SS	11	34				15
			WO						
12		12.0-13.0 m, SM, silty SAND, very fine subangular sand-silt, loose-medium dense, greenish gray, *Alluvium*	SS	12	43				10
			WO						
13		13.0-19.0 m, SP-SW, SAND, fine-medium subangular-subround sand with little coarse,rather clean- clean, poorly graded with well graded at bottom, loose-medium dense, greenish gray-grayish to brownish green, *Alluvium*	SS	13	39				13
			WO						
14			SS	14	32				24
			WO						
15			SS	15	37				30
			WO						
16			SS	16	31				20
			WO						
17			SS	17	32				20
			WO						
18			SS	18	40				17
			WO						
19		19.0-22.0 m, ML, SILT, with little clay, non-slight plasticity, rather clean, medium dense, light-grayish brown-brown with some gray mottled, *Alluvium*	SS	19	45				21
			WO						
20			SS	20	45				18
			WO						
21			SS	21	44				13
			WO						
22		22.0-23.0 m, SM, silty SAND, 10% silt, fine subangular-subround sand, clean, very dense, grayish yellow-yellow, *Alluvium*	SS	22	37				50/22
			WO						
23		23.0-25.0 m, ML, SILT, with little clay, non-slight plasticity, medium dense, grayish-light brown, *Alluvium*	SS	23	39				27
			WO						
24			SS	24	45				28
			WO						
25		25.0-27.0 m, SP-SW, SAND, fine-coarse subangular-subround sand, clean, poorly-well graded, dense-very dense, pale gray-grayish yellow, *Alluvium*	SS	25	41				31
			WO						

BORING LOG

BORING NO. BH3-A2
SHEET 2 OF 2

PROJECT: Bridge Construction on N360, Cabo Delgado
LOCATION: Messalo 1 (Bridge 3) @ North Abutment
CLIENT: Chodai Co., Ltd.

Coord nates: N: 8689864.0000 E: 620490.0000
Ground Elevation (m-MSL): 44 (GPS) m
Max Drilling Depth: 27.00 m

Water Level: 0.90 m
Starting Date: 11/5/2015
Finishing Date: 14/5/2015

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Organic Content (%) 1.0 2.0 3.0	Plastic Limit / Natural Water Content / Liquid Limit (%) 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
26		25.0-27.0 m, SP-SW, SAND, fine-coarse subangular-subround sand, clean, poorly-well graded, dense-very dense, pale gray-grayish yellow-yellowish gray, *Alluvium*	SS	25	41				
			WO						
			SS	26	45				48
27			SS	27	39				50//28
		End of hole @ 27.0 m							

Loss
Lab, WO - Wash out, SS-Split Spoon Sampling

(2) Messalo III bridge

BORING LOG

BOREHOLE BH4-A1
SHEET 1 OF 2

PROJECT: Bridge Construction on N380 Cabo Delgado
LOCATION: Messalo 3 (Bridge 4) @ South Abutment
CLIENT: Chodai Co., Ltd.

Coordinates: S 8690490.3730 E 620293.1800
Ground Elevation (m-MS.): 47.3090 m
Max.Drilling Depth: 32.34 m

Water Level: -1.800 m
Starting Date: 15-18/4/2015
Finishing Date: 22/5/2015

DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO	RECOVERY (cm)	Total Unit Weight (Ton/m³) 1.6 1.8 2.0	Plastic Limit / Natural Water Content / Liquid Limit (%) 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
1		0.0-2.0 m, SW, SAND, fine-medium subangular-subround sand with some coarse, well graded, very loose, light brown, *Alluvium*	WO						
			WO						
			SS	1	20				5
2			WO						
		2.0-3.0 m, CL, silty CLAY, 30% silt, medium plasticity, medium stiff, brownish gray, *Alluvium*	SS	2	39				6
3			WO						
		3.0-6.0 m, ML, SILT-SILT with clay, nil-20% clay, non-low plasticity, loose, brown-brownish gray-gray, *Alluvium*	SS	3	45				5
4			WO						
			SS	4	32				4
5			WO						
			SS	5	41				4
6			WO						
		6.0-7.0 m, CL, silty CLAY, 30% silt, medium plasticity, stiff, brownish gray-gray, *Alluvium*	SS	6	45				10
7			WO						
		7.0-8.0 m, SM, silty SAND, 40% silt, very fine-fine subangular-subround sand, medium dense, gray, *Alluvium*	SS	7	41				10
8			WO						
		8.0-15.0 m, ML, SILT, with little clay, non-slight plasticity, medium dense, brownish gray-gray, *Alluvium*	SS	8	45				13
9			WO						
			SS	9	45				13
10			WO						
			SS	10	45				13
11			WO						
			SS	11	41				13
12			WO						
			SS	12	42				13
13			WO						
			SS	13	45				11
14			WO						
			SS	14	45				13
15			WO						
		15.0-16.0 m, SM, silty SAND, 30% silt, fine subangular-subround sand, medium dense, greenish gray, *Alluvium*	SS	15	45				16
16			WO						
		16.0-17.0 m, ML, SILT, non plasticity, clean, medium dense, gray, *Alluvium*	SS	16	42				19
17			WO						
		17.0-18.0 m, SM, silty SAND, 20% silt, fine subangular-subround sand, medium dense, gray, *Alluvium*	SS	17	32				14
18			WO						
		18.0-19.0 m, SW, SAND, fine-coarse subangular sand, clean, well graded, medium dense, pale gray, *Alluvium*	SS	18	30				22
19			WO						
		19.0-27.0 m, SP, SAND, fine-medium subangular sand, clean, poorly graded, medium dense with random dense @ 23 m, yellowish gray, *Alluvium*	SS	19	35				23
20			WO						
			SS	20	42				25
21			WO						
			SS	21	45				28
22			WO						
			SS	22	45				24
23			WO						
			SS	23	45				41
24			WO						
			SS	24	45				17
25			WO						
			SS	25	45				28
			WO						

BORING LOG

BORING NO. BH4-A1

SHEET 2 OF 2

PROJECT: Bridge Construction on N380, Cabo Delgado

LOCATION: Messalo 3 (Bridge 4) @ South Abutment

CLIENT: Chodai Co., Ltd.

Coordinates: N. 8690490.3730 E. 620293.1800

Ground Elevation (m-MSL): 47.3090 m

Max.Drilling Depth: 32.34 m

Water Level -1.80 m

Starting Date: 15-18/4/2015

Finishing Date: 22/5/2015

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO	RECOVERY (cm)	Organic Content (%) 1.0 2.0 3.0	Plastic Limit / Natural Water Content / Liquid Limit (%) 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
26		19.0-27.0 m, SP, SAND, fine-medium subangular sand, clean, poorly graded, medium dense with random dense @ 23 m, yellowish gray, *Alluvium*	SS	25	45				
			WO						
			SS	26	45				37
27			WO						
		27.0-32.19 m, SW, SAND, fine-coarse subangular sand, well graded, dense-very dense, gray-yellowish gray, *Alluvium*	SS	27	37				39
			WO						
28			SS	28	36				38
			WO						
29			SS	29	32				41
			WO						
30			SS	30	31				50/24
			WO						
31			SS	31	33				33
			WO						
32			SS	32	25				50/19
		End of hole @ 32.34 m							

Loss

Lab, WO - Wash out, SS-Split Spoon Sampling

BORING LOG

BOREHOLE BH4-P1

SHEET 1 OF 1

PROJECT: Bridge Construction on N380, Cabo Delgado

LOCATION: Messalo 3 (Bridge 4) @ Middle P er

CLIENT: Chodai Co., Ltd.

Coordinates: S: 8690526.0000 E: 620277.0000

Ground Elevation (m-MSL): 58 (GPS) m

Max.Drilling Depth 25.50 m

Water Level -0.500 m

Starting Date: 19/4/2015

Finishing Date: 21/4/2015

DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Ton/m³) 1.6 1.8 2.0	Plastic Limit / Natural Water Content / Liquid Limit (%) 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
1		0.0-2.0 m, ML, SILT with clay, 20% clay, low plasticity, loose, brownish gray, *Alluvium*	WO						
			WO						
			SS	1	38				6
2			WO						
		2.0-3.0 m, SP, SAND, fine subangular-subround sand, poorly graded, loose, brown, *Alluvium*	SS	2	45				5
3			WO						
		3.0-4.0 m, SM, silty SAND, 20% silt, fine subround sand, loose, yellowish gray, *Alluvium*	SS	3	35				4
4			WO						
		4.0-6.0 m, CL, silty CLAY, 20% silt, medium plasticity, medium stiff, dark gray-gray, *Alluvium*	SS	4	45				8
			WO						
5			SS	5	45				7
			WO						
6		4.0-6.0 m, CL, silty-sandy CLAY, 40% silt-fine subangular-subround sand, low plasticity, medium stiff, gray-brownish gray, *Alluvium*	SS	6	45				8
			WO						
7		7.0-8.0 m, ML, SILT, non plasticity, loose, brownish gray, *Alluvium*	SS	7	45				10
			WO						
8		8.0-9.0 m, CL, silty CLAY, 40% silt, low plasticity, loose, gray, *Alluvium*	SS	8	45				10
			WO						
9		9.0-13.0 m, ML, SILT, non plasticity, loose mostly, yellowish-brownish-greenish gray, *Alluvium*	SS	9	40				12
			WO						
10			SS	10	40				9
			WO						
11			SS	11	40				10
			WO						
12			SS	12	45				9
			WO						
13		13.0-14.0 m, SP, SAND, medium subangular-subround sand, poorly graded, medium dense, yellowsh gray, *Alluvium*	SS	13	35				15
			WO						
14		14.0-15.0 m, ML, SILT, non plasticity, medium dense, greenish gray, *Alluvium*	SS	14	38				21
			WO						
15		15.0-16.0 m, CL, silty CLAY, 40% silt, low plasticity, very stiff,, brownish-greenish gray, *Alluvium*	SS	15	45				18
			WO						
16		16.0-17.0 m, SP, SAND, fine subround sand, poorly graded, loose, greenish gray, *Alluvium*	SS	16	38				10
			WO						
17		17.0-18.0 m, SM, silty SAND, silt-very fine sand,medium dense, greenish gray, *Alluvium*	SS	17	39				17
			WO						
18		18.0-19.0 m, SW, SAND, fine-coarse subangular-subround sand, clean, well graded, medium dense, grayish yellow, *Alluvium*	SS	18	25				24
			WO						
19		19.0-21.0 m, SP, SAND, fine-medium subangular-subround sand, poorly graded, medium dense-dense, greenish gray-grayish yellow, *Alluvium*	SS	19	37				29
			WO						
20			SS	20	32				32
			WO						
21		21.0-22.0 m, ML, SILT, non plasticity, medium dense, dark greenish gray, *Alluvium*	SS	21	42				21
			WO						
22		22.0-25.5 m, SP, SAND, fine-medium subangular-subround sand, poorly graded, dense-very dense, yellowish gray, *Alluvium*	SS	22	37				35
			WO						
23			SS	23	32				35
			WO						
24			SS	24	35				33
			WO						
25			SS	25	21				5022
		End of hole @ 25.5 m	WO						

BORING LOG

BOREHOLE BH4-A2

SHEET 1 OF 1

PROJECT: Bridge Construction on N380 Cabo Delgado

LOCATION: Messalo 3 (Bridge 4) @ North Abutment

CLIENT: Chodai Co., Ltd.

Coordinates: S 8690575.0000 E 620261.0000

Ground Elevation (m-MSL): 49 (GPS) m

Max.Drilling Depth: 25.50 m

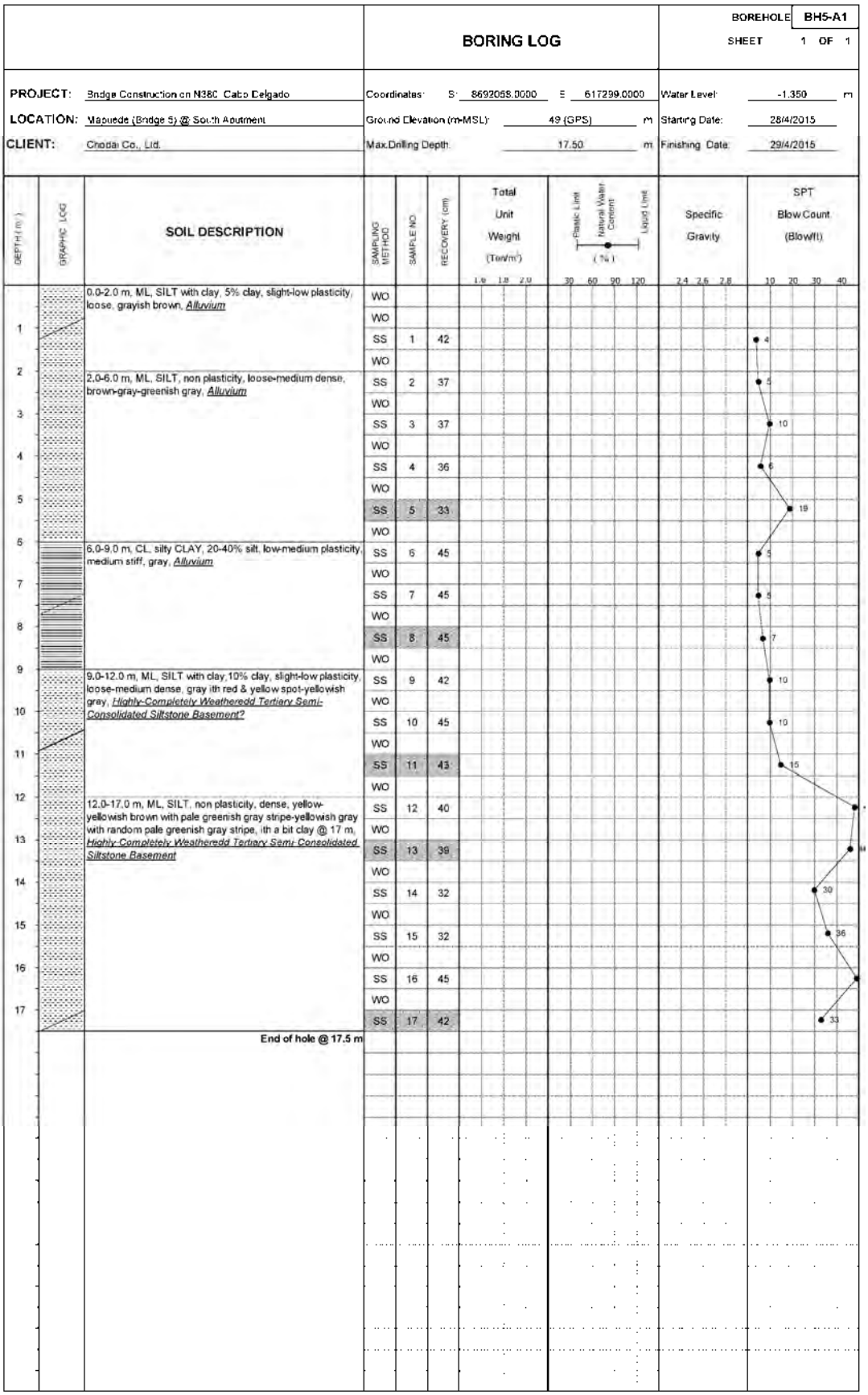
Water Level: -1.600 m

Starting Date: 23/4/2015

Finishing Date: 25/4/2015

DEPTH (m.)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	Total Unit Weight (Ton/m³) 1.6 1.8 2.0	Plastic Limit / Natural Water Content / Liquid Limit (%) 30 60 90 120	Specific Gravity 2.4 2.6 2.8	SPT Blow Count (Blow/ft) 10 20 30 40
		0.0-1.0 m, SP, SAND, fine subround sand, poorly graded, very loose, reddish brown, *Backfill*	WO						
1		1.0-2.0 m, CL, silty CLAY, 20% silt, medium plasticity, soft, dark brownish gray, *Alluvium*	SS	1	8				2
			WO						
2		2.0-3.0 m, ML, SILT, non plasticity, loose, grayish brown, *Alluvium*	SS	2	45				5
			WO						
3		3.0-4.0 m, SP, SAND, fine subround sand, poorly graded, loose, brown, *Alluvium*	SS	3	36				5
			WO						
4		4.0-6.0 m, ML, SILT-SILT with clay, nil-10% clay, non-low plasticity, loose-medium dense, brownish-yellowish gray-gray, *Alluvium*	SS	4	25				4
			WO						
5			SS	5	41				14
			WO						
6		6.0-7.0 m, CL, silty CLAY, 30% silt, low plasticity, medium stiff, gray, *Alluvium*	SS	6	45				8
			WO						
7		7.0-12.0 m, ML, SILT-SILT with clay, nil-10% clay, non-low plasticity, medium dense, brownish-yellowish gray-gray-dark gray, *Alluvium*	SS	7	45				11
			WO						
8			SS	8	41				12
			WO						
9			SS	9	37				13
			WO						
10			SS	10	21				11
			WO						
11			SS	11	42				11
			WO						
12		6.0-7.0 m, CL, silty CLAY, 30% silt, low plasticity, stiff, brownish gray, *Alluvium*	SS	12	43				12
			WO						
13		13.0-15.0 m, ML, SILT, non plasticity, medium dense, greenish-yellowish gray, *Alluvium*	SS	13	39				14
			WO						
14			SS	14	25				18
			WO						
15		15.0-16.0 m, CL, silty CLAY, 40% silt, low plasticity, very stiff, brownish gray, *Alluvium*	SS	15	45				15
			WO						
16		16.0-18.0 m, ML, SILT, non-slight plasticity, medium dense, brownish-greenish gray, *Alluvium*	SS	16	32				13
			WO						
17			SS	17	36				21
			WO						
18		18.0-21.0 m, SP, SAND, fine-medium subangular-subround sand, poorly graded, medium dense-dense, greenish-yellowish gray-grayish yellow, *Alluvium*	SS	18	23				20
			WO						
19			SS	19	25				27
			WO						
20			SS	20	25				34
			WO						
21		21.0-22.0 m, SW, SAND, fine-coarse subangular-subround sand,clean, well graded, dense, yellowish gray, *Alluvium*	SS	21	25				33
			WO						
22		22.0-25.0 m, ML, SILT, non plasticity, medium dense-dense, greenish gray-gray, *Alluvium*	SS	22	25				21
			WO						
23			SS	23	45				34
			WO						
24			SS	24	32				31
			WO						
25		25.0-25.5 m, SP, SAND, F-M sand,clean, poorly graded	SS	25	25				31
		End of hole @ 25.5 m	WO						

(3) Mapuede bridge



BORING LOG

BOREHOLE BH5-A2

SHEET 1 OF 1

PROJECT: Bridge Construction on N380, Cabo Delgado

LOCATION: Mapuede (Bridge 5) @ North Aoutment

CLIENT: Chodai Co., Ltd.

Coordinates: S: 8692052.0000 E 617258.0000

Ground Elevation (m-MSL): 47 (GPS) m

Max.Drilling Depth: 16.50 m

Water Level >-4.0 m

Starting Date: 26/4/2015

Finishing Date: 27/4/2015

DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION	SAMPLING METHOD	SAMPLE NO.	RECOVERY (cm)	SPT Blow Count (Blow/ft)
0		0.0-4.0 m, SW-SP, SAND, fine-medium subangular-subround sand mostly,well-poorly graded, loose-medium dense, reddish brown, *Backfill*	WO			
			WO			
1			SS	1	29	4
			WO			
2			SS	2	36	19
			WO			
3			SS	3	32	10
			WO			
4		4.0-5.0 m, CL, silty CLAY, 20% silt, medium plasticity, medium stiff, gray, *Alluvium*	SS	4	35	6
			WO			
5		5.0-6.0 m, SP, SAND, fine-medium subangular-subround sand, poorly graded, medium dense, pale greenish gray, *Alluvium*	SS	5	45	15
			WO			
6		6.0-8.0 m, SP, SAND, fine subround sand, poorly graded, loose-medium dense, pale greenish gray, *Alluvium*	SS	6	25	8
			WO			
7			SS	7	35	17
			WO			
8		8.0-9.0 m, ML, SILT with clay,10% clay, low plasticity, loose, dark gray, *Alluvium*	SS	8	45	5
			WO			
9		9.0-10.0 m, ML, SILT with clay,10% clay, low plasticity, medium dense, green, *Highly-Completely Wieathered Tertiary Semi-Consolidated Siltstone (Basement)*	SS	9	34	11
			WO			
10		10.0-16.5 m, ML, SILT, non plasticity, medium-very dense, pale greenish-yellowsh gray-grayish yellow, *Highly-Completely Wieathered Tertiary Semi-Consolidated Siltstone (Basement)*	SS	10	37	16
			WO			
11			SS	11	40	27
			WO			
12			SS	12	43	48
			WO			
13			SS	13	40	50/23
			WO			
14			SS	14	42	33
			WO			
15			SS	15	25	50/12
			WO			
16			SS	16	42	50/27
		End of hole @ 16.5 m				

Total Unit Weight (Ton/m³): 1.6 1.8 2.0

Plastic Limit / Natural Water Content / Liquid Limit (%): 30 60 90 120

Specific Gravity: 2.4 2.6 2.8

6-3 Term of reference for IEE

(1) IEE/EIA-ToR of Environmental and Social Consideration Study for Bridge Rehabilitation Projects

Relevant environmental and social studies shall be carried out based on both Mozambique's EIA-related laws and JICA Guidelines for Environmental and Social Considerations (2010). Upon considering the project outline of this bridge rehabilitation projects, certain type of the environmental study such as IEE and/or EIA would be appropriate enough for its environmental license application. The details for subtask of this Environmental and Social Study are described in Tables A1 - A3.

Table A.1 Major Environmental Tasks to be required for the Environmental and Social Study

	Environmental Tasks
1	Descriptions of Current Environment Condition
	Collect environmental baseline information and describe current environmental condition. 1) Bio-Physical condition 2) Socio-Cultural condition More detailed descriptions of this baseline environmental information collection are attached in Table A2.
2	**Local Biological Environmental Field Study at Quirimbusu National Park**
	Scientific description of the flora and fauna as well as other natural resources and habitats around the Quirimbusu National Park and its surrounding buffer zone areas site, shall be summarized and analyzed. In particular, possibilities of existence of migration path, water points and/or feeding grounds around the each project site shall be analyzed.
3	RAP-related Survey
	According to the basic design study results of this bridge rehabilitation project, all new bridge and approach road alignment are located within current RoW and most of engineering works are to be conducted therein. So that, there will be no land-take-related expropriation within this project. If some additional changes will occur within this bridge rehabilitation project and be likely to have expropriation and/or resettlement of nearby households, entire RAP-related information has to be summarized. More detailed descriptions of this baseline environmental information collection are attached in Table A3.
4	Environmental Impact Assessment
	Evaluate potential environmental impacts of three project stages such as 1) pre-construction phase, 2) construction phase, and 3) operational phase shall be described. Besides, following impact assessment studies shall be conducted in order to stress out the advantage/disadvantage of the proposed project quantitatively.
5	Environmental Mitigation

	Environmental Tasks
	Describe comprehensive, effective measures of the mitigation (i.e., avoidance, reduction, and elimination) of negative impacts for the pre-construction, construction and operation phases of the project
6	Environmental Management
	Establish appropriate environmental management plan. Specific objectives of this plan are to 1) define organizational and administrative arrangements for the environmental monitoring, including the definition of responsibilities of staff, coordination, liaison and reporting procedures, and 2) to discuss procedures for pro-active environmental management, so that potential problems can be identified and mitigation measures to be adopted prior to the construction commencement.
7	Environmental Monitoring
	Establish appropriate environmental monitoring program. The scope of the monitoring plan are 1) to identify the monitoring tasks, 2) to identify the nature and the schedule of the monitoring, and 3) to identify samples to be taken for analysis and parameters to be measured.
8	Public Consultations
	Public Consultation shall be conducted at Maputo and the study site, respectively. More detailed descriptions of this baseline environmental information collection are attached in Table A4.
9	Preparation of IEE/EIA D/F
	Prepare IEE/EIA D/F Report that documents the impact study finding. 1) Basic IEE/EIA D/F Report 2) Summary of final report written in both Portuguese and English (10 – 15 pages in length).
10	Preparation of Public Involvement
	Prepare suitable handout or brochure to be used for the public participation process.
11	Revising of IEE/EIA D/F
	Based on the following information or results, revising of IEE/EIA D/F report shall be conducted 1) Feedback loop obtained from the public participation into the IEE/EIA process 2) Comments and advises from relevant environmental agencies. 3) Results of additional and/or supplemental studies.
12	Preparation of IEE/EIA Final Report

	Environmental Tasks
	Prepare IEE/EIA Final Report that documents the impact study finding. 1) Basic IEE/EIA Final Report 2) Summary of final report written in both Portuguese and English (10 – 15 pages in length). 3) Executive summary written in both Portuguese and English (3 – 5 pages in length). 4) Abstract from the executive summary or the summary written in both Portuguese and English (1 – 2 paragraphs in length)

Table A.2 Descriptions of Current Environment Condition

1. Bio-Physical condition
1) Regional hydrology (e.g., major tributaries, channels, regional water balance) 2) Water quality of surface/subsurface within the study area. 3) Air quality 4) Regional drainage 5) Roadside noise/vibration/air quality 6) Climate 7) Geology 8) Disaster Records (e.g., past earthquake, landslide, inundation or flood events) 9) Soil 10) Biological Environment (e.g., Quirimbas National Park area)
2. Socio-Cultural condition
1) Cultural (historical and archaeological) resources (e.g., ruins, memorial facilities, historic spots and others) 2) Visual resources (e.g., scenic zones, townscape) 3) Land take/resettlements (e.g., conditions of existing roadside building) 4) Illegal squatter 5) Land use 6) Water use (e.g., water supply system, well, oasis) 7) School, hospital, park, library, religious facilities. 8) Waste Disposal Site (location, capacity, treatment method) 9) Vehicle Registration 10) Vehicle Inspection/Maintenance Program 11) Clean Fuel Program 12) Sewage system 13) Property price (e.g., land and house by type) around the study area.
3. Pollution

1) Roadside Noise/Vibration 2) Roadside Air Quality 3) Soil Contamination 4) Water Contamination 5) Bad odor

Table A.3 RAP-related Survey

1) Collection of relevant legislations on land acquisition, resettlement and compensation 2) Inventory survey 3) Interview survey 4) Map showing location of each PAPs Tasks 2) and 3), mentioned above, aim to identify profiles of households living in the Study Area and to clarify the profiles of their inventories. The surveys 2) and 3) include the preparation of questionnaires, the survey's implementation by means of questionnaire, compilation and analysis of survey results. Questionnaires consist of questions related to inventory of properties such as house, farmlands, buildings, crops and household profiles.

Table A.4 Public Consultations

(1) Outline In order to disseminate the study outline, the draft ToR of the environmental and social study and the findings of the proposed study, two (2) one-day public consultations at Maputo and the study sites, shall be conducted. In particular, all PAPs shall be invited at the public consultations to be held at the study site. Public notice using either of poster, newspaper, TV, radio and other media shall be conducted prior to each stakeholder meeting campaigns. At least three (3) consultants will work at each public consultation as the facilitator, the computer/equipment operator and note taker. All the expenses, including the copy of presentation materials, the hall charge, transport expenses of the participants, and meal/drinks are payable by the consultant and should be included in the cost proposal. Also, all the discussion at the public consultations will be recorded and minutes of the meeting are prepared by the consultants. Relevant information, to be used for the public consultation, is provided by both ANE and JST. It is noted that contents of both presentation and handout shall be consulted and approved by both ANE and JST before each stakeholder meeting. (2) Opinion Surveys Within this series of stakeholder meeting, several opinion surveys are planned to be conducted in order to analyze each stakeholder's view of the proposed bridge rehabilitation project. The survey form is to be developed by the ANE and JST, and selected Consultant shall make appropriate amount of copies of that survey sheets, conduct those opinion surveys to all

participants of each stakeholder meeting at the end of each meeting, and then, conduct post-data processing work.

(3) Public Review Period

All contents of Q/A Session, to be discussed within this stakeholder meeting, are to be presented in the public domain (e.g., Library, Internet or by some appropriate measures). This public review process shall be carried out after each stakeholder meeting (i.e., at least twice). Prior to each public review, appropriate public notice shall be conducted, using either of poster, newspaper, TV, radio and other media.

(4) Deliverables

1) Presentation Material (PowerPoint File)

2) M/M shall be prepared in both English and Portuguese.

3) List of Participants

4) Photo Records

5) Survey Sheets of Opinion Survey and Post Data Processing file (Excel-format)

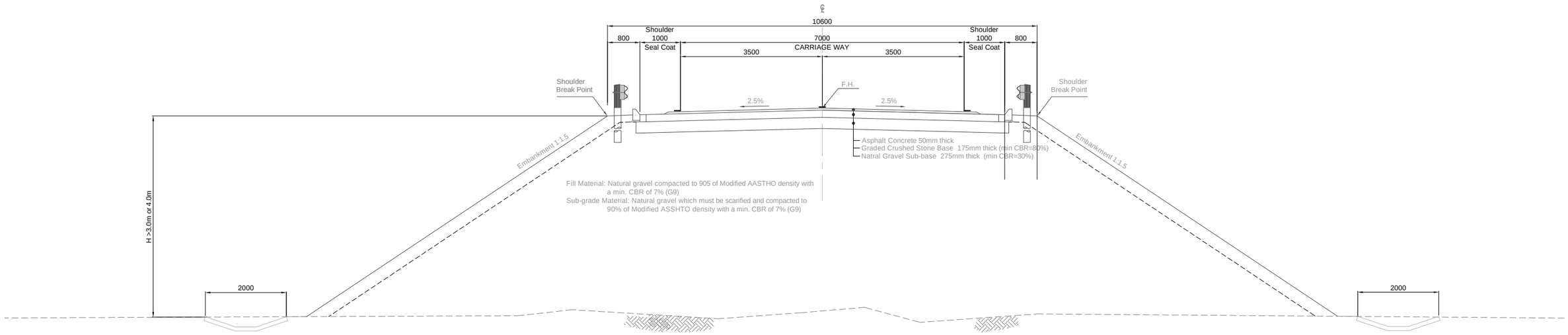
(4) Equipment and others

Support for Environmental Approval Application

All study works, mentioned above, shall be completed by the end of March 2016, and environmental approval shall be made by the end of either of January or February 2016. In order to make a successful environmental approval process, selected Consultant shall support ANE's relevant application work until the environmental license for the proposed bridge rehabilitation project is issued.

TYPICAL ROAD CROSS SECTION

TYPICAL ROAD CROSS SECTION FOR 2-LANE (Paved Section)
H> 4.0m



TYPICAL ROAD CROSS SECTION FOR 2-LANE (Paved Section)
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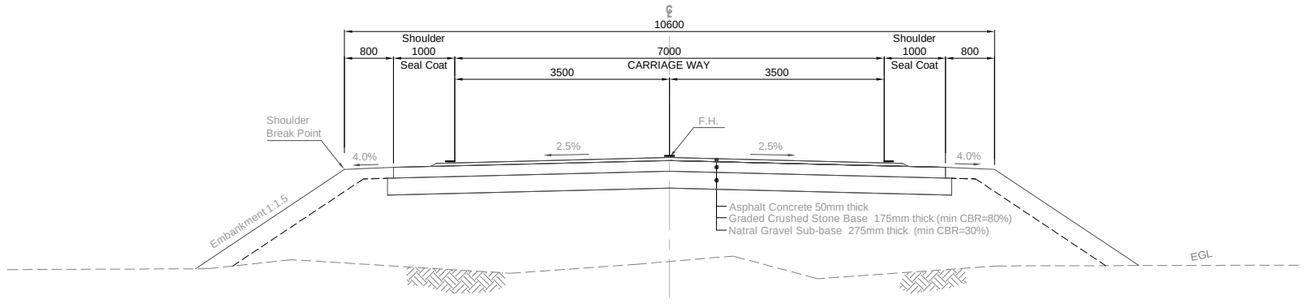
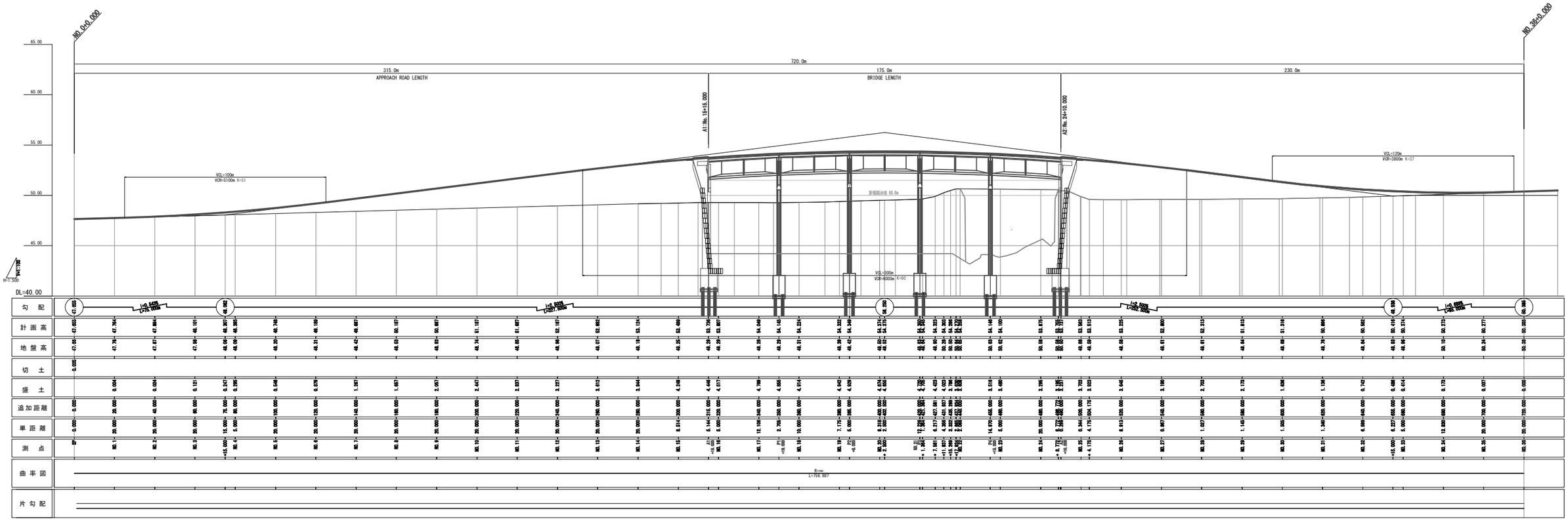


NATIONAL ROADS ADMINISTRATION(ANE)	THE PROJECT FOR CONSTRUCTION OF BRIDGES ON N380 IN CABO DELGADO PROVINCE	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	TITLE	SCALE	DATE	DRAWING NO.



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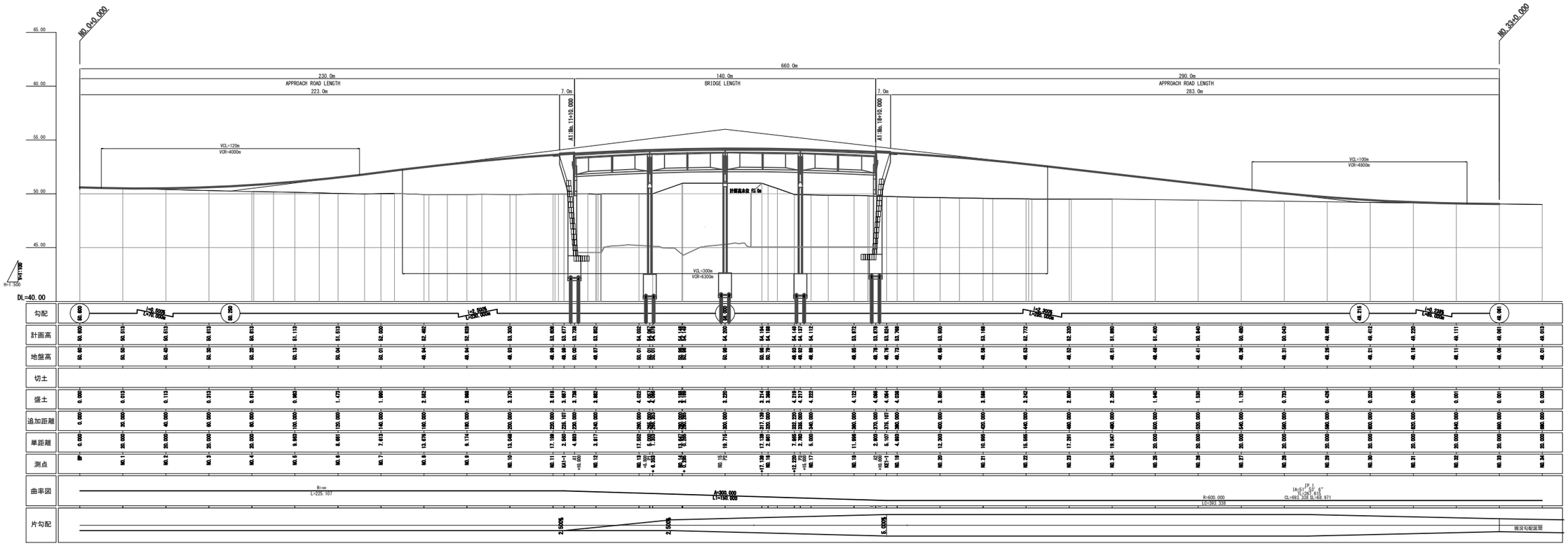
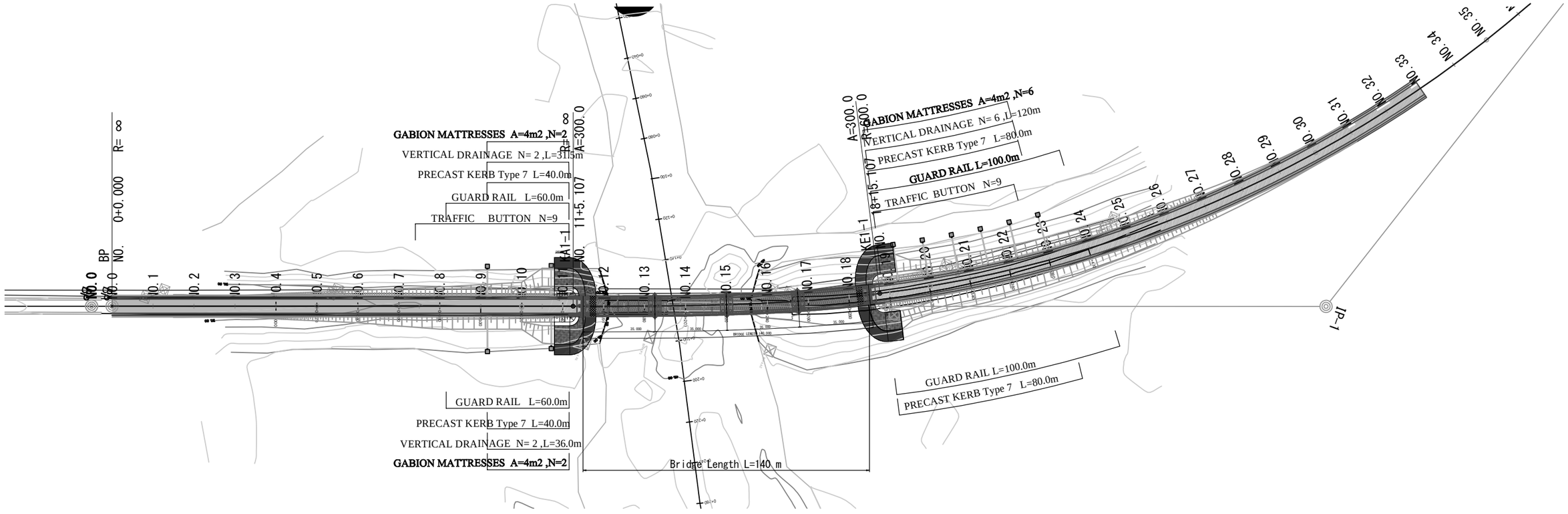
			PLAN and PROFILE (MESSALO 1)	1:2000		





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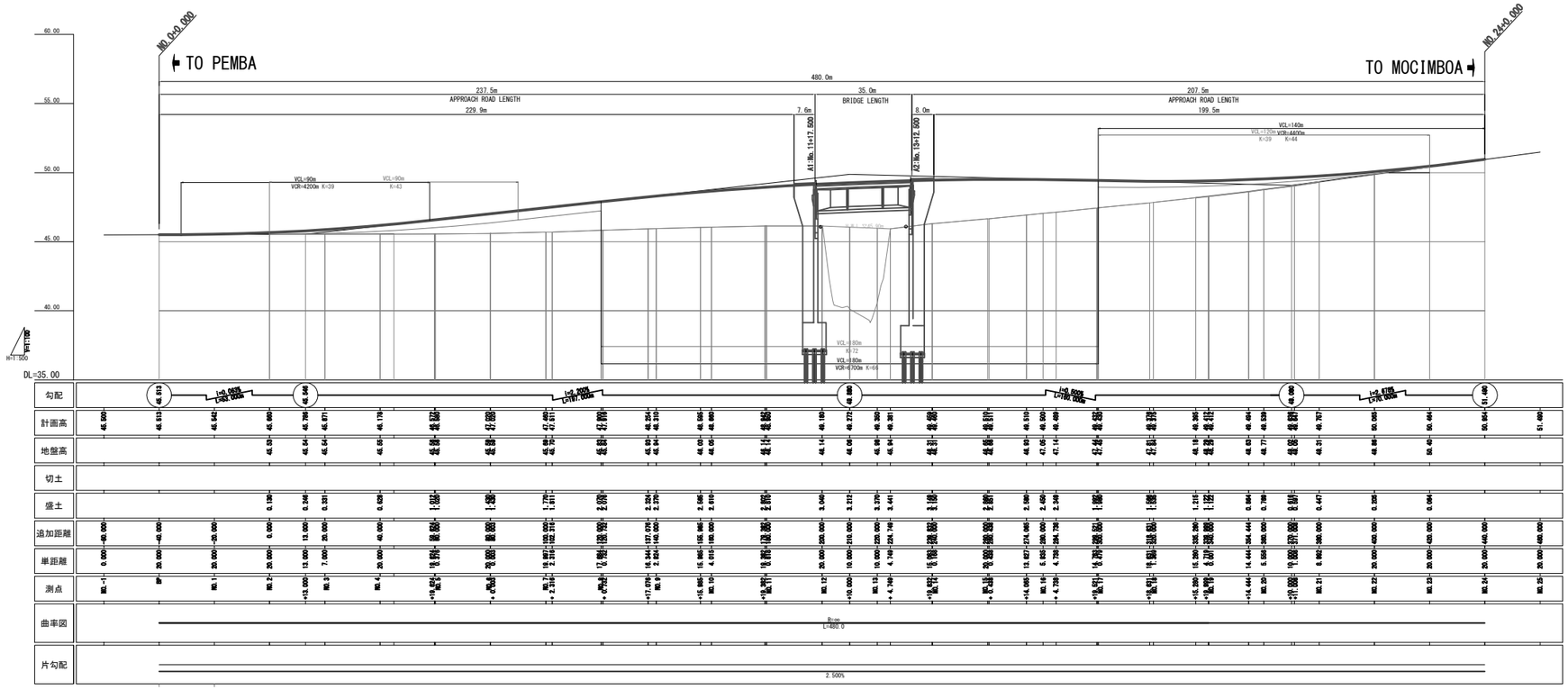
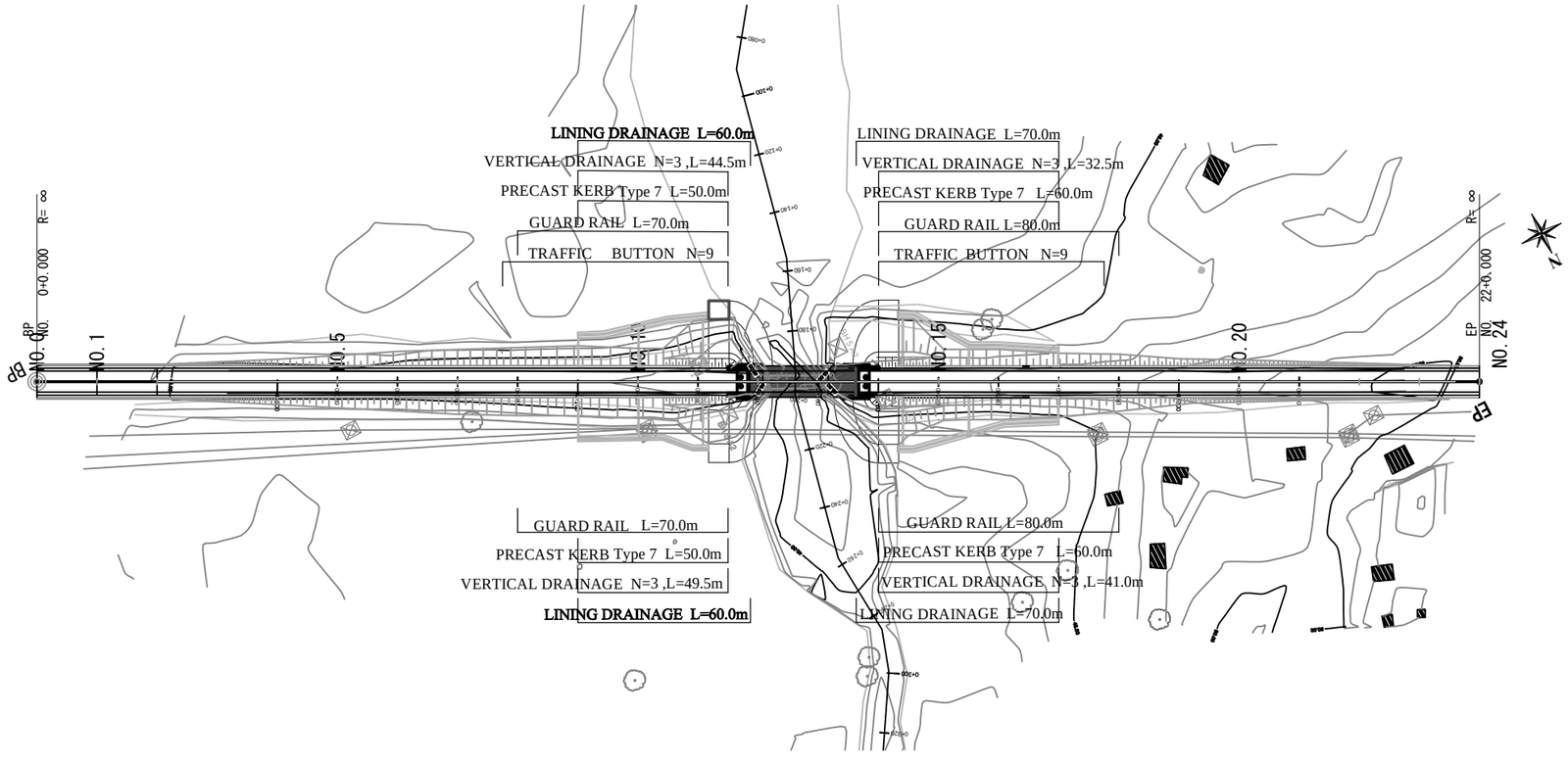
			PLAN and PROFILE (MESSALO 3)	1:2000		





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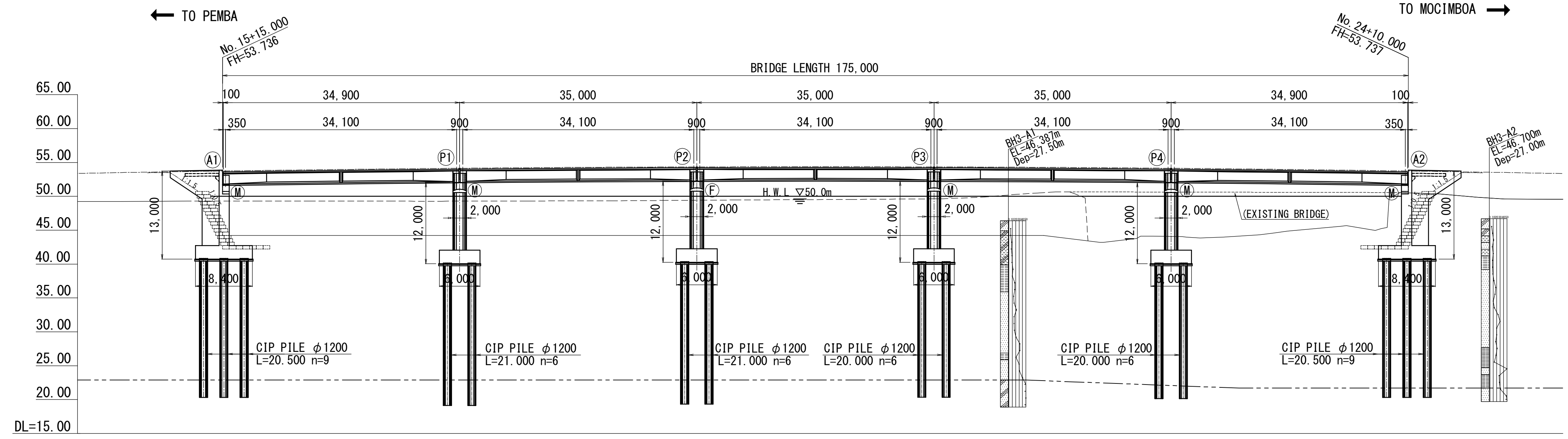
			PLAN and PROFILE (Mapuede)	1:2000		

GENERAL VIEW OF MESSALO 1

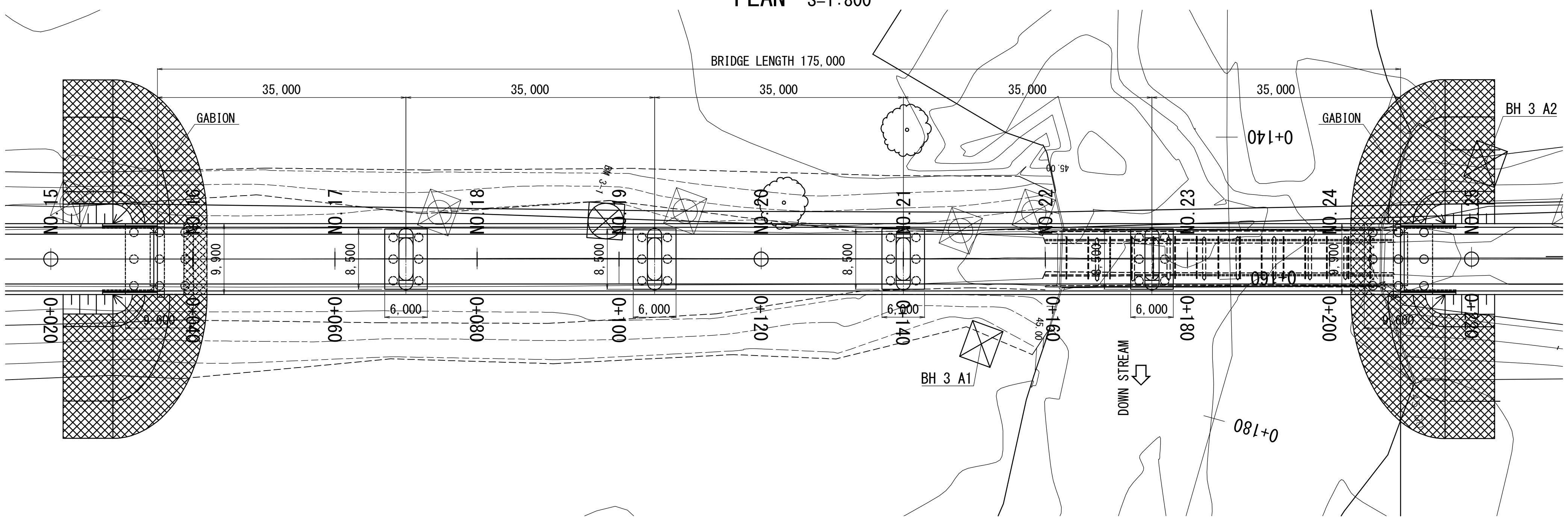
ELEVATION S=1:800



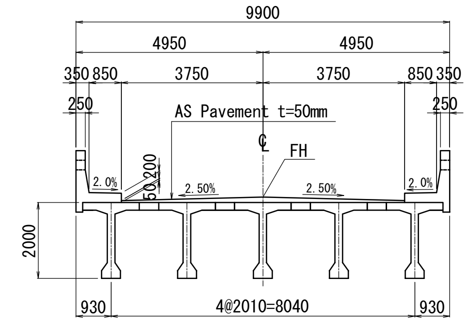
GRADIENT: i=2.500% L=327.500m — 56.250 — i=2.500% L=252.500m

PROPOSED HEIGHT	GROUND LEVEL	DISTANCE	CHAINAGE
53.499	49.25	300.000	NO.15
53.660	49.29	309.856	+ 9.856
53.736	49.29	315.000	A1 +15.000
53.807	49.29	320.000	NO.16
53.911	49.29	327.894	+ 7.894
54.049	49.28	340.000	NO.17
54.121	49.28	347.295	+ 7.295
54.145	49.29	350.000	P1 +10.000
54.224	49.31	360.000	NO.18
54.301	49.34	372.825	+12.825
54.332	49.39	380.000	NO.19
54.349	49.42	385.000	P2 +5.000
54.364	49.46	390.682	+10.682
54.374	49.50	400.000	NO.20
54.375	49.52	402.500	+ 2.500
54.372	49.54	407.774	+ 7.774
54.350	49.63	420.000	NO.21
54.345	49.64	421.364	P3 + 1.364
54.323	49.90	427.581	+ 7.581
54.303	50.28	431.937	+11.937
54.286	50.50	435.269	+15.269
54.270	50.64	437.934	+17.934
54.258	50.65	440.000	NO.22
54.146	50.63	455.000	P4 +15.000
54.100	50.62	460.000	NO.23
53.875	50.58	480.000	NO.24
53.755	50.56	488.772	+ 8.772
53.737	50.50	490.000	A2 +10.000
53.674	50.37	494.223	+14.223
53.588	49.90	499.656	+19.656
53.583	49.88	500.000	NO.25
53.513	49.59	504.175	+ 4.175
53.392	49.58	511.087	+11.087

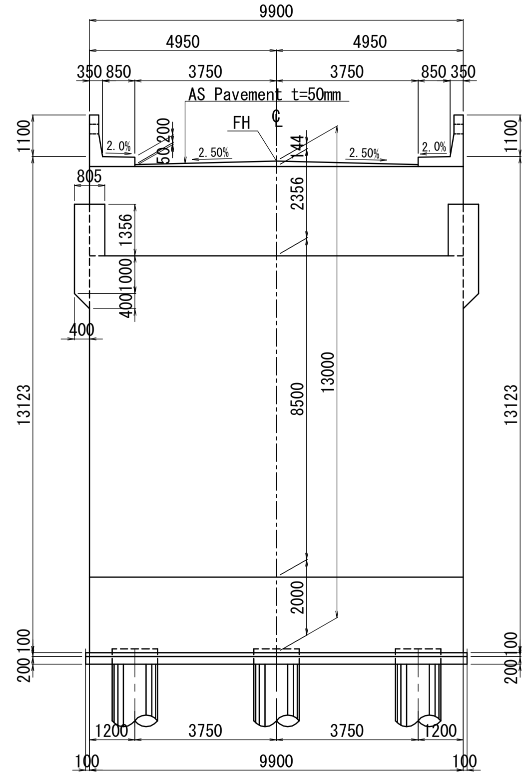
PLAN S=1:800



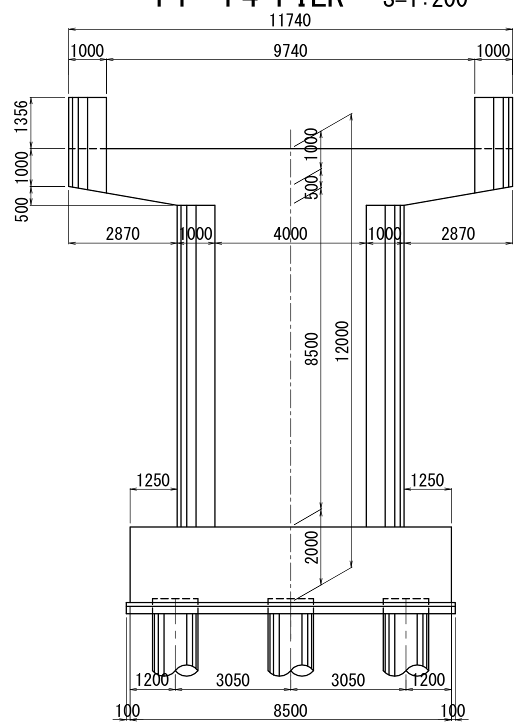
GIRDER SECTION S=1:200



A1, A2 ABUTMENT S=1:200



P1～P4 PIER S=1:200



NOTE:
1) HWL was estimated based on the hearing of the field survey.
   It will be finalized based on the hydraulic analysis results.
2) Dashed Line was estimated existing ground Line.
   It will be excavating.

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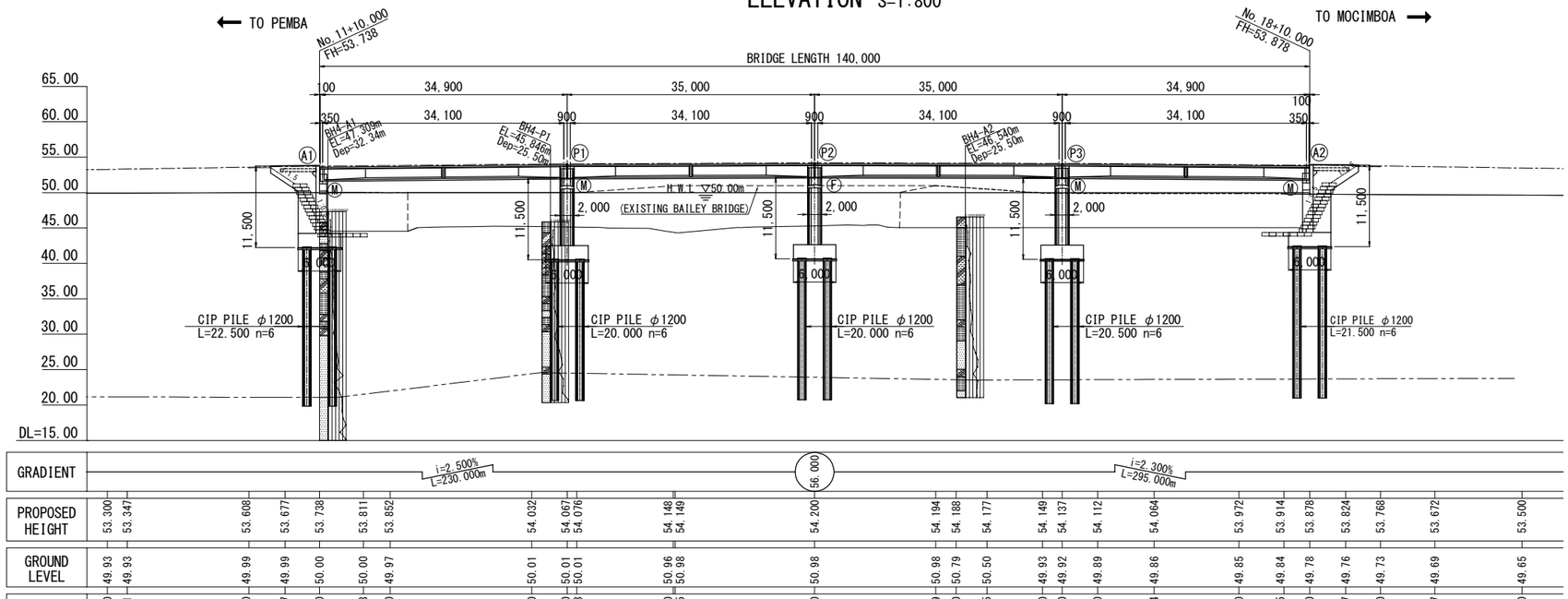
			GENERAL VIEW OF MESSALO 1	AS SHOWN		

GENERAL VIEW OF MESSALO 3

ELEVATION S=1:800



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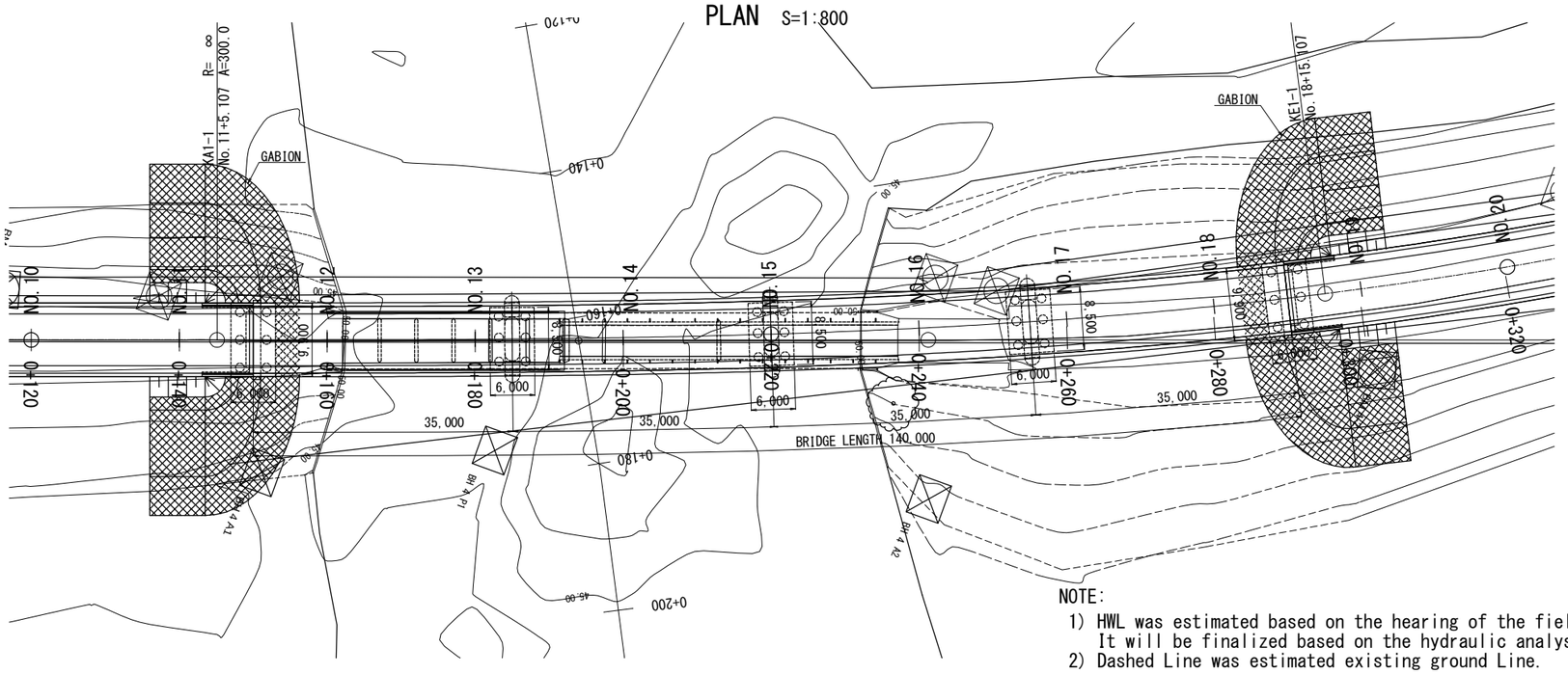

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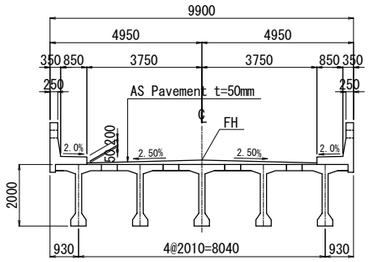
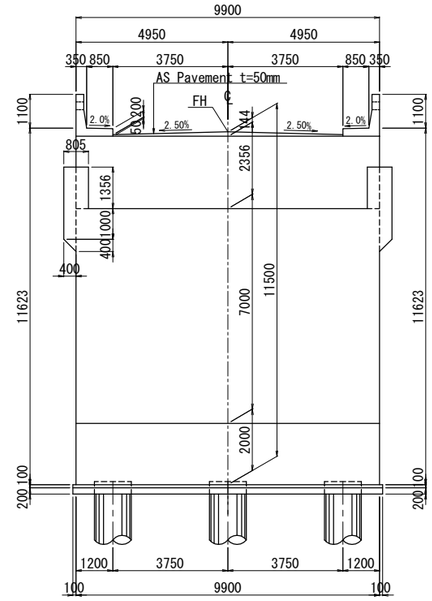
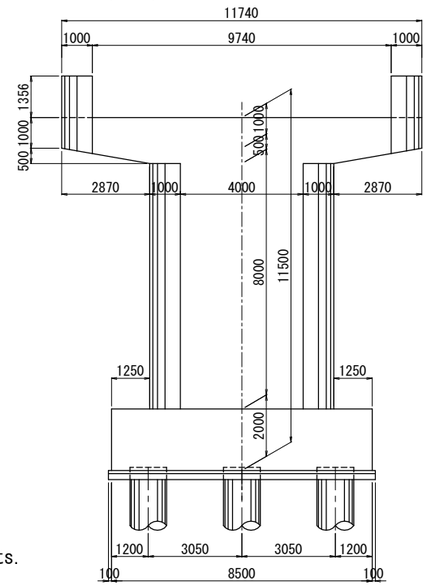
GIRDER SECTION S=1:200



A1, A2 ABUTMENT S=1:200



P1, P2, P3 PIER S=1:200



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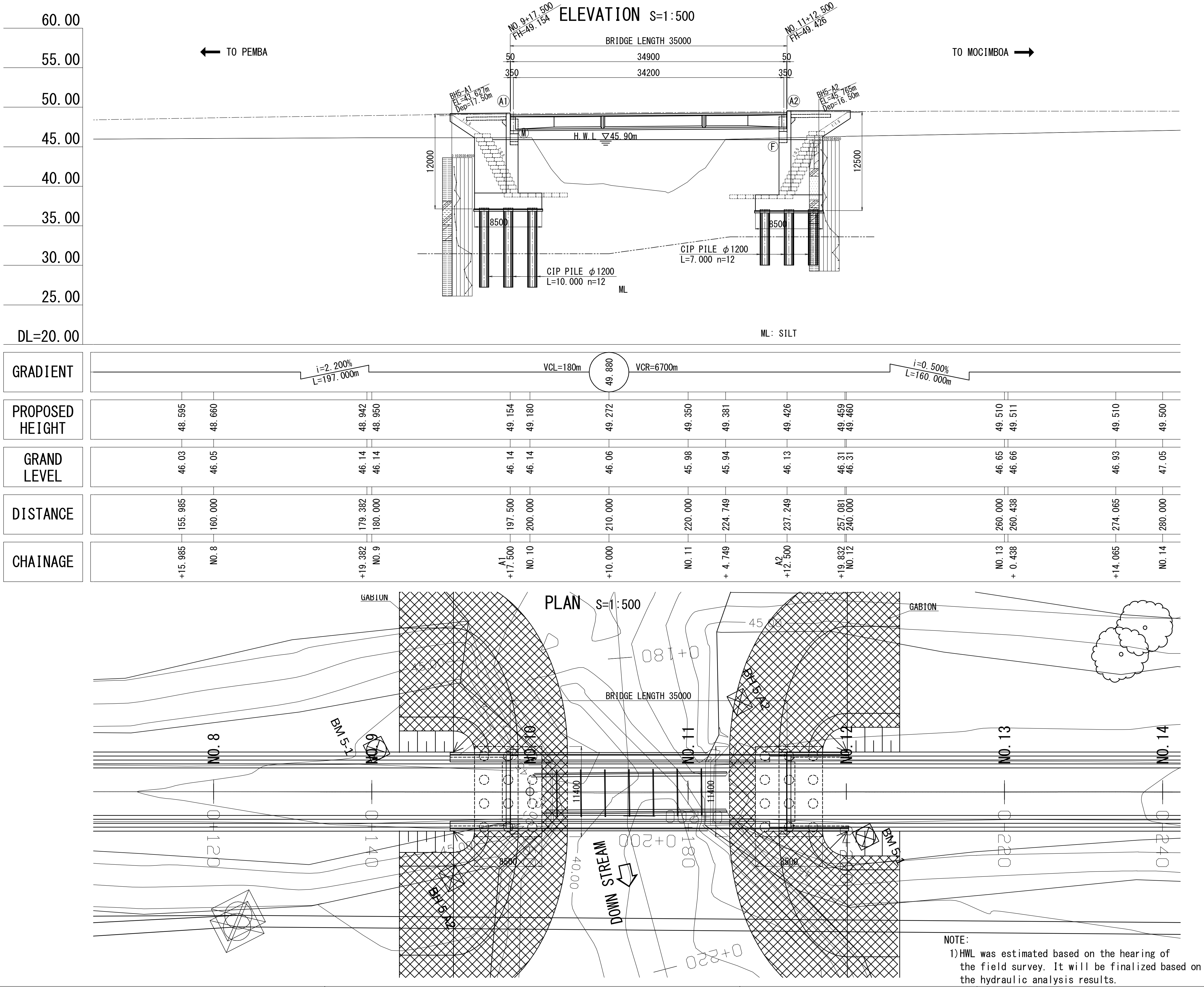
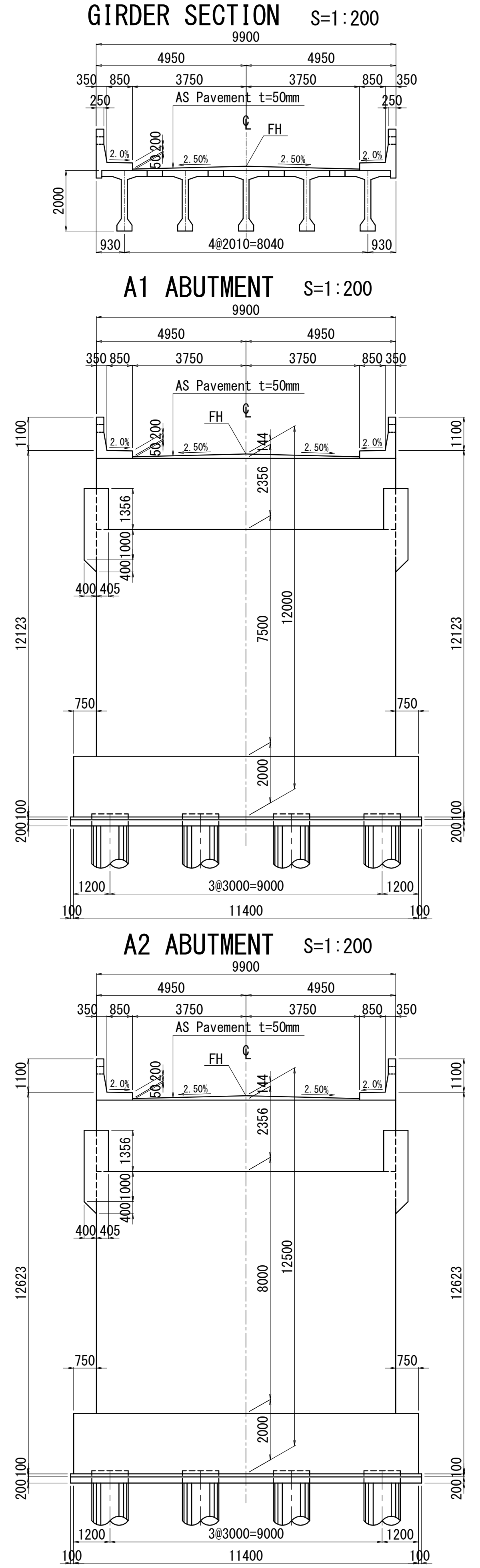
			GENERAL VIEW OF MESSALO 3	AS SHOWN	

GENERAL VIEW OF MAPUEDE





NOTE:
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