National Road Administration (ANE)
The Republic of Mozambique

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR CONSTRUCTION OF BRIDGES
ON
N380 IN CABO DELGADO PROVINCE (PHASE-2)
IN
THE REPUBLIC OF MOZAMBIQUE

December 2019

JAPAN INTERNATIONAL COOPERATION AGENCY

CHODAI CO., LTD.

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Exchange rates in this report
1.00 USD = 111.62 JPY
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(Average between December 2018 and February 2019)
MZN : Mozambique Metical

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 the Republic of Mozambique, and conducted a field investigations. 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.

December, 2019

Itsu ADACHI
Director General,
Infrastructure and Peacebuilding Department
Japan International Cooperation Agency

Summary

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 km2, 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.

Mozambique has a population of about 29.49 million and has grown at an annual rate of 2.7 ~ 2.9% over the past 10 years. The economic growth rate was around 6 ~ 7%, but since 2016, it has been in the 3% range for 3 consecutive years. However, the private sector is highly willing to invest due to the abundant resources (natural gas, coal), and Mozambique is one of the countries expected to achieve stable growth in the future.

(2) Background of the Requested Japanese Assistance

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 (hereinafter “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, many bridges on this national road were built by the government of Portugal about 60 years ago and there is a risk of bridge collapse due to deterioration. Therefore, it is necessary to replace bridges as soon as possible.

Based on this situation, the government of Japan concluded a grant agreement (hereinafter “G/A”) for grant aid "The Project for Construction of Bridges on N380 in Carbo Delgard Province" in April 2017

to replace 3 bridges that are at particularly high risk of collapse. The Preparatory Survey for the Project for Construction of Bridges on N380 in Cabo Delgado Province (Phase 2) (hereinafter "the Survey") was requested by the government of Mozambique in August 2017 following the above project, and is a grant aid for rebuilding undeveloped 4 bridges on N380.

The Government of Mozambique requested the replacement of five bridges in August 2017. After consultation with the ANE, it was agreed in December 2018 that four bridges except the Catipusse Bridge would be targat to the request.

(3) Summary of the Survey Findings and Project Contents

From February 2019 to November 2019, JICA dispatched a total of 2 preparatory missions to the field. In the first site survey, the following were mainly carried out: Topographic and geological surveys, meteorological and hydrological surveys, environmental surveys, socioeconomic surveys, and construction-related procurement conditions and price surveys on terget bridges. Based on these survey results, road width composition, bridge location, road alignment, bridge type, etc. were examined, and the results of the examination were discussed and confirmed with the local parties concerned. After that, in Japan, they carried out the outline design such as road and bridge design, construction plan, estimation of the project cost, decision of the obligations of the Mozambique government, etc., and they compiled it as a cooperation preparatory survey report (draft). In the 2nd site survey (November 2019), this plan and the outline design contents were explained to the Mozambique government.

List of Target Bridges

Item	Muagamula Br.	Muera I Br.	Muera II Br.	Mungoe Br.
Bridge location on N380	Macomia+12.8km	Macomia +85.7km	Macomia +85.9km	Macomia +99.2km
Length of target section (Bridge and Road)	790 m	400 m	370 m	480 m
Carriageway width	3.5m × 2 Lane	3.5m × 2 Lane	3.5m × 2 Lane	3.5m × 2 Lane
Shoulder width (Bridge)	0.25 m	0.25 m	0.25 m	0.25 m
(Road)	1.00 m	1.00 m	1.00 m	1.00 m
Sidewalk width (Bridge)	0.85m (each side)	0.85m (each side)	0.85m (each side)	0.85m (each side)
(Road)	N/A	N/A	N/A	N/A
Total width (Bridge)	9.90m	9.90m	9.90m	9.90m
(Road)	10.60m	10.60m	10.60m	10.60m
Bridge type	Concrete bridge	Concrete bridge	Concrete bridge	Concrete bridge
Bridge length	35.0 m	50.0 m	25.0 m	25.0 m
Span arrangement	1 @ 35.0m	2 @ 25.0m	1 @ 25.0m	1 @ 25.0m
Superstructure type	Simple span post-tension T girder	2 span continuous post-tension T girder	Simple span post-tension T girder	Simple span post-tension T girder
Substructure type	2 inversed T type abutments	2 inversed T type abutments and a wall type pier	2 inversed T type abutments	2 inversed T type abutments
Foundation type	CIP piles	CIP piles	CIP piles	CIP piles

(4) Project Period and Estimated Project Cost

The planned period is 10.5 months for the detailed design work and tender assistance work, and 22.0 months for construction. The project cost is estimated to be 11 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.

i) 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.

ii) 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.

iii) Road Development Plan

Formulation of a trunk road network has a high priority in the Economic and Social Plan Integrated Road Sector Program 2016 (PRISE) prepared by ANE. 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.

iv) 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

i) Quantitative Outputs

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

Increase of Annual Average Daily Traffic (AADT)

The traffic volume has been increasing by around 3.7% every year according to the traffic survey which ANE carried out between 2010 and 2017. The percentage of heavy vehicle traffic exceeds 50.0% 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 505 cars /12hours in 2026 from 391 cars/12 hours in 2019.

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.

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.

Reduction of Travel Time

The Bailey bridge between Maccomia and Oasis on National Route 380 has load restrictions. For this reason, a heavy vehicle full of luggage will use a detour (Macomia-Mucojo-Oasse) from Macomia to the coast. In this case, the travel time is about 300 minutes because the distance is longer than that of N380 and the road is unpaved. After the project, it will be possible to travel to Oasse using N380, so the travel time will be approximately 75 minutes and the travel time will be shortened by approximately 225 minutes.

Quantitative Outputs

Index	Initial Value (2019)	Target Value (2026) 【3 years after completion】
Traffic volume (12 hours)	391	505
Travel time for heavy vehicles(Macomia-Oasse)	300 minutes	75 minutes
Passenger volume （paasenger/year） （12hour, 6:00-18:00）	496,000	640,000
freight flows （ton/year）	273,000	353,000

ii) Qualitative Outputs

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

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

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.

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.

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.

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.

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.

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.

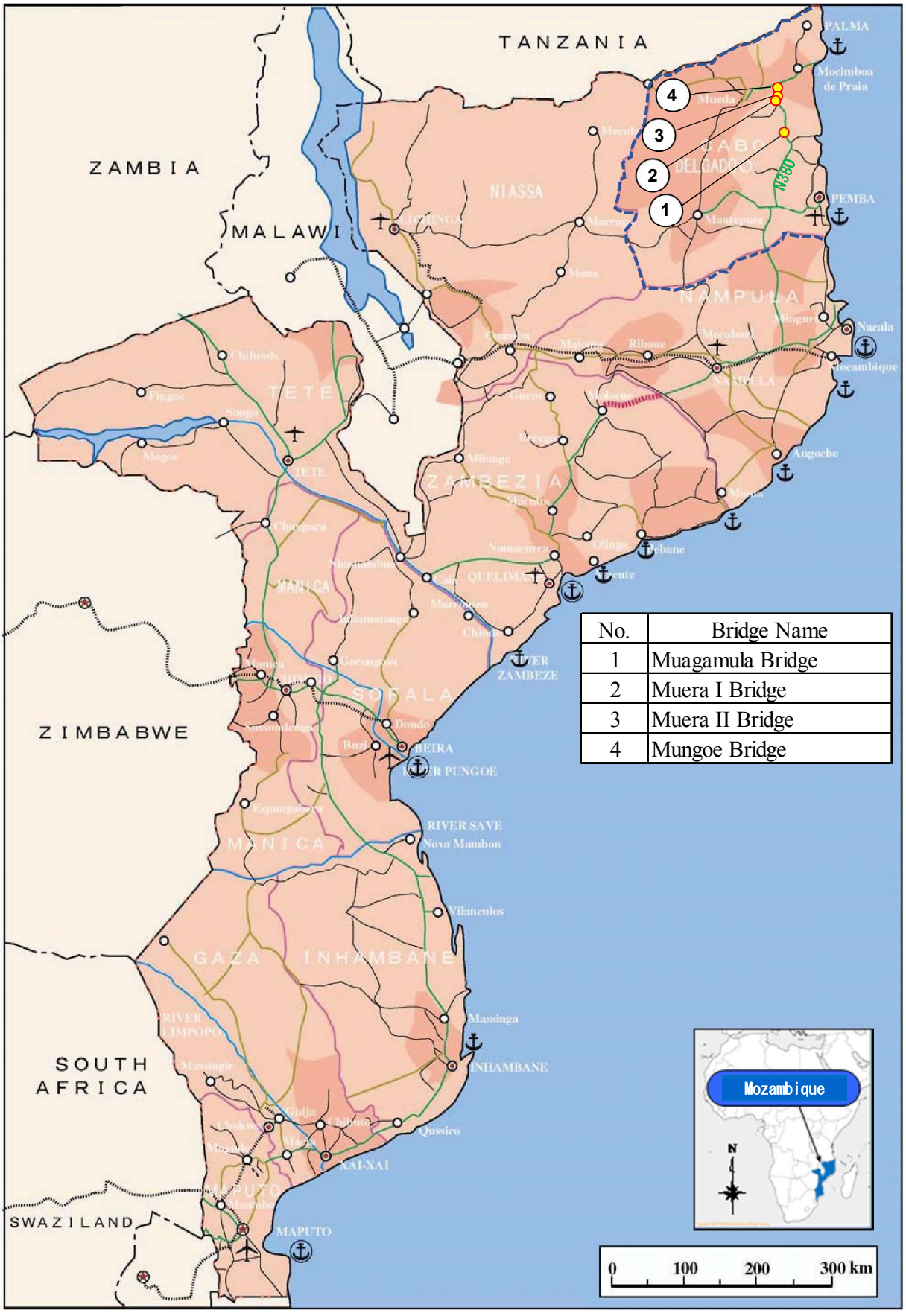
The traffic volume on N380 will increase once the bridges have been replaced.

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.

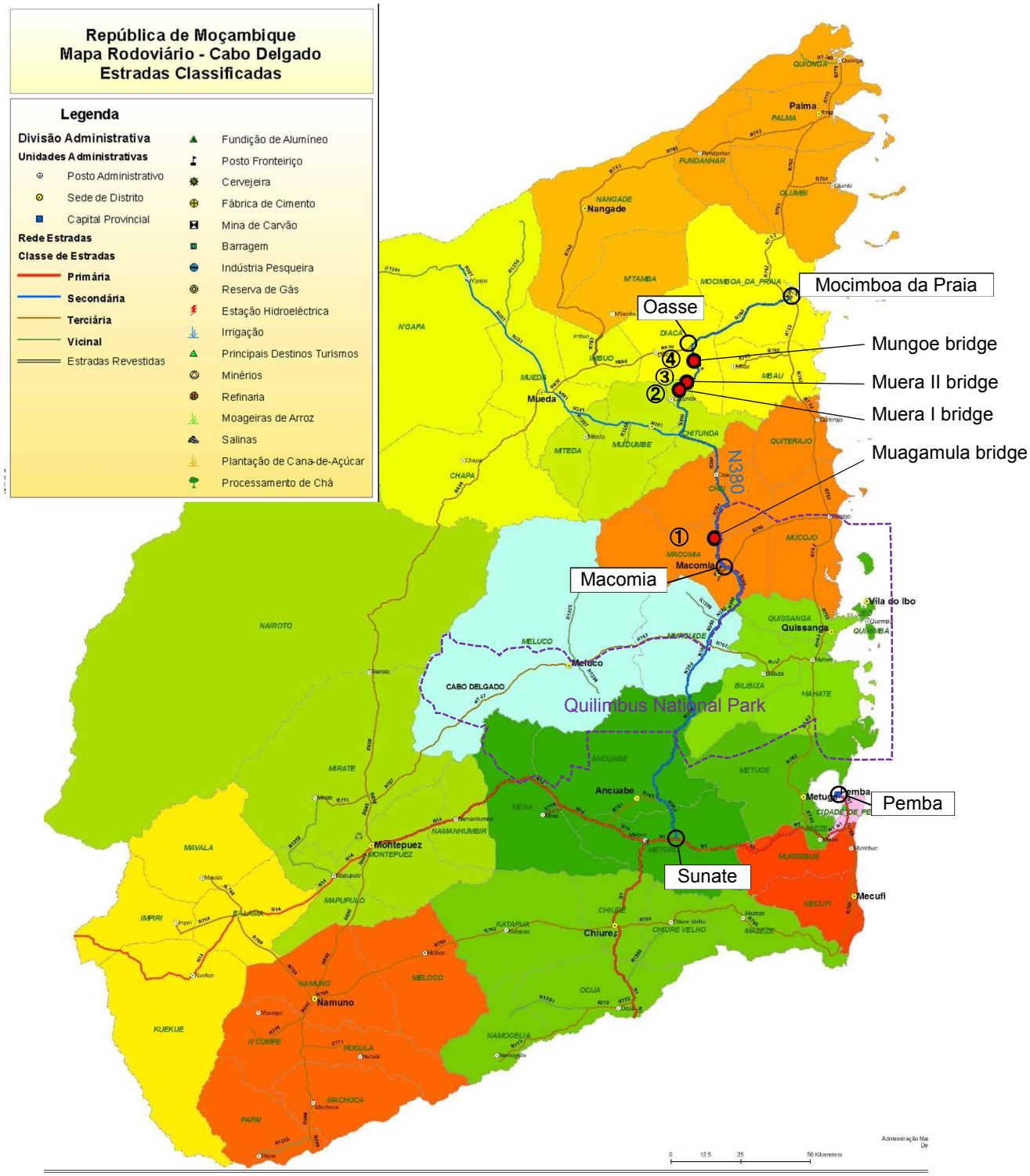
Contents

Location Map (Mozambique)



No.	Bridge Name
1	Muagamula Bridge
2	Muera I Bridge
3	Muera II Bridge
4	Mungoe Bridge

Locatin Map (Cabo Delgado Province)



Perspective

1．Muera I Bridge

Completion perspective drawing of Muera I Bridge (1)

Completion perspective drawing of Muera I Bridge (2)

2. Muera II Bridge

Completion perspective drawing of Muera II Bridge (1)

Completion perspective drawing of Muera II Bridge (2)

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Abbreviations

AfDB	African Development Bank
ANAC	National Administration for Conservation Areas
ANE	National Roads Administration
CENACARTA	Centro National de Cartografia e Teledeteccao
CFM	Portos e Caminhos de Ferro de Mocambique
DAC	Development Assistance Committee
DNA	National Directorate of Water
DPTADER	Provincial Directorate for Land, Emviromental and Rural Development
EIA	Environmental Impact Assessment
E/N	Exchange of Notes
EU	European Union
FE	Road Fund
GDP	Gross Domestic Product
GNI	Gross National Income
GRDP	Gross Regional Domestic Product
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
MOPHRH	Ministry of Public Works, Housing and Water Resources
NGO	Non-Governmental Organization
PARPA	Action Plan for the Reduction of Absolute Poverty
PEDEC-NACALA	Project for Economic Development Strategies in the Nacala Corridor
PRSP	Poverty Reduction Strategy Papers
QNP	Quirimbas National Park
RAP	Resettlement Action Plan
ROW	Right of Way
SADC	Southern Africa Development Community
SATCC	Southern Africa Transport and Communications Commission
SEA	Simplified Environmental Assessment

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.

Ministry of Public Works, Housing and Water Resources (hereinafter "MOPHRH") 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.

ANE subsequently developed Master Plan for National Highway Network of Mozambique, 2015, which outlined the importance of constructing a highway network and improving existing roads to improve safe and smooth transport capacity, and the direction of road policy in response to national development goals and strategies. Believing that networks among economic hubs are important for the revitalization of society and the economy in promoting road policies under this master plan, Economic and Social Plan Integrated Road Sector Program 2016 (PRISE 2016) was formulated in 2016 and construction of road networks is being promoted.

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

30,352km. On the other hand, the pavement rate is only 26 % for the whole road network as shown in Table 1-1 Road Length List (km). The total road length in Cabo Delgado Province is 2,917 km, with 770 km (26 %) of paved and 2,147 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 Road Length List (km)

Province	Road Length (2017)		
	Paved	Unpaved	Sub-total
Maputo	639	997	1,636
Gaza	892	1,819	2,711
Inhambane	705	2,175	2,880
Sofala	677	1,665	2,342
Manica	748	1,721	2,469
Tete	961	1,985	2,946
Zambezia	888	3,571	4,459
Nampula	849	3,169	4,018
Cabo Delgado	**770**	**2,147**	**2,917**
Niassa	693	3,281	3,974
Total	7,822	22,530	30,352
Pavement Rate	26%		

Source: ANE Road Inventry

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 (hereinafter “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, many bridges on this national road were built by the government of Portugal about 60 years ago and there is a risk of bridge collapse due to deterioration. Therefore, it is necessary to replace bridges as soon as possible.

Based on this situation, the government of Japan concluded a grant agreement (hereinafter “G/A”) for grant aid "The Project for Construction of Bridges on N380 in Carbo Delgard Province" in April 2017 to replace 3 bridges that are at particularly high risk of collapse. The Preparatory Survey for the Project for Construction of Bridges on N380 in Cabo Delgado Province (Phase 2) (hereinafter “the Survey”) was requested by the government of Mozambique in August 2017 following the above project, and is a grant aid for rebuilding undeveloped 4 bridges on N380.

The Government of Mozambique requested the replacement of five bridges in August 2017. After consultation with the ANE, it was agreed in December 2018 that four bridges except the Catipusse Bridge would be targat to the request.

Table 1-2 Outline of the Project

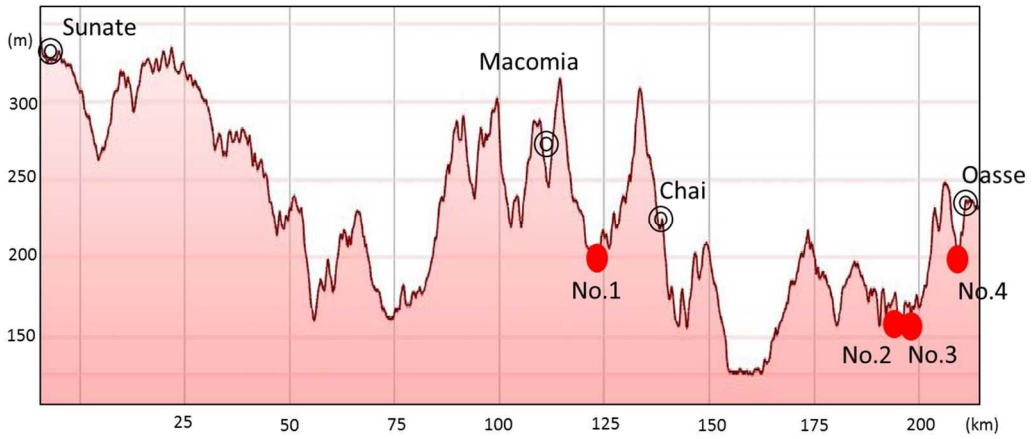
Location	N380, Cabo Delgado Province, Mozambique
Overall goal	Economy and social development in northern region of Mozambique and neighboring countries (Tanzania, Malawi and Zambia) promoted by the improvement of transportation capability of National Road N380.
Objectives	The bridge construction project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

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 1-1 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.

Topographic survey around the target bridge has been carried out in the preparatory survey for phase 1 project. However, additional topographic surveys were conducted in this study for the sections where the extent of survey coverage was expected to be insufficient (40 ~ 80 metres of road along the bridges Muela I and II and Mungoe).



Sorce: The JICA Study Team (Edited from Google Earth)

Figure 1-1 Schematic Topographical Profile of N380

1.3.2 Geological Investigation

The geological map of target area in Figure 1-2 shows that the road area around N380 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)

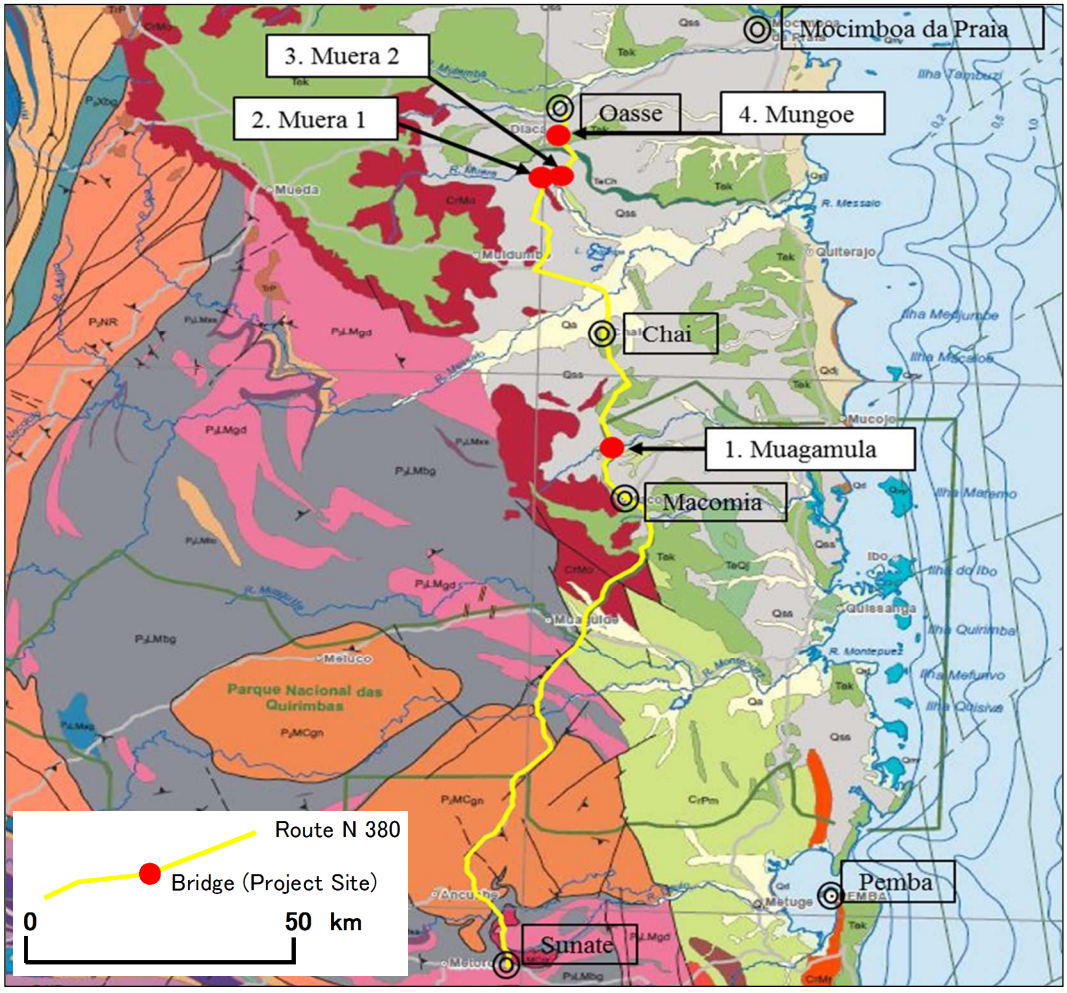
Fan-shaped Pleistocene terrace deposits are widely distributed in the northern area of Macomia. Very stiff silt and dense sand will be suitable as a bearing layer for the Messalo bridges.

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). 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 ┘



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

Figure 1-2 Geological Map of Study Area

1.3.3 Hydorogical Investigation

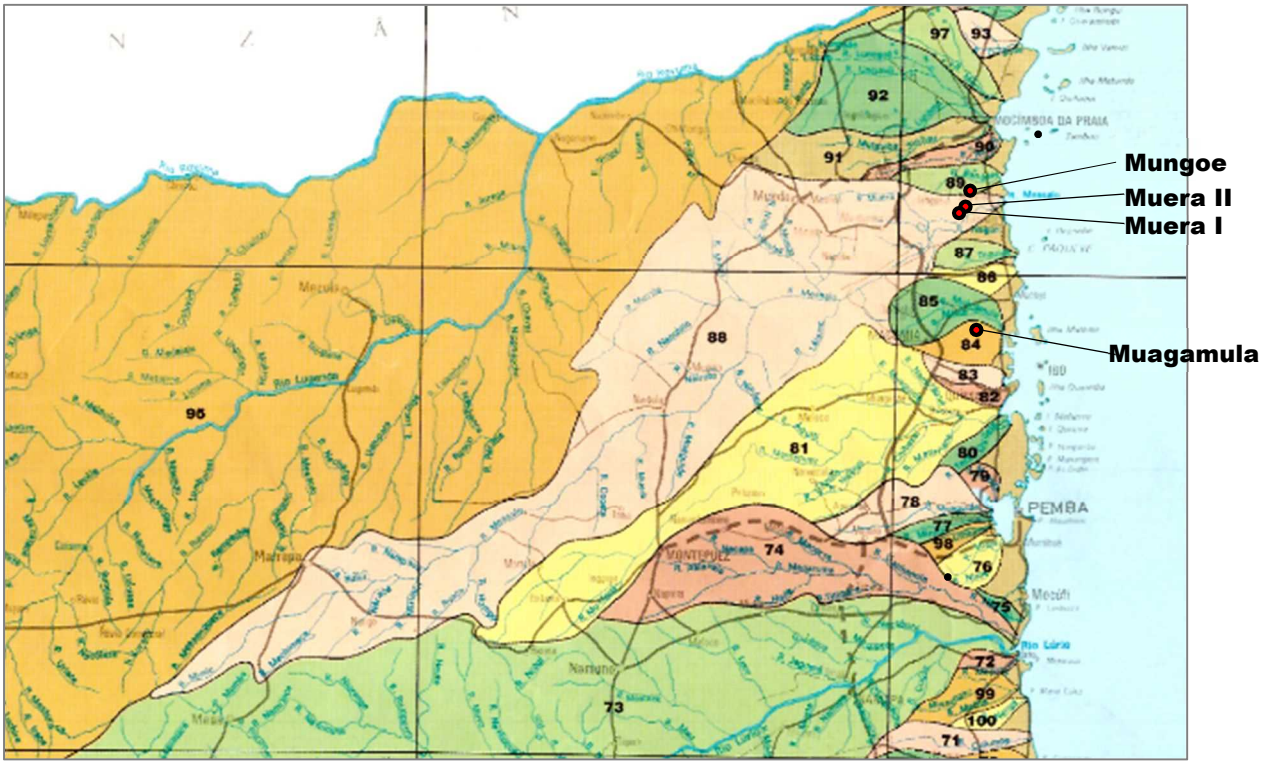
The rivers located at the target bridges are natural rivers. The catchment area of Messalo River is about 24,000 km2 and one of the largest rivers in Mozambique. Muera River is connected to Messalo River in the downstream region of N380 and belongs to the Messalo basin.

Muera I Bridge and the Muera II Bridge, which are planned to be located on Muera River, are included in the Mesaro basin. Muagamula Bridge and Mungoe Bridge are bridges over medium-scale rivers.

Target bridges and river basin list as shown in Table 1-3, and bridge location and river basin area is shown in Figure 1-3.

Table 1-3 Target Bridges and River Basin List

No	Bridge	Basin	Remark
1	Muagamula Br.	(85) Muacamula	–
2	Muera I Br.	(88) Messalo	Confluence with Messalo River in the downstream area of the bridge
3	Muera II Br.		
4	Mungoe Br.	(88) Monga	–



Sorce: DNA (National Directorate of Water)

Figure 1-3 Target Bridge Location and River Basin Area

1. 4 Environmental and Social Considerations

1.4.1 Project Component and Impacts on Environment

The Project is replacement of four bridges from temporary bridges to permanent bridges. Impact on natural and social environment due to the project might be limited because the locations of four bridges are exiting bridges and there is not expected any new alignment.

The Study also confirmed that the Project will not cause severe secondary, cumulative, and inseparable impact. Therefore, the survey focuses on direct impact caused by the project and evaluate the impact followed by mitigation measures.

As a result, project component which will cause adverse impact is found as bridge construction works as well as changes on traffic in the operational phase. Environmental elements which is expected to be affected by the project are mainly in the field of contamination and ecosystem. There might not be land acquisition and resettlement issues.

1.4.2 Baseline of Environmental and Social Conditions

1.4.2.1 Pollution Items

(1) Air Quality

Standard of air quality in Mozambique is regulated in following documents.

- Regulations on the Emission of Effluents and Environmental Quality Standards (Decree no. 18/2004 dated June 2)
- Amendments to Appendix I and inclusion of Appendices 1A and 1B to Decree no. 18/2004 (Decree no. 67/2010, dated December 31)

The standards above are not set for vehicles, therefore, past projects in Mozambique, such as Mozambique LNG Project, referred WHO's standard, "Air Quality Guidelines Global Update, 2005". The project also refers the standard with domestic standards shown in the table below.

Table 1-4 Air Quality Standards for the Project

Pollutant	Average Period	Guidelines Value (μ g/m^3)	
		WHO	Decree No. 67 (2010)
SO_2	1-year		40
	24-hour	125 (Interim Target-1)	100
		50 (Interim Target-2)	
		20 (Guideline)	
	1-hour		800
	10-minute	500 (Guideline)	
NO_2	1-year	40 (Guideline)	10
	1-hour	200 (Guideline)	190
TSP	1-year		60
	24-hour		150
PM_{10}	1-year	70 (Interim Target-1) 50 (Interim Target-2) 30 (Interim Target-3) 20 (Guideline)	
	24-hour	150 (Interim Target-1) 100 (Interim Target-2) 75 (Interim Target-3) 50 (Guideline)	
$PM_{2.5}$	1-year	35 (Interim Target-1) 25 (Interim Target-2) 15 (Interim Target-3) 10 (Guideline)	
	24-hour	75 (Interim Target-1) 50 (Interim Target-2) 37.5 (Interim Target-3) 25 (Guideline)	
CO	8-hour average		10,000
	1-hour average		30,000
	15-minute		100,000
	30-minute		60,000
Ozone	8-hour daily maximum	160 (Interim Target-1) 100 (Guideline)	120
Benzene	1-hour average		160
	24-hour		50
	One-year mean		4.4×10^{-6}

Source: http://www.mzlng.com/Responsibility/Environmental-Social-Management/

(2) Water Quality

Standard of water quality in Mozambique is only regulated in the drinking water standard (Mozambican Water Quality Standards for Human Consumption (Ministerial Diploma no. 180/2004, of 15 September). The standards above are not set for surface water, therefore, past projects in Mozambique, such as Mozambique LNG Project, referred IFC's standard of EHS Guidelines. The project also refers the IFC standard shown in the table below.

Table 1-5 IFC's Standard for Effluent Water

Parameters	Units	Effluent Limits
Total hydrocarbon content	mg/l	10
pH		6-9
BOD	mg/l	25
COD	mg/l	125
TSS	mg/l	35
Phenols	mg/l	0.5
Sulfides	mg/l	1
Heavy metals a.	mg/l	5 Total
Chlorides	mg/l	600 average, 1,200 max.

Source: http://www.mzlng.com/Responsibility/Environmental-Social-Management/

(3) Noise and Vibration

There are no standards on noise and vibration in Mozambique. Past projects in Mozambique, such as Mozambique LNG Project, referred IFC's standard of EHS Guidelines and WHO's standard (Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, 1999). The project also refers above standards shown in the table below.

Table 1-6 Noise Standard for the Project (Case of Mozambique LNG Project)

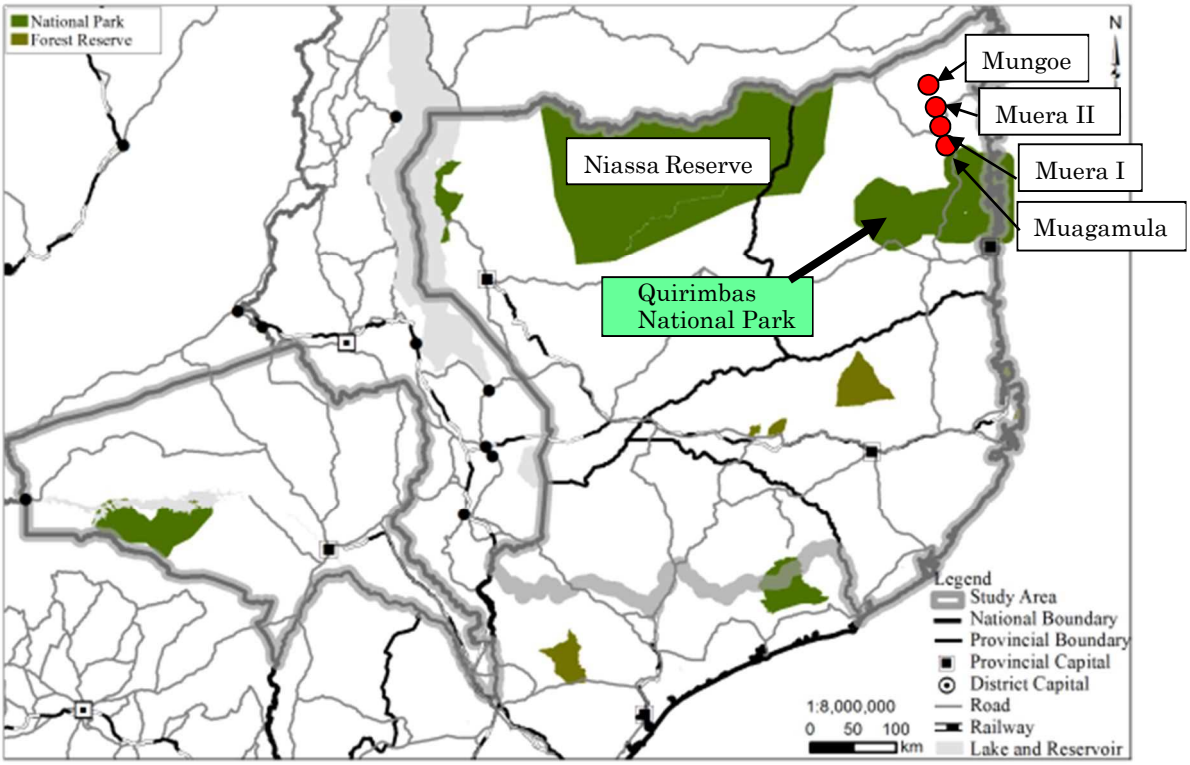
Receptor	One Hour LAeq (dBA)	
Total hydrocarbon content	Day Time 07:00-22:00	Night Time 22:00-07:00
Ambient Conditions	Maximum increase in background levels of 3 dB at the nearest receptor location off-set	
Residential/Institutional/Educational	55	45
Industrial/Commercial	70	70

Source: http://www.mzlng.com/Responsibility/Environmental-Social-Management/

1.4.2.2 Protected Area for Natural Environment

(1) Outline of the Protected Areas

There are two protected areas near the project sites in north Mozambique. One is the Quirimbas National Park (QNP) which includes a section of National Road No. 380 and another one is Niassa Reserve located the border between Cabo Delgado Province and Niassa Province (Figure 1-4).



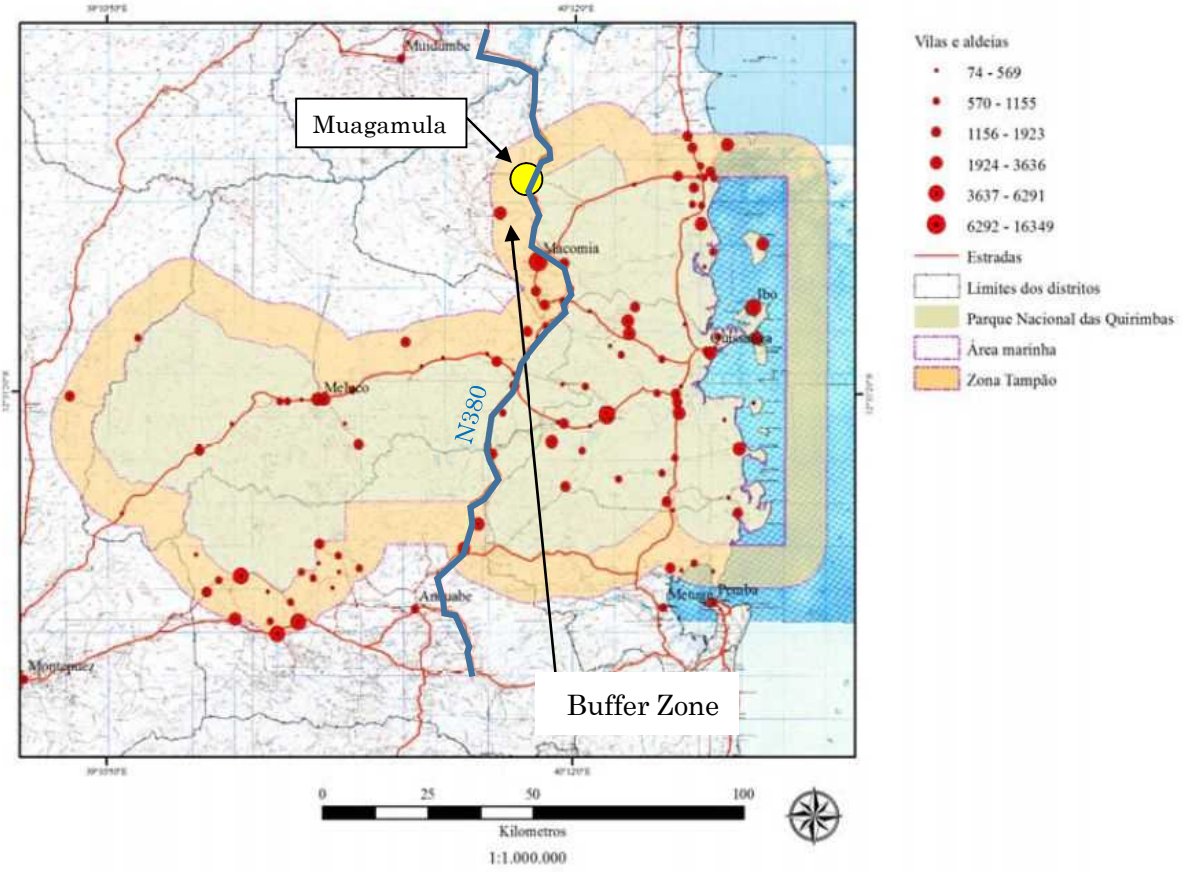
Source : The Project for Nacala Corridor Economic Development Strategies (Modified by the Study Team)

Figure 1-4 Protected Areas in North Mozambique

Niassa Reserve is far from the project sites more than 50 km and it is not expected any impact including secondary and cumulative one due to the project. On the other hand, QNP is close to the project sites. However, there might not be severe impact on QNP because the project only targets replacement of existing bridges. One of the bridges, Muagamula Bridge, is located in the buffer zone of QNP. Therefore, the survey assessed any possible impacts for QNP in terms of regulations.

According to the Management Pland for QNP (2012-2021), the buffer zone is registered as band-shape area with 10km from the border of QNP. There is no strict regulation and/or approval process as QNP, however, some activities utilizing natural resources are required approval by authorities. This project is not required any other approval except ordinal EIA procedures.

In addition, there is no cultural heritage around the project sites.



Source: Management Plan for QNP (2012-2021), Ministry of Tourism with additional description

Figure 1-5 Quirimbas National Park and its Buffer Zone

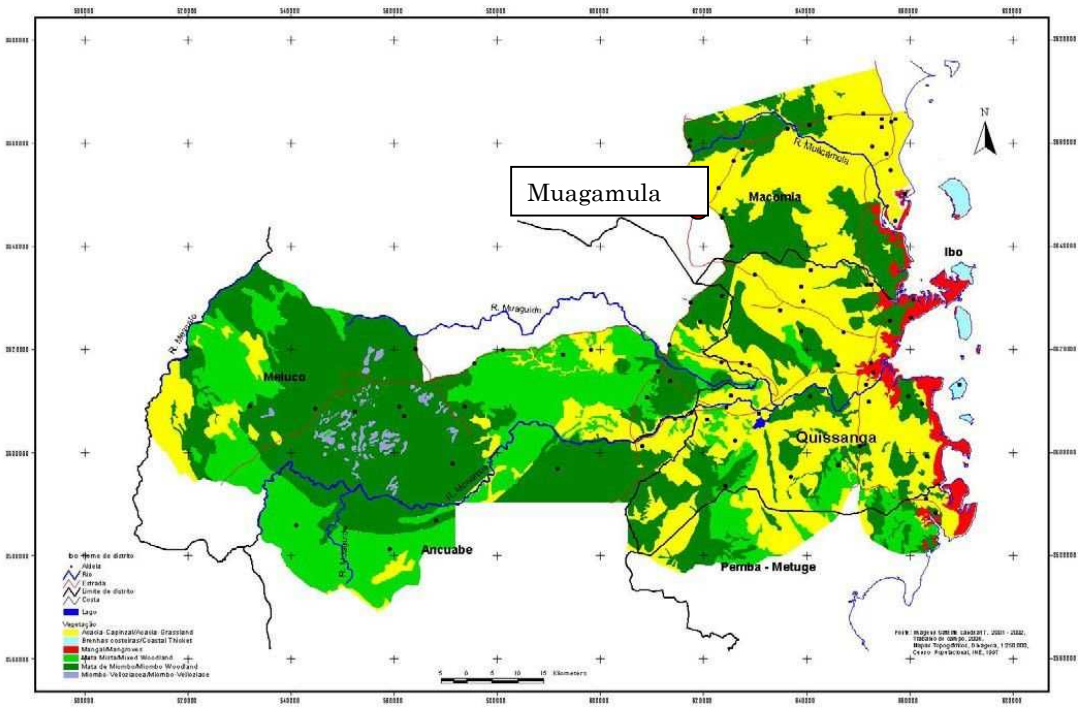
(2) Quirimbas National Park (QNP)

QNP is located in Cabo Delgado Province which is created on July 4th, 2002. World Wildlife Fund (WWF) was assigned for managing the park until 2010 followed by ANAC (Administraçao Nacional das Areas de Conservaçao) under MITADER at present. There are 154 villages, 102 villages in the boundary areas of the park and 52 villages in the buffer zone, in QNP with population of around 166 thousand people.

Area of QNP is 750,639 ha (1,854,870 acres). Land area is 598,402 ha and other part is marine and islands. National Road No.380 penetrates the land area of QNB from North to South.

1) Flora of Quirimbas National Park (QNP)

International organizations including WWF and research institutions has continuously studied flora and fauna in QNP. The inventory survey for flora/fauna implemented by Universidade Eduardo Mondlane headed by Bendeira is shown in the figure and table below. Based on the results, flora of QNP is classified into 6 areas and the location next to Muagamula Bridge is belonging to glass land. Biodiversity level of the area is relatively not high.



Source: Bandeira et. al., 2007

Figure 1-6 Typical Vegetation Condition of Quirimbas National Park (QNP)

Table 1-7 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

2) Fauna of Quirimbas National Park (QNP)

QNP has rich ecosystem with biodiversity from ocean to mountainous area. There are observed animal groups including African Elephant in land areas and Dugong in marine. Table 1-8 summarizes the inventory survey (GRNB) of local fauna of QNP, surveyed by Universidade Eduardo Mondlane, Maputo, Mozambique.

Table 1-8 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,

Based on GRNB, is has been observed several mammals listed in different level of IUCN's threatened species as followings.

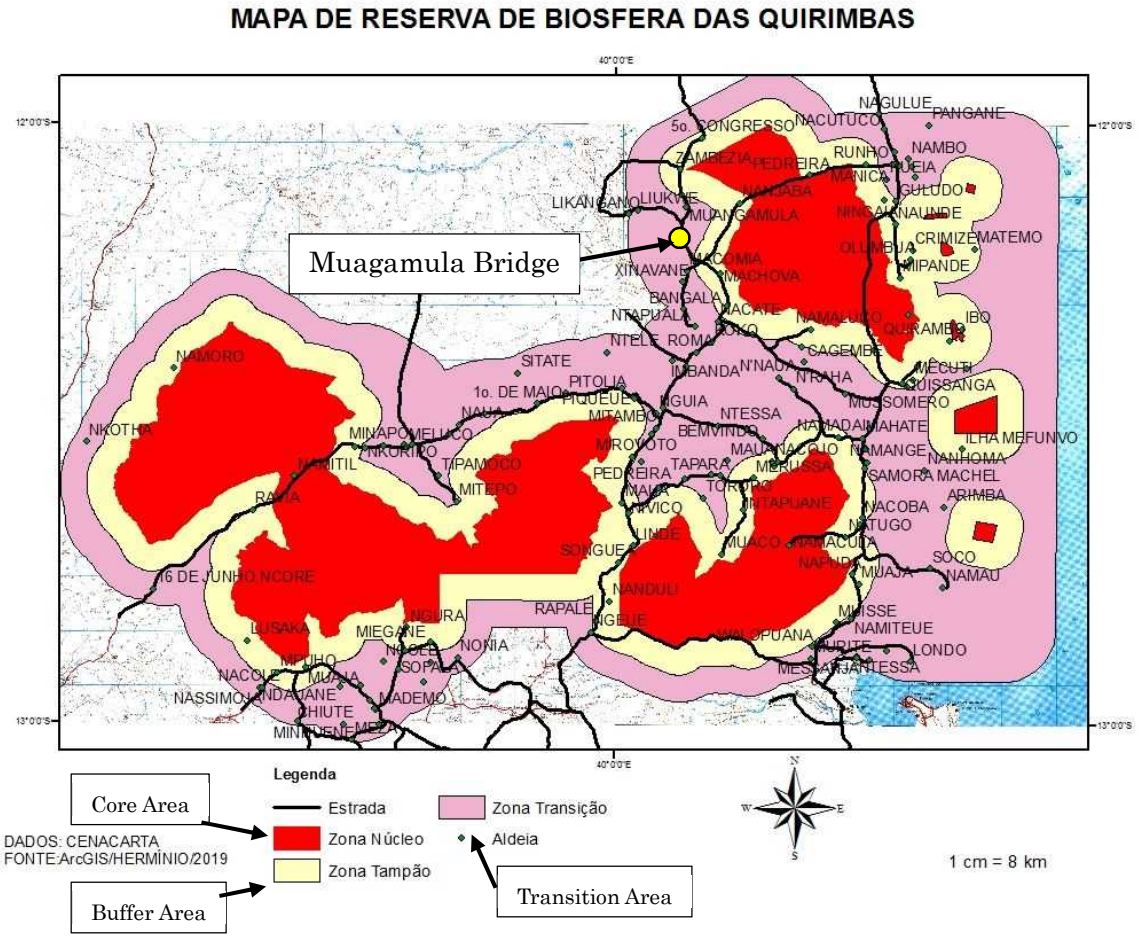
- Lycaon pictus — EN: Endangered
- Hippopotamaus amphibius — VU: Vulnerable
- Panthera leo — VU: Vulnerable
- Acinonyx jubatus — VU: Vulnerable
- Loxodonta africana — LR/nt: Near Threatened
- Panthera pardus — LR/nt: Near Threatened

According to the study results, conducted in 2008 and 2009, by CERU (Conservation Ecology Research Unit), it is found that several elephants migrates inside/outside of QNP. On the other hand, according to the interview survey from relevant people and office, such as a former field officer of QNP office, ANAC, DEPTADER in Cabo Delgado, and ANE Pemba Office, it has not been observed wild animals and their road killing along the National Road No. 380 in principle. It may not common and rather rare that large wild animals migrate crossing the road.

Based on the material survey and interview survey, the project including Muagamula Bridge which is located in the buffer area of QNP is out of the regulated area. According to ANAC, the authority in charge of national park management, clearly confirmed that the project is not required any pre-discussion and/or regulation without ordinal EIA procedures. That evaluation is also confirmed by the past decision of MITADER and DEPTADER which determined the project as Category B of Mozambique even it included Catipuse Bridge located in QNP at the time of the phase 1 project.

(3) UNESCO's Biosphere Reserve (BR)

The area within QNP is registered as the first Biosphere Reserves (BR) by UNESCO in 2018. Figure 1-7 shows the zoning map of Quirimubs Biosphere Reserves (QBR) with the location of Muagamula bridge and Table 1-9 shows each area of zonings.



Source: Quirimbus National Park Management Office

Figure 1-7 Zoning of QBR and location of the Muagamula Bridge

Table 1-9 Area of Quirimubs BR

Zones	Area (ha)
Core Areas	416,113
Buffer Area	426,098
Transition Area	639,023
Total	1,481,234

* Zoning classification is not the final version

Based on the zoning map, Muagamula bridge is located in the "Transition Area". The area is defined as "area with a central function in sustainable development which may contain a variety of agricultural activities, settlements and other uses and in which local communities, management agencies, scientists, non-governmental organizations, cultural groups, economic interests and other stakeholders work together to manage and sustainably develop the area's resources." in UNESCO's zoning scheme of BR. Thus, the transition allows people to implement socio-economic activities for their livelihood. According to UNESCO Maputo Office, the management plan of QBR will be prepared with coordination between QNP's plan.

According to ANAC which takes responsibility of management on national park, QBR is registered within existing QNP including buffer zone. Therefore, there is no additional regulation further than QNP's regulation. ANAC is preparing new QNP management plan considering QBR to invite more visitors to QNP area in terms of ecotourism and sustainable socio-economic activities.

1.4.2.3 Land Use, Living Areas of Indigenous People

Each four bridge is far from residential area and there is no land-attached private properties. Land use around the bridges including the area for de tour during the construction is principally grass land or river and there is no private land use (Figure 1-8). There is no living area and rights of indigenous people around the project sites.

Source: Google Earth with modification

Figure 1-8 Satellite Images of Four Bridges

1.4.2.4 Land Acquisition and Involuntary Resettlement

Project areas around the four bridges are within right-of-way (ROW) of state land, the area within 30m from existing road centerline in both sides. The project may not cause any land acquisition and resettlement including socio-economic impact.

1.4.3 Environmental Legal Framework and Administration

1.4.3.1 Laws/Regulations and Standards

Law/Regulations and Standards in Mozambique is shown in following table with brief explanation for major documents.

Table 1-10 Legal Framework on Environment of Mozambique

Document Level	Name of Legal Documents
Policy	National Environmental Policy (No.5, 1995)
Law	Environmental Law (Law No.20, 1997)
	Land Law (Law No.19, 1997)
	Forest and Wildlife Law (Law No.10, 1999)
	Biodiversity Conservation Law (Law No. 16, 2014)
	Law for Protection of Cultural Assess (Law No.19, 1988)
Regulations and Guidelines	Regulations for Environmental Impact Assessment (Decree No.54, 2015)
	Regulations on the Environmental Audit Process (Decree No.25, 2011)
	Guidelines for the EIA Process (Ministerial Diploma No. 129, 2006)
	Guidelines for Public Participation in the EIA Process (Ministerial Diploma No. 130, 2006)
	Regulations for Environmental Inspections (Decree No.11, 2006)
	Regulations for Environmental Quality Standards and Effluent Emissions (Decree No.18, 2004 amended by Decree No.67, 2010)
	Regulations for the Management of Urban Solid Waste (Decree No.94, 2014)
	Regulations for Management of Hazardous Waste (Decree No. 83, 2014)
	Regulations for the Forest and Wildlife Law (Decree No.12, 2002)
	Regulations for the Resettlement Prices Resulting from Economic Activities (Decree No.31, 2012)

Source (Modified): Environmental and Social Considerations in Detailed Planning Survey, The Project for National Power System Development Master Plan Study in the Republic of Mozambique (2016)

(1) Environmental Law (1997): Law No.20 (1997) Environmental Law

Environmental Law is applied for all kinds of public and private development for sounds environment. Any activities causing impacts on environment shall be approved by MITADER with EIA survey. Article 8 states appropriate stakeholder participation for environmental management and natural resources management. Article 9 states prohibited actions and items for pollution. Thus, Environmental Law is principle law of environment in Mozambique.

(2) EIA Process Guidelines (2006)

EIA Process Guidelines stipulates principles on environmental management as following.

- Necessity of Environmental Management for Biodiversity and People's Life
- Evaluation on Tradition of local community

- Environmental protection system
- Importance of public participation
- Principle of payment by polluter
- Importance of international cooperation on environmental management

(3) EIA Process Regulation (2015): Decree No.54 (2015) Approving the Regulation on the Process for the Environmental Impact Assessment (EIA)

This Decree revised former Decree (No.45, 2004) and provided approval process of EIA. The Decree consists of 5 chapters (30 articles) with 8 annexes. Basic framework is described as bellows.

a) Registration of the Project: Project owner submits to MITADER

b) Screening: MITADER classified the project based on Screening Report. Provincial Office of MITADER (DPTADER) is in charge of the project falling into Category B Project.

c) Environmental Impact Assessment (EIA): SEA and ESMP (Environmental and Social Monitoring Plan) is prepared.

d) Environmental License: DPTADER issues the license in case of Category B Projects

e) Monitoring: Project owner implements monitoring for environment

f) Public participation: Appropriate public participation is required at the stage of scoping and draft report of SEA in case of Category B.

(4) Land Law (1997): Law No.19 (1997)

Land in Mozambique is principally belonging to state based on Land Law (article 3). People use land use rights for possessing land practically. Article 18 stipulates land acquisition and resettlement for public purpose with appropriate compensation. National Park is classified into "Total Protection Zone" (article 7) and it is needed to obtain approval from Cadastre Services if construction activities are planned in that area.

(5) Regulations for the Resettlement Process Resulting from Economic Activities (Decree No.31, 2012)

This regulation describes principles on resettlement caused by public and private sectors including compensation and livelihood restoration.

1.4.3.2 Environmental Approval

(1) Environmental Category

Implementation of EIA study and the environmental license application process of any development projects are administered by Decree No 45 of 2004. There are following three environmental categories, i.e., Categories A, B and C, depending on the order of the magnitude of potential negative environmental and/or social impacts, to be caused by the implementation of the project of concerns. "Category A" - projects shall prepare for the full-scale EIA report in order to obtain the environmental approval whereas "Category B" - projects shall prepare for SER (Simplified Environmental Report). Box below summarizes the categorization criteria, used for the selection of "Category A" - project.

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.

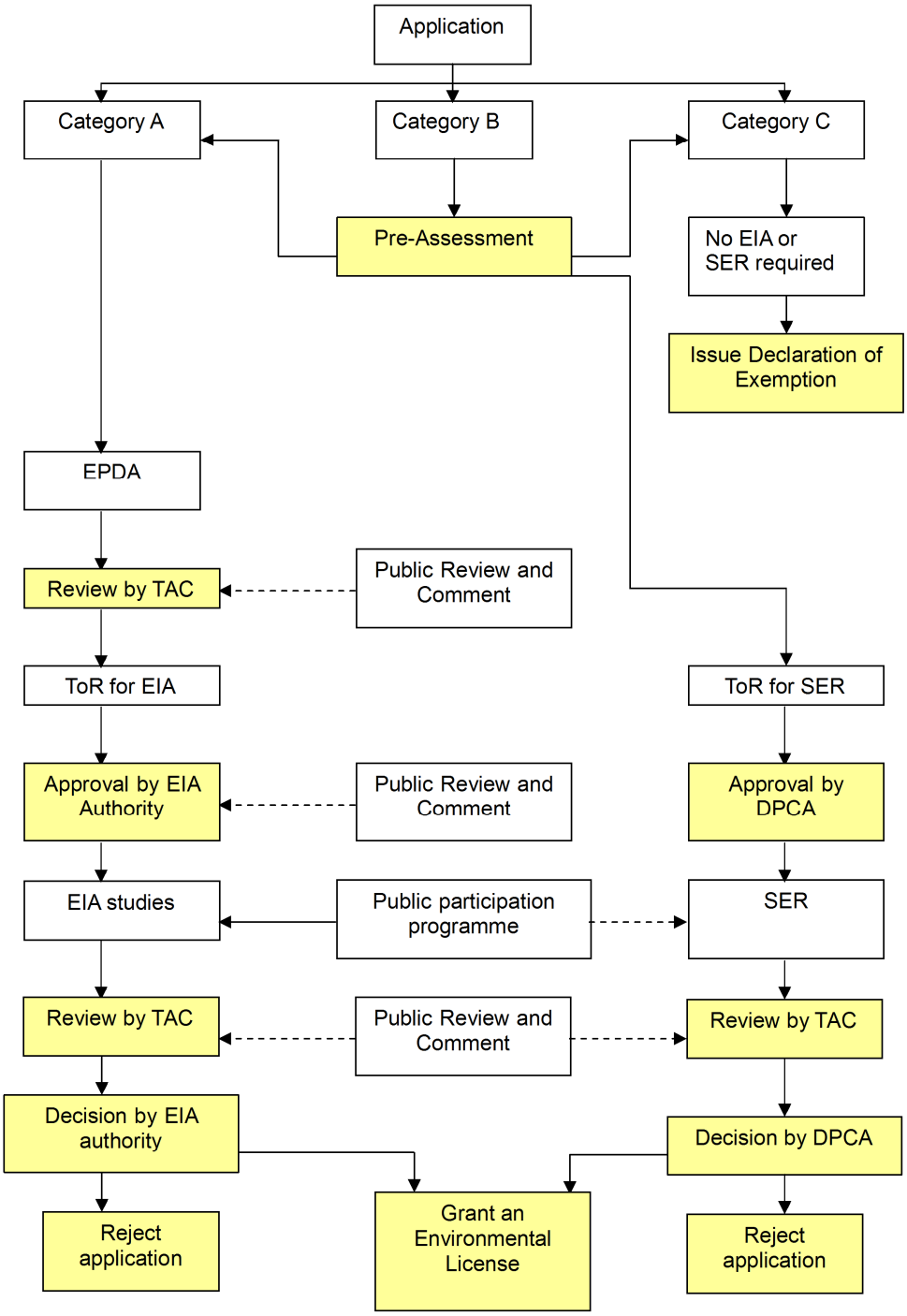
Projects falling into Category B is required Simplified Environmental and Social Impact Assessment Report (SER) and Environmental and Social Management Plan (ESMP) for the license from DPTADER.

For the Category B project, which may not have serious impact as Category A, is required Simplified Environmental and Social Impact Assessment Report (SER) and Environmental and Social Management Plan (ESMP) for environmental approval.

The 8 bridges including 4 bridges of the Project were classified as Category B by DPTADER in Cabo Delgado Province on August, 2015, during the survey of Phase 1.

(2) Procedures for Environmental Approval

Approval process for the Project will comply with Decree No.54, 2015. Framework of EIA approval procedures are shown in following figure.



*: Shaded blocks indicate activities by the competent authority.

Figure 1-9 Environmental Approval Process in Mozambique

(3) Situation of Environmental Approvals

National Road No. 380 which includes four bridges of the project had already obtained environmental license, however, each bridge was not included. Among the bridges, three bridges under Japanese Grant Aid has been approved for implementation. Status of environmental approval is shown in the following table. During this survey period, EIA (SEA) including target four bridges are approved by DEPTADER and licenses are issued after payment by ANE.

Table 1-11 Status of Environmental Reviewing National Road No. 380

	Road Improvement Project	Status of Environmental Approval
1	National Road No. 380 Improvement (North Section)	Portugal Government assisted the project. Environmental license has been issued. Project has been completed. Bridges were not targeted.
2	National Road No. 380 Improvement (South Section)	Chinese government assisted the project. Environmental license has been issued (2013). Project has not been completed due to withdrawal of finance by China.
3	Mapuede Bridge, Mesalo 1, Mesalo 3	Environmental license has been issued and construction has been commenced (as of March 2019).

1.4.4 Policy Gap Analysis

Table below shows the results of policy gap analysis between JICA's Guidelines for Environmental and Social Considerations and domestic legal framework of Mozambique. Principally, items mentioned by JICA's Guidelines are found in legal documents of Mozambique. However, some detail conditions can be gaps and might be fulfilled with practical measures.

Table 1-12 Comparison between JICA and Mozambique guideline

Item	JICA Guidelines	Mozambique Legal Framework	Gap and Measures
Information Disclosure	EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form understandable to them. EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted.	Environment Law and other legal documents stipulates language and structure of EIA report including public participation and information disclosure.	Unspecified conditions, such as access to information by local people, shall be provided by ANE and other relevant authorities.

Item	JICA Guidelines	Mozambique Legal Framework	Gap and Measures
Public Discussion	In preparing EIA reports, consultations with stakeholders, such as local residents, must take place after sufficient information has been disclosed. Records of such consultations must be prepared. Consultations with relevant stakeholders, such as local residents, should take place if necessary, throughout the preparation and implementation stages of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared.	Article 8 of Environment Law stipulates necessity of appropriate public participation. Guidelines for Public Participation in EIA Process (Ministerial Diploma No. 130/2006 of 19 July) stipulates guidelines for the public participation.	Public discussion is not mandatory for Category B project, however, stakeholder meetings are implemented for this project. JICA study also support additional activities to follow up public discussion.
Target Items of EIA	The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities, all members of which are susceptible to environmental and social impacts and may have little access to decision-making processes within society	Guidelines for Public Participation in EIA Process (Ministerial Diploma No. 130/2006 of 19 July) and Decree No. 54/2015 approving the Regulation on the Process for the Environmental Impact Assessment (EIA) regulate items for EIA.	Based on the JICA Guidelines for Environmental and Social Considerations., necessary items are assessed and reported in JICA reports and/or SEA report.
Monitoring, Grievance, etc.	Monitoring results shall be disclosed to stakeholders of the project. In cases where sufficient monitoring is deemed essential for appropriate environmental and social considerations, project proponents etc. must ensure that project plans include feasible monitoring plans.	N/A	Monitoring plan and format shall be applied based on the JICA Guidelines for Environmental and Social Considerations.
Ecosystem and Flora/Fauna	Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests	N/A	There are not estimated crucial changes and impact by the project.
Indigenous People	Impact on indigenous people caused by the project shall be avoided with possible measures. If cannot be avoided, the impact shall be minimized and be compensated with practical measures for indigenous people.	N/A	The project has no impact on indigenous people.

1.4.5 Institutional Framework on Environmental and Social Considerations

1.4.5.1 Ministry of Land, Environment and Rural Development (MITADER)

MITADER takes responsibility on environmental issues including safeguard and natural resources management. MITADER was established on January 2015 after a merger between Ministry of Land. MITADER review EIA of large-scale projects.

In regional level, MITADER set regional offices, Provincial Directorate for Land, Environmental and Rural Development, DPTDAR). There is an office in Pemba in case of Cabo Delgado Province.

One of the autonomous organizations, National Administration for Conservation Areas, ANAC) is under the direct connection from the Minister of MITADER, which is originated from Ministry of Agriculture and Ministry of Tourism. ANAC manages reserved areas including national parks in Mozambique.

Figure 1-10 shows organizational chart of MITADER.

1.4.5.2 Environmental Department in ANE

ANE belonging to Ministry of Public Works and Housing established Unit of Social Issues and Environment in 2000. After that Cross-Cutting Issues Office took over the responsibility. At present, the name of the office change to Monitoring Department (MD) and 6 officers are working in. MD takes responsibilities on EIA, Social issues, Gender, HIV/AIDS, and other cross-cutting issues.

Figure 1-10 Organizational Chart of MITADER

1.4.6 Comparison of Alternative plan

Alternative plans are discussed with four options as below:

Plan-A: Permanent bridges construction at existing bridge locations

Plan-B: Permanent bridges construction at new locations

Plan-C: Using temporal bridges (bailey bridges) with maintenance

Plan-D: No action (without project)

Alternative discussions are implemented with multiple items including consistency of transportation policy, benefit on regional economy, safe and reliable cross-river method, transportation time between towns, construction and maintenance cost, and natural and social environment.

As a result, Plan-A and Plan-B are prioritized because four target bridges are the bottleneck of the National Road No.380 which doesn't have alternative route. Moreover, difference between Plan-A and Plan-B is location of the newly planned bridge. In terms of environmental aspects and cost for the project, Plan-A is recommended as the proposed plan.

Table 1-13 is shown the discussion of alternative comparison.

Table 1-13 Alternative Discussion

Items	Plan-A	Plan-B	Plan-C	Plan-D
Outline	Permanent Bridge Construction (Existing Location)	Permanent Bridge Construction (New Location)	Using Temporal Bridge with Maintenance	Without Project (No action for Present Situation)
Consistency with Development Plan	The Plan corresponds with the plan of permanent bridge along National Road No.380 (Master Plan)	The Plan corresponds with the plan of permanent bridge along National Road No.380 (Master Plan)	Not consistent with the Master Plan	Not consistent with the Master Plan
	○	○	×	×
Growth of Regional Economy	The plan contributes to regional economy by strengthening of road network.	The plan contributes to regional economy by strengthening of road network.	Economic growth rate is not changed.	In case of bridge collapse, reginal economy may be affected by de-tour time.
	○	○	△	×
Safe River Crossing	Risks of bridge collapse may be decreased and safe traffic of river-crossing may be secured.	Risks of bridge collapse may be decreased and safe traffic of river-crossing may be secured.	Risks of bridge collapse may be increased and traffic may be stopped at the crossing points.	Risks of bridge collapse may be increased and traffic may be stopped at the crossing points.
	○	○	△	×
Period of Traffic Blocking	No Blocking Period	No Blocking Period	There is possibility of traffic blocking for several months in case of flooding or bridge collapse.	There is possibility of traffic blocking for several months in case of flooding or bridge collapse.
	○	○	×	×
Transport Time of Large Vehicle	Trip time between Macomia and Oasi is shorten to 75 minutes	Trip time between Macomia and Oasi is shorten to 75 minutes	Large vehicle with full loading cannot pass the bridge and have to make a detour with more than 300 minutes.	Large vehicle with full loading cannot pass the bridge and have to make a detour with more than 300 minutes.
	○	○	×	×

Cost for Project and Maintenance	The plan requires construction cost and maintenance cost for permanent bridges.	The plan requires construction cost and maintenance cost for permanent bridges much more than Plan-A because the bridge location is new.	Construction cost is not required. Maintenance cost or replacement cost is needed for maintenance or change.	Construction cost is not required. Replacement cost is needed for change.
	Δ	×	Δ	Δ
Social Environment	Land acquisition and resettlement is not required. Benefit for social environment is expected because of safe traffic at river crossing points.	Land acquisition and resettlement is required. Benefit for social environment is expected because of safe traffic at river crossing points.	Land acquisition and resettlement is not required. Access to public facilities and/or urgent vehicles may be hindered.	Land acquisition and resettlement is not required. Access to public facilities and/or urgent vehicles may be hindered.
	○	Δ	Δ	Δ
Natural Environment	Impact on air, water, vibration, ecosystem, and etc., may be expected. However, the degree of the impact might be limited comparing to Plan-B with new bridges during construction and operation phases.	Impact on air, water, vibration, ecosystem, and etc., may be expected. However, the degree of the impact might be larger that Plan-A during construction and operation phases.	No change	No change
	Δ	×	○	○
Recommended Plan and Reasons	Recommended ○x6 Δx2 ×x0	Not best plan ○x5 Δx2 ×x1	Not Recommended ○x1 Δx4 ×x3	Not Recommended ○x1 Δx2 ×x5
	This plan requires initial costs. However, newly constructed bridge may give much benefits and solve bottlenecks. Construction at present bridge locations may minimize impact on environment. Therefore, the Plan-A is most prioritized.	This plan requires initial costs. However, newly constructed bridge may give much benefits and solve bottlenecks. Construction at new bridge locations may cause deeper impact comparing to Plan-A.	Construction cost is not required, however, repeated flooding and bridge collapses may cause traffic blockage. Using existing temporal bridges cannot be a permanent solution in terms of regional safety and economic growth.	Construction cost is not required, however, repeated flooding and bridge collapses may cause traffic blockage. Non-actions for existing temporal bridges may cause traffic blockage along National Road No.380 in the future. It is not recommended "without project" in terms of safe traffic and regional growth.

1.4.7 Scoping

Draft scoping of environment and social considerations was discussed based on the results of Phase 1 Project and additional confirmation/survey. Table 1-14- Table 1-17 summarize the scoping results of the project.

Table 1-14 Scoping result (Muagamula Bridge)

Impact item		Evaluation		Reason of evaluation
		Before works During works	In service	
Pollution countermeasures				
1	Air pollution	B-	B-	During works: Temporal deterioration of the roadside air quality by construction vehicles are expected. In service: Deterioration of air quality is expected with increased traffic.
2	Water pollution	B-	C	During works: Earth work may cause temporal water pollution. In service: Road side soil may be eroded by rainwater and water flowing from road may be polluted.
3	Solid wastes	B-	D	During works: The disposal soil due to construction might be generated. In service: Not expected.
4	Soil pollution	B-	D	During works: Soil pollution can be occurred by inappropriate treatment of wastewater and/or accident. In service: Not expected
5	Noise and vibration	B-	B-	During works: Temporal deterioration of noise and vibration by construction vehicles are expected. In service: Deterioration to vibration is expected with traffic increase.
6	Land subsidence	D	D	Not expected.
7	Bad odor	D	D	Not expected.
8	Bottom sediment	D	D	Not expected.
Natural environment				
9	Protected areas	B-	D	Pre-Works and During works: The bridge is located in buffer zone of Quirimbas National park. Therefore, specific regulations may pause on the project. In service: Not expected
10	Ecosystem	B-	B-	During works: Risks of roadkill may be increased due to construction vehicles. In service: Risks of roadkill may be increased due to traffic with higher speed.
11	Hydrological phenomena	D	D	Not expected.
12	Topography and geology	D	D	Not expected.

Social environment				
13	Resettlement of residents	D	D	Not expected.
14	Impoverished classes	D	D	Not expected.
15	Minorities and indigenous population	D	D	Not expected.
16	Local economy (employment and means of livelihood, etc.)	D	D	Not expected.
17	Land use and use of local resources	D	D	Not expected.
18	Water use	D	D	Not expected.
19	Existing social infrastructure and social services	D	D	Not expected.
20	Social infrastructure and social organizations such as local decision-making agencies, etc.	D	D	Not expected.
21	Maldistribution of damage and benefits	D	D	Not expected.
22	Clash of interests in the area	D	D	Not expected.
23	Cultural heritage	D	D	Not expected.
24	Landscape	D	D	Not expected.
25	Gender	D	D	Not expected.
26	Rights of children	D	D	Not expected.
27	HIV/AIDS and other infections	B-	D	During works: Risk of infectious disease may be increased due to migration of construction workers. In service: Not expected.
28	Working environment (including labor safety)	B-	D	During works: Risks of construction accidents are increased in the phase of upper works of the bridge construction. In service: Not expected.
Others				
29	Accidents	B-	D	During works: Risks of traffic accidents are increased due to construction vehicles. In service: Need survey
30	Trans-boundary impacts and climate change	D	D	Not expected.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

Table 1-15 Scoping result (Muera I Bridge)

Impact item		Evaluation		Reason of evaluation
		Before works During works	In service	
Pollution countermeasures				
1	Air pollution	B-	B-	During works: Temporal deterioration of the roadside air quality by construction vehicles are expected. In service: Deterioration of air quality is expected with increased traffic.
2	Water pollution	B-	C	During works: Earth work may cause temporal water pollution. In service: Road side soil may be eroded by rainwater and water flowing from road may be polluted.
3	Solid wastes	B-	D	During works: The disposal soil due to construction might be generated. In service: Not expected.
4	Soil pollution	B-	D	During works: Soil pollution can be occurred by inappropriate treatment of wastewater and/or accident. In service: Not expected
5	Noise and vibration	B-	B-	During works: Temporal deterioration of noise and vibration by construction vehicles are expected. In service: Deterioration to vibration is expected with traffic increase.
6	Land subsidence	D	D	Not expected.
7	Bad odor	D	D	Not expected.
8	Bottom sediment	D	D	Not expected.
Natural environment				
9	Protected areas	D	D	Not expected.
10	Ecosystem	D	D	Not expected.
11	Hydrological phenomena	D	D	Not expected.
12	Topography and geology	D	D	Not expected.
Social environment				
13	Resettlement of residents	D	D	Not expected.
14	Impoverished classes	D	D	Not expected.
15	Minorities and indigenous population	D	D	Not expected.
16	Local economy (employment and means of livelihood, etc.)	D	D	Not expected.

17	Land use and use of local resources	D	D	Not expected.
18	Water use	D	D	Not expected.
19	Existing social infrastructure and social services	D	D	Not expected.
20	Social infrastructure and social organizations such as local decision-making agencies, etc.	D	D	Not expected.
21	Maldistribution of damage and benefits	D	D	Not expected.
22	Clash of interests in the area	D	D	Not expected.
23	Cultural heritage	D	D	Not expected.
24	Landscape	D	D	Not expected.
25	Gender	D	D	Not expected.
26	Rights of children	D	D	Not expected.
27	HIV/AIDS and other infections	B-	D	During works: Risk of infectious disease may be increased due to migration of construction workers. In service: Not expected.
28	Working environment (including labor safety)	B-	D	During works: Risks of construction accidents are increased in the phase of upper works of the bridge construction. In service: Not expected.
Others				
29	Accidents	B-	D	During works: Risks of traffic accidents are increased due to construction vehicles. In service: Need study.
30	Trans-boundary impacts and climate change	D	D	Not expected.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

Table 1-16 Scoping result (Muera II Bridge)

Impact item		Evaluation		Reason of evaluation
		Before works During works	In service	
Pollution countermeasures				
1	Air pollution	B-	B-	During works: Temporal deterioration of the roadside air quality by construction vehicles are expected. In service: Deterioration of air quality is expected with increased traffic.
2	Water pollution	B-	C	During works: Earth work may cause temporal water pollution. In service: Road side soil may be eroded by rainwater and water flowing from road may be polluted.
3	Solid wastes	B-	D	During works: The disposal soil due to construction might be generated. In service: Not expected.
4	Soil pollution	B-	D	During works: Soil pollution can be occurred by inappropriate treatment of wastewater and/or accident. In service: Not expected
5	Noise and vibration	B-	B-	During works: Temporal deterioration of noise and vibration by construction vehicles are expected. In service: Deterioration to vibration is expected with traffic increase.
6	Land subsidence	D	D	Not expected.
7	Bad odor	D	D	Not expected.
8	Bottom sediment	D	D	Not expected.
Natural environment				
9	Protected areas	D	D	Pre-Works and During works: The bridge is located in buffer zone of Quirimbas National park. Therefore, specific regulations may pause on the project. In service: Not expected
10	Ecosystem	D	D	During works: Risks of roadkill may be increased due to construction vehicles. In service: Risks of roadkill may be increased due to traffic with higher speed.
11	Hydrological phenomena	D	D	Not expected.
12	Topography and geology	D	D	Not expected.

Social environment				
13	Resettlement of residents	D	D	Not expected.
14	Impoverished classes	D	D	Not expected.
15	Minorities and indigenous population	D	D	Not expected.
16	Local economy (employment and means of livelihood, etc.)	D	D	Not expected.
17	Land use and use of local resources	D	D	Not expected.
18	Water use	D	D	Not expected.
19	Existing social infrastructure and social services	D	D	Not expected.
20	Social infrastructure and social organizations such as local decision-making agencies, etc.	D	D	Not expected.
21	Maldistribution of damage and benefits	D	D	Not expected.
22	Clash of interests in the area	D	D	Not expected.
23	Cultural heritage	D	D	Not expected.
24	Landscape	D	D	Not expected.
25	Gender	D	D	Not expected.
26	Rights of children	D	D	Not expected.
27	HIV/AIDS and other infections	B-	D	During works: Risk of infectious disease may be increased due to migration of construction workers. In service: Not expected.
28	Working environment (including labor safety)	B-	D	During works: Risks of construction accidents are increased in the phase of upper works of the bridge construction. In service: Not expected.
Others				
29	Accidents	B-	D	During works: Risks of traffic accidents are increased due to construction vehicles. In service: Need study.
30	Trans-boundary impacts and climate change	D	D	Not expected.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

Table 1-17 Scoping result (Mungoe Bridge)

Impact item		Evaluation		Reason of evaluation
		Before works During works	In service	
Pollution countermeasures				
1	Air pollution	B-	B-	During works: Temporal deterioration of the roadside air quality by construction vehicles are expected. In service: Deterioration of air quality is expected with increased traffic.
2	Water pollution	B-	C	During works: Earth work may cause temporal water pollution. In service: Road side soil may be eroded by rainwater and water flowing from road may be polluted.
3	Solid wastes	B-	D	During works: The disposal soil due to construction might be generated. In service: Not expected.
4	Soil pollution	B-	D	During works: Soil pollution can be occurred by inappropriate treatment of wastewater and/or accident. In service: Not expected
5	Noise and vibration	B-	B-	During works: Temporal deterioration of noise and vibration by construction vehicles are expected. In service: Deterioration to vibration is expected with traffic increase.
6	Land subsidence	D	D	Not expected.
7	Bad odor	D	D	Not expected.
8	Bottom sediment	D	D	Not expected.
Natural environment				
9	Protected areas	D	D	Pre-Works and During works: The bridge is located in buffer zone of Quirimbas National park. Therefore, specific regulations may pause on the project. In service: Not expected
10	Ecosystem	D	D	During works: Risks of roadkill may be increased due to construction vehicles. In service: Risks of roadkill may be increased due to traffic with higher speed.
11	Hydrological phenomena	D	D	Not expected.
12	Topography and geology	D	D	Not expected.

Social environment				
13	Resettlement of residents	D	D	Not expected.
14	Impoverished classes	D	D	Not expected.
15	Minorities and indigenous population	D	D	Not expected.
16	Local economy (employment and means of livelihood, etc.)	D	D	Not expected.
17	Land use and use of local resources	D	D	Not expected.
18	Water use	D	D	Not expected.
19	Existing social infrastructure and social services	D	D	Not expected.
20	Social infrastructure and social organizations such as local decision-making agencies, etc.	D	D	Not expected.
21	Maldistribution of damage and benefits	D	D	Not expected.
22	Clash of interests in the area	D	D	Not expected.
23	Cultural heritage	D	D	Not expected.
24	Landscape	D	D	Not expected.
25	Gender	D	D	Not expected.
26	Rights of children	D	D	Not expected.
27	HIV/AIDS and other infections	B-	D	During works: Risk of infectious disease may be increased due to migration of construction workers. In service: Not expected.
28	Working environment (including labor safety)	B-	D	During works: Risks of construction accidents are increased in the phase of upper works of the bridge construction. In service: Not expected.
Others				
29	Accidents	B-	D	During works: Risks of traffic accidents are increased due to construction vehicles. In service: Need study.
30	Trans-boundary impacts and climate change	D	D	Not expected.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

1.4.8 Environmental and Social Consideration TOR

Table 1-18 shows TOR of the survey on environmental and social considerations based on the results of draft scoping.

Table 1-18 TOR of Environmental and social considerations

Environmental Item	Survey Item	Survey Method
Air pollution	① Confirmation of environmental standards ② Air quality measurement ③ Estimation of air quality based on future traffic volume ④ Impact during the works	① Survey of existing materials (Domestic standards, WHO standards, etc.) ② Site measurement (Result of SEA by ANE) ③ Traffic volume analysis ④ Confirmation of works, method, location and range
Water pollution	① River water quality ② Use of river water in daily life	① Site measurement (Result of SEA by ANE) ② Interview survey around the areas
Solid wastes	① Method for treating construction wastes	① Interview survey to related authorities
Soil pollution	① Measurement for oil leaking	① Confirmation of construction method, machines
Noise and vibration	① Confirmation of environmental standards ② Distance from sources to residential areas, hospitals and schools ③ Impact during the works	① Survey of existing materials (Domestic standards, WHO standards, etc.) ② Site survey and interview survey ③ Confirmation of construction method, machines
Protected areas	① Registration and legal restriction (Muagamula Bridge)	① Interview survey to relevant authorities ② Document Survey
Ecosystem	① Increasing of roadkill	① Interview survey to relevant authorities ② Document Survey
HIV/AIDS and other infections	① Risks of HIV/AIDS	① Interview survey to relevant authorities ② Document Survey
Working environment (including labor safety)	① Labor safety measures	① Survey of similar project cases (contents of contracts with works subcontractors, etc. in similar projects)
Accidents	① Increasing of traffic accident during the operational phase	① Document survey ② Field Survey

1.4.9 Results of Environmental and Social Considerations

Based on the SEA prepared by ANE and additional survey, results of environmental and social considerations are summarized as followings.

1.4.9.1 Air pollution

SEA survey by ANE measured air quality at bridge construction points. Table 1-19 shows results of measurement and comparing standards. According to the results, SO_2 at Muagamula bridge exceeded the domestic standard. Generally, SO_2 is originated from fossil fuel, therefore, monitoring SO_2 during construction is recommended.

Table 1-19 Results of Air Quality Survey

Reference Standard		CO (μg/m^3)	NO_2 (μg/m^3)	SO_2 (μg/m^3)	TSP (μg/m^3)
WHO Standard		-	-	20 (Guideline)	-
Decree No.67		10,000 (8-hour ave.)	200 (1-hour)	100	150 (24-hour)
Bridge	Location	CO (μg/m^3)	NO_2 (μg/m^3)	SO_2 (μg/m^3)	TSP (μg/m^3)
Muagamula Bridge	Muagamula 1	116 (0.1 ppm)	114 (0.06 ppm)	53 (0.02 ppm)	-
	Muagamula 2	116 (0.1 ppm)	133 (0.07 ppm)	133 (0.05 ppm)	-
Mungoe Bridge	Rio Nango	2,212 (1.90 ppm)	6.90	6.54	7.90
	Rio Nango	2,224 (1.91 ppm)	6.92	6.53	7.87
Muela 1 and 2 Bridges	Rio Nwela 1	2,247 (1.93 ppm)	6.20	6.76	7.45
	Rio Nwela 1	2,247 (1.93 ppm)	6.20	6.76	7.46
	Rio Nwela 2	2,259 (1.94 ppm)	6.45	6.72	7.46
	Rio Nwela 2	2,247 (1.93 ppm)	6.50	6.73	7.46

1.4.9.2 Water Quality

SEA survey by ANE measured water quality at bridge construction points. Table 1-20 shows results of measurement and comparing standards.

Table 1-20 Results of Water Quality Survey

Parameter	Muagamula (ARM-07)	Mungoe (Aldeia Nango)	Muera 1	Muera 2	IFC Standard	Diploma No.18 (2004) / DM 180 (2004)
Temperature (℃)	24.8	25	25	25	-	-
pH	7.98	8	8	8	6-9	6.5-8.5
TDS (mg/l)	1,177	-	-	-	-	< 500
OD (mg/l)	6.91	< 2.5	4.56	4.8		4-5 (20□)
NH_4^+ (mg/l)	< 0.02	3.5	0.4	1.5		< 5
Arsenic (mg/l)	0	< 0.01	< 0.01	< 0.01		0.01
Cadmium (mg/l)	< 0.01	< 0.003	< 0.003	< 0.003		0.003
Cu (mg/l)	< 0.05	0.03	0.01	0.01		1.0
Total Coliforms (mg/l)	Presence in 100ml	> 2400	> 2400	> 2400		-
Pb (mg/l)	0.002	< 0.03	< 0.01	< 0.01		0.01
Cr (mg/l)	0.005	< 0.05	< 0.05	< 0.05		0.05
Cl (mg/l)	< 25	20.2	45.7	18		250
SO_4^{2-} (mg/l)	-	< 1	2.8	< 1		-
BOD (mg/l)	-	275	278	102	25	-
COD (mg/l)	-	105	312	67	125	-
Total Phosphorus (mg/l)	0.409					0.1
Total Iron (mg/l)	0.99	1.3	1	< 0.2		0.3
Mn (mg/l)	0.13	< 0.1	< 0.1	< 0.1		0.1
Hg (mg/l)	< 0.001	< 0.001	< 0.001	< 0.001		0.001
NO_3^- (mg/l)	13.7	< 0.5	< 0.5	< 0.5		50.0
NO_2^- (mg/l)	< 0.01	> 0.03	< 0.03	< 0.03		3.0
Total Nitrogen (mg/l)	0.055	0.4	0.05	4.8		-
SS (mg/l)	480	150	80	100	35	-
Zn (mg/l)	< 0.02	0.01	1.1	0.01		3.0

According to the results, some elements shown in the following table exceeded the IFC standard and domestic standard. Generally, turbidity of surface water around the bridges is originally high and contaminated by pesticide and fertilizer. Therefore, monitoring on these items during construction and operation is required.

Table 1-21 Items of Water Quality Exceeded the Standards

Parameter	Muagamula (ARM-07)	Mungoe (Aldeia Nango)	Muera 1	Muera 2
TDS	Equal to double of upper limit of the standard	-	-	-
OD	Exceeded 20% of upper limit of the standard	-	-	-
BOD	-	Equal to 10 times of the standard	Equal to 10 times of the standard	Equal to 4 times of the standard
COD			Equal to 3 times of the standard	
Phosphorus	Equal to 4 times of the standard			
SS	Equal to 10 times of the standard	Equal to 5 times of the standard	Equal to 3 times of the standard	Equal to 3 times of the standard

1.4.9.3 Solid Waste

Existing bridges, bailey bridges, can be re-used for another locations, therefore, construction waste from bridge sites are very limited. Other debris from the clearance of existing bridges can be recycled as road basement. No more specific construction waste is expected. General waste from construction yards and camping yards including toilet will be generated. It is recommended that appropriate disposal of these solid waste is monitored during the construction.

1.4.9.4 Soil Pollution

Construction of the bridges required several kinds of machines which use engines with gasoline and diesel fuel. Therefore, lack of maintenance and accident may cause soil pollution in the limited areas. Smooth and appropriate measures are necessary to avoid and minimize oil leaking due to such accidents.

1.4.9.5 Noise and Vibration

SEA survey by ANE measured noise and vibration (only Muagamula bridge) baselines at bridge construction points. Table 1-22 shows results of noise measurement and comparing standards. Noise level at Muagamula bridge in daytime slightly exceeded the standard of Industry/commercial area. On the other hand, there is no residents around the area of bridges construction.

Table 1-22 Result of Noise Measurement

Point	Hours	Leq, dB(A)	Duration (s)	Environmental Noise LAeq, dB (A)	Residual Noise dB (A)	Note
Muagamula	11:25-11:40	Min-45	840	77.4	44.8	
		Max-91	60			
Rio Nango	-	-	-	47.7	-	without traffic
Rio Muera 1	-	-	-	44.2	-	
Rio Muera 1	-	-	-	45.1	-	
Rio Muera 2	-	-	-	48.2	-	
Rio Muera 2	-	-	-	48.1	-	

Table 1-23 shows results of vibration measurement and comparing standards. Baseline data at Muagamula is 6.4 mm/s, and the value is the level of "uncomfortable" according to SEA. On the other hand, there is no residents around the area of bridges construction.

Table 1-23 Result of Vibration Measurement

Point	Hours	Vp (mm/s)	Environmental Vibration, Veq (mm/s)	Observations
Muagamula	11:25-11:40	Min-1.6	6.4	Without traffic
		Max-8.6		vehicles in transit

1.4.9.6 Protected Area

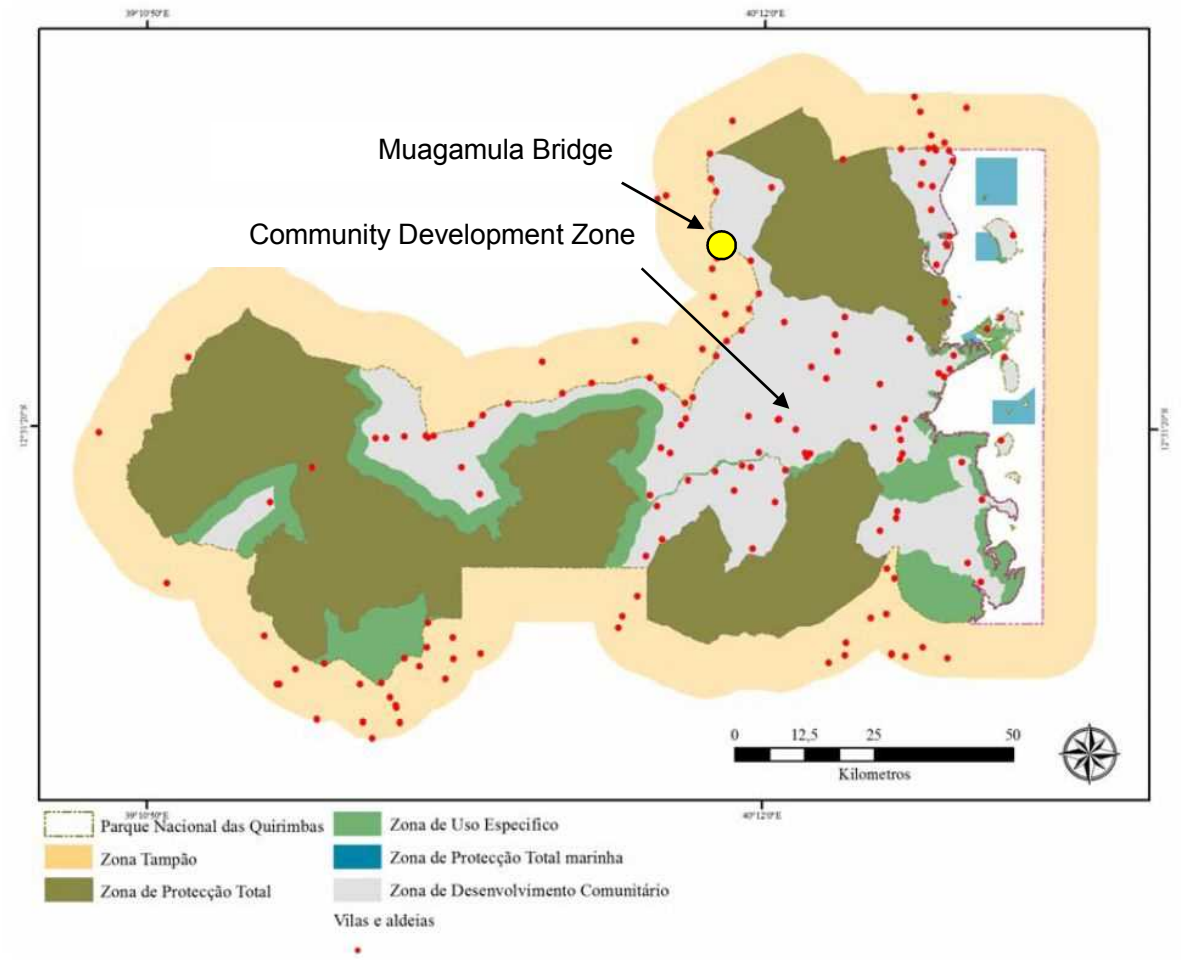
Only Muagamula bridge is located within the buffer zone of Quirimbas National Park (QNP). Situation of the bridge and QNP is described as following;

- Muagamula Bridge is located in the buffer zone which is extended from the border of QNP.
- Zone of QNP which is next to Muagamula bridge is Community Development Zone (ZDC)
- Vicinity of Macomia village around 15km far from the Muagamula bridge is belonging to conflict area of human and wild animals.
- Fauna around the Muagamula bridge is relatively poor and lands are highly used by human activities
- QNP areas are registered as Biosphere Reserve of UNESCO in 2018.
- Impact caused by the project would be limited because the construction is not new alignment but at the existing bridge sites.

- DEPTADER determined the project as Category B (Impact is not severe as Category A)

Based on above conditions and situations, Figure 1-11 shows location of Muagamula bridge and QNP. According to the map, Muagamula bridge is not inside the QNP and neighboring zone of QNP is ZDC where the local people is allowed to continue their socio-economical activities (Gray colored area in the map).

Target four bridges including Muagamula bridge is no required any specific application due to regulation of QNP. According to MITADER, any development activities in the buffer zone and community development zone of national park is just required EIA process. In addition, UNESCO's Biosphere Reserve does not pause any additional regulation and processes.



Source: Quirimubs National Park Management Plan (2012-2021), Ministry of Tourism

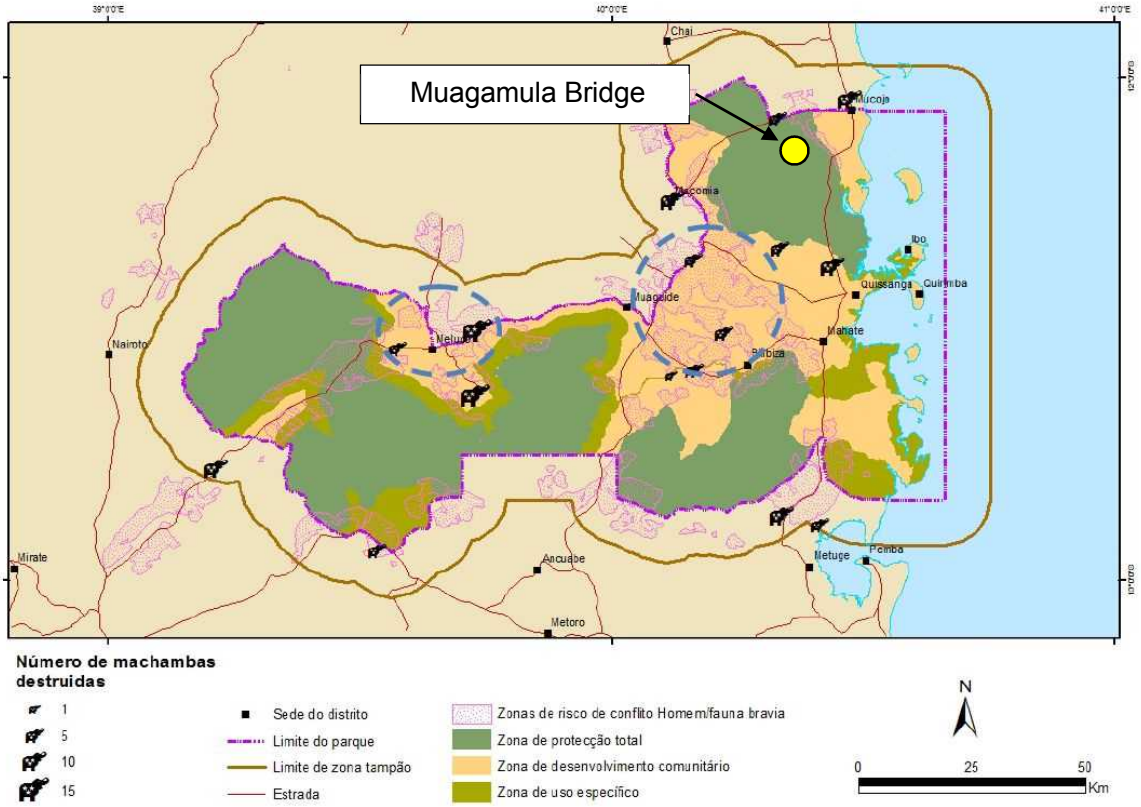
Figure 1-11 Location of Muagamura Bridge with QNP

1.4.9.7 Ecosystem

Based on Management Plan of QNP (2012-2021), confliction between human and elephants are reported in the vicinity of Macomia village located around 15km from Muagamula bridge. It has not been recorded and reported elephants and other large wild animals' migration around the bridge area. Figure 1-12 shows conflict areas, purple dotted areas, in and surrounding of QNP.

On the other hand, roadkill is quite rare case along the National Road No. 380 according to relevant officers in both Maputo and Pemba. Considering the situation, monitoring of animal crossing is

required during the constriction period and further action might be discussed based on the results of monitoring, if necessary.



Source: Quirimubs National Park Management Plan (2012-2021), Ministry of Tourism

Figure 1-12 Conflict Areas between Human Life and Elephant

1.4.9.8 HIV/AIDS

HIV/AIDS issue is still one of the concerns of construction in Mozambique. Therefore, contractor shall implement educational activities for prevention of HIV/AIDS during the construction period.

1.4.9.9 Working environment (including labor safety)

Risk of construction accident may be increased during the upper bridge works. Therefore, contractor shall implement educational activities for safety management periodically and consider measures such as installation of safety fences during the construction period.

1.4.9.10 Accident

Possibility of traffic accident will be increased due to improvement of bridges and high-speed vehicles. Monitoring is needed on management of vehicle speed of construction machined/cars during construction period. Another monitoring is needed on increasing of traffic accident around the bridge in the operational phase. On the other hand, traffic safety in the regions and passing traffic will be enhanced due to safe and reliable river-crossing all the time.

1.4.10 Impact Assessment

Table 1-24 to Table 1-27 shows the result of the environmental and social considerations survey based on the site reconnaissance, hearings at related agencies, and collection of materials for Messalo I, Messalo III, and Mapuede bridge.

Table 1-24 Environmental and Social Consideration Result (Muagamula bridge)

Impact item		Evaluation in scoping		Evaluation based on survey results		Reason of evaluation
		Before works During works	In service	Before works During works	In service	
1	Air pollution	B-	B-	B-	D	During Works: Temporal and regional impact may occur due to operation of construction machineries. Such pollution may be dissolved after diffusion toward down stream of wind, therefore, impact on air is not critical at local communities. In service: Increasing of traffic volume due to the bridge is limited and smooth traffic at the bridge point may reduce the emission. Therefore, deterioration of air quality due to future traffic is not expected.
2	Water pollution	B-	C	B-	D	During works: The substructure works will be scheduled during the dry season. The digging method of construction adopts the coffer dam method, however, muddy water may run from the construction site. In service: With appropriate drainage system, rain water may not cause muddy water flow from the bridge areas.
3	Solid wastes	B-	D	B-	D	During works: The waste might be generated from construction sites. In service: No impact because new wastes are not generated by services
4	Soil pollution	B-	D	B-	D	During works: Crane truck and pile machine may cause oil leaking and soil pollution can be occurred at the sites. In service: No impact because new pollution is not occurred by services
5	Noise and vibration	B-	B-	B-	D	During works: There is possibilities of temporal noise pollution based on high noise level at the baseline data In services: Around a project site, there are not houses and facilities. Therefore, impact of noise and vibration may not occur.
6	Land subsidence	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause land subsidence.
7	Bad odor	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause bad odor.

8	Bottom sediment	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on bottom sediment.
9	Protected areas	B-	D	B-	D	During works: The bridge is located in the buffer area of QNP, therefore, there are possibilities of touching to regulations during construction
10	Ecosystem	B-	B-	B-	D	During works: Impact on ecosystem is expected because the location of the bridge is next to QNP. In service: No impact is expected because the construction is rehabilitation of existing bridge and traffic volume will not be drastically changed in the near future.
11	Hydrological phenomena	D	D	D	D	Construction in riverbed areas are implemented during the dry season. cross-section of river is not affected after completion. Therefore, impact is not expected.
12	Topography and geology	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on topography and geology.
13	Resettlement of residents	D	D	D	D	No impact is expected because it is not estimated any land acquisition and resettlement.
14	Impoverished classes	D	D	D	D	No impact is expected because it is not estimated any component which cause negative on vulnerable groups.
15	Minorities and indigenous population	D	D	D	D	No impact is expected because there are not minorities and indigenous people in the project affected areas.
16	Local economy (employment and means of livelihood, etc.)	D	D	D	D	No impact is expected because there is no component which may cause negative impact on local economy.
17	Land use and use of local resources	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on land use and use of local resources.
18	Water use	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on water use.
19	Existing social infrastructure and social services	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on existing social infrastructure and social services.
20	Social infrastructure and social organizations such as local decision-making agencies, etc.	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on social infrastructure and social organizations such as local decision making agencies.
21	Maldistribution of damage and benefits	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on maldistribution of damage and benefits.

22	Clash of interests in the area	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on clash of interests in the area.
23	Cultural heritage	D	D	D	D	No impact is expected because it is not estimated any impact on cultural heritage.
24	Landscape	D	D	D	D	No impact is expected because it is not estimated any design which will cause negative impact on landscape.
25	Gender	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will change social framework of gender equivalent.
26	Rights of children	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will change social framework of rights of children.
27	HIV/AIDS and other infections	B-	D	B-	D	During works: Because many workers stay in the camping yard temporarily from the neighboring districts, infectious diseases might spread out. In service: No impact is expected after construction period.
28	Working environment (including labor safety)	B-	D	B-	D	During works: There are risks for works at high places during the girder erection and other works. In service: No impact is expected after construction period.
29	Accidents	B-	C	B-	B+	During works: Increased traffic volume with construction vehicles may cause temporal traffic block and traffic accident. In service: Safe river-crossing contributes decreasing of number of traffic accident. In addition, separation of vehicles and pedestrian may decrease risks of traffic accident.
30	Trans-boundary impacts and climate change	D	D	D	D	No impact is expected because traffic volume after the construction may not increase drastically.

A+/-: Significant negative impact is expected.
B+/-: Negative impact is expected to some extent.
C+/-: Extent of negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

Table 1-25 Environmental and Social Consideration Result (Muera I bridge)

Impact item		Evaluation in scoping		Evaluation based on survey results		Reason of evaluation
		Before works During works	In service	Before works During works	In service	
1	Air pollution	B-	B-	B-	D	During Works: Temporal and regional impact may occur due to operation of construction machineries. Such pollution may be dissolved after diffusion toward down stream of wind, therefore, impact on air is not critical at local communities. In service: Increasing of traffic volume due to the bridge is limited and smooth traffic at the bridge point may reduce the emission. Therefore, deterioration of air quality due to future traffic is not expected.
2	Water pollution	B-	C	B-	D	During works: The substructure works will be scheduled during the dry season. The digging method of construction adopts the coffer dam method, however, muddy water may run from the construction site. In service: With appropriate drainage system, rain water may not cause muddy water flow from the bridge areas.
3	Solid wastes	B-	D	B-	D	During works: The waste might be generated from construction sites. In service: No impact because new wastes are not generated by services
4	Soil pollution	B-	D	B-	D	During works: Crane truck and pile machine may cause oil leaking and soil pollution can be occurred at the sites. In service: No impact because new pollution is not occurred by services
5	Noise and vibration	B-	B-	B-	D	During works: There is possibilities of temporal noise pollution based on high noise level at the baseline data In services: Around a project site, there are not houses and facilities. Therefore, impact of noise and vibration may not occur.
6	Land subsidence	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause land subsidence.
7	Bad odor	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause bad odor.
8	Bottom sediment	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on bottom sediment.
9	Protected areas	D	D	D	D	No impact is expected because the bridge site is far from the border of a national park.

10	Ecosystem	D	D	D	D	No impact is expected because the construction is rehabilitation of existing bridge and does not cause negative impact on ecosystem.
11	Hydrological phenomena	D	D	D	D	Construction in riverbed areas are implemented during the dry season. cross-section of river is not affected after completion. Therefore, impact is not expected.
12	Topography and geology	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on topography and geology.
13	Resettlement of residents	D	D	D	D	No impact is expected because it is not estimated any land acquisition and resettlement.
14	Impoverished classes	D	D	D	D	No impact is expected because it is not estimated any component which cause negative on vulnerable groups.
15	Minorities and indigenous population	D	D	D	D	No impact is expected because there are not minorities and indigenous people in the project affected areas.
16	Local economy (employment and means of livelihood, etc.)	D	D	D	D	No impact is expected because there is no component which may cause negative impact on local economy.
17	Land use and use of local resources	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on land use and use of local resources.
18	Water use	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on water use.
19	Existing social infrastructure and social services	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on existing social infrastructure and social services.
20	Social infrastructure and social organizations such as local decision-making agencies, etc.	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on social infrastructure and social organizations such as local decision making agencies.
21	Maldistribution of damage and benefits	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on maldistribution of damage and benefits.
22	Clash of interests in the area	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on clash of interests in the area.
23	Cultural heritage	D	D	D	D	No impact is expected because it is not estimated any impact on cultural heritage.
24	Landscape	D	D	D	D	No impact is expected because it is not estimated any design which will cause negative impact on landscape.
25	Gender	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will change social framework of gender equivalent.

26	Rights of children	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will change social framework of rights of children.
27	HIV/AIDS and other infections	B-	D	B-	D	During works: Because many workers stay in the camping yard temporarily from the neighboring districts, infectious diseases might spread out. In service: No impact is expected after construction period.
28	Working environment (including labor safety)	B-	D	B-	D	During works: There are risks for works at high places during the girder erection and other works. In service: No impact is expected after construction period.
29	Accidents	B-	C	B-	B+	During works: Increased traffic volume with construction vehicles may cause temporal traffic block and traffic accident. In service: Safe river-crossing contributes decreasing of number of traffic accident. In addition, separation of vehicles and pedestrian may decrease risks of traffic accident.
30	Trans-boundary impacts and climate change	D	D	D	D	No impact is expected because traffic volume after the construction may not increase drastically.

Table 1-26 Environmental and Social Consideration Result (Muela II bridge)

Impact item		Evaluation in scoping		Evaluation based on survey results		Reason of evaluation
		Before works During works	In service	Before works During works	In service	
1	Air pollution	B-	B-	B-	D	During Works: Temporal and regional impact may occur due to operation of construction machineries. Such pollution may be dissolved after diffusion toward down stream of wind, therefore, impact on air is not critical at local communities. In service: Increasing of traffic volume due to the bridge is limited and smooth traffic at the bridge point may reduce the emission. Therefore, deterioration of air quality due to future traffic is not expected.
2	Water pollution	B-	C	B-	D	During works: The substructure works will be scheduled during the dry season. The digging method of construction adopts the coffer dam method; however, muddy water may run from the construction site. In service: With appropriate drainage system, rain water may not cause muddy water flow from the bridge areas.
3	Solid wastes	B-	D	B-	D	During works: The waste might be generated from construction sites. In service: No impact because new wastes are not generated by services

4	Soil pollution	B-	D	B-	D	During works: Crane truck and pile machine may cause oil leaking and soil pollution can be occurred at the sites. In service: No impact because new pollution is not occurred by services
5	Noise and vibration	B-	B-	B-	D	During works: There is possibilities of temporal noise pollution based on high noise level at the baseline data In services: Around a project site, there are not houses and facilities. Therefore, impact of noise and vibration may not occur.
6	Land subsidence	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause land subsidence.
7	Bad odor	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause bad odor.
8	Bottom sediment	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on bottom sediment.
9	Protected areas	D	D	D	D	No impact is expected because the bridge site is far from the border of a national park.
10	Ecosystem	D	D	B-	D	No impact is expected because the construction is rehabilitation of existing bridge and does not cause negative impact on ecosystem.
11	Hydrological phenomena	D	D	D	D	Construction in riverbed areas are implemented during the dry season. cross-section of river is not affected after completion. Therefore, impact is not expected.
12	Topography and geology	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on topography and geology.
13	Resettlement of residents	D	D	D	D	No impact is expected because it is not estimated any land acquisition and resettlement.
14	Impoverished classes	D	D	D	D	No impact is expected because it is not estimated any component which cause negative on vulnerable groups.
15	Minorities and indigenous population	D	D	D	D	No impact is expected because there are not minorities and indigenous people in the project affected areas.
16	Local economy (employment and means of livelihood, etc.)	D	D	D	D	No impact is expected because there is no component which may cause negative impact on local economy.
17	Land use and use of local resources	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on land use and use of local resources.
18	Water use	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on water use.
19	Existing social infrastructure and social services	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on existing social infrastructure and social services.

20	Social infrastructure and social organizations such as local decision-making agencies, etc.	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on social infrastructure and social organizations such as local decision making agencies.
21	Maldistribution of damage and benefits	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on maldistribution of damage and benefits.
22	Clash of interests in the area	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on clash of interests in the area.
23	Cultural heritage	D	D	D	D	No impact is expected because it is not estimated any impact on cultural heritage.
24	Landscape	D	D	D	D	No impact is expected because it is not estimated any design which will cause negative impact on landscape.
25	Gender	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will change social framework of gender equivalent.
26	Rights of children	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will change social framework of rights of children.
27	HIV/AIDS and other infections	B-	D	B-	D	During works: Because many workers stay in the camping yard temporarily from the neighboring districts, infectious diseases might spread out. In service: No impact is expected after construction period.
28	Working environment (including labor safety)	B-	D	B-	D	During works: There are risks for works at high places during the girder erection and other works. In service: No impact is expected after construction period.
29	Accidents	B-	C	B-	B+	During works: Increased traffic volume with construction vehicles may cause temporal traffic block and traffic accident. In service: Safe river-crossing contributes decreasing of number of traffic accident. In addition, separation of vehicles and pedestrian may decrease risks of traffic accident.
30	Trans-boundary impacts and climate change	D	D	D	D	No impact is expected because traffic volume after the construction may not increase drastically.

Table 1-27 Environmental and Social Consideration Result (Mungoe bridge)

Impact item		Evaluation in scoping		Evaluation based on survey results		Reason of evaluation
		Before works During works	In service	Before works During works	In service	
1	Air pollution	B-	B-	B-	D	During Works: Temporal and regional impact may occur due to operation of construction machineries. Such pollution may be dissolved after diffusion toward down stream of wind, therefore, impact on air is not critical at local communities. In service: Increasing of traffic volume due to the bridge is limited and smooth traffic at the bridge point may reduce the emission. Therefore, deterioration of air quality due to future traffic is not expected.
2	Water pollution	B-	C	B-	D	During works: The substructure works will be scheduled during the dry season. The digging method of construction adopts the coffer dam method, however, muddy water may run from the construction site. In service: With appropriate drainage system, rain water may not cause muddy water flow from the bridge areas.
3	Solid wastes	B-	D	B-	D	During works: The waste might be generated from construction sites. In service: No impact because new wastes are not generated by services
4	Soil pollution	B-	D	B-	D	During works: Crane truck and pile machine may cause oil leaking and soil pollution can be occurred at the sites. In service: No impact because new pollution is not occurred by services
5	Noise and vibration	B-	B-	B-	D	During works: There is possibilities of temporal noise pollution based on high noise level at the baseline data In services: Around a project site, there are not houses and facilities. Therefore, impact of noise and vibration may not occur.
6	Land subsidence	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause land subsidence.
7	Bad odor	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause bad odor.
8	Bottom sediment	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on bottom sediment.
9	Protected areas	D	D	D	D	No impact is expected because the bridge site is far from the border of a national park.

10	Ecosystem	D	D	B-	D	No impact is expected because the construction is rehabilitation of existing bridge and does not cause negative impact on ecosystem.
11	Hydrological phenomena	D	D	D	D	Construction in riverbed areas are implemented during the dry season. cross-section of river is not affected after completion. Therefore, impact is not expected.
12	Topography and geology	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on topography and geology.
13	Resettlement of residents	D	D	D	D	No impact is expected because it is not estimated any land acquisition and resettlement.
14	Impoverished classes	D	D	D	D	No impact is expected because it is not estimated any component which cause negative on vulnerable groups.
15	Minorities and indigenous population	D	D	D	D	No impact is expected because there are not minorities and indigenous people in the project affected areas.
16	Local economy (employment and means of livelihood, etc.)	D	D	D	D	No impact is expected because there is no component which may cause negative impact on local economy.
17	Land use and use of local resources	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on land use and use of local resources.
18	Water use	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on water use.
19	Existing social infrastructure and social services	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on existing social infrastructure and social services.
20	Social infrastructure and social organizations such as local decision-making agencies, etc.	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on social infrastructure and social organizations such as local decision making agencies.
21	Maldistribution of damage and benefits	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on maldistribution of damage and benefits.
22	Clash of interests in the area	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will cause negative impact on clash of interests in the area.
23	Cultural heritage	D	D	D	D	No impact is expected because it is not estimated any impact on cultural heritage.
24	Landscape	D	D	D	D	No impact is expected because it is not estimated any design which will cause negative impact on landscape.
25	Gender	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will change social framework of gender equivalent.

26	Rights of children	D	D	D	D	No impact is expected because it is not estimated any construction method or equipment which will change social framework of rights of children.
27	HIV/AIDS and other infections	B-	D	B-	D	During works: Because many workers stay in the camping yard temporarily from the neighboring districts, infectious diseases might spread out. In service: No impact is expected after construction period.
28	Working environment (including labor safety)	B-	D	B-	D	During works: There are risks for works at high places during the girder erection and other works. In service: No impact is expected after construction period.
29	Accidents	B-	C	B-	B+	During works: Increased traffic volume with construction vehicles may cause temporal traffic block and traffic accident. In service: Safe river-crossing contributes decreasing of number of traffic accident. In addition, separation of vehicles and pedestrian may decrease risks of traffic accident.
30	Trans-boundary impacts and climate change	D	D	D	D	No impact is expected because traffic volume after the construction may not increase drastically.

1.4.11 Mitigation measure

Table 1-28 shows the discussed environmental impacts of the Project and proposed mitigation measures.

Table 1-28 Environmental Impact and Mitigation Measures by Works

Impact item	Element (Work)	Mitigation measure	Responsible authority	Management authority	Cost
Air pollution	Piling work	・Construction machinery for digging works shall be maintained regularly to minimize emission gas.	Contractor	ANE/ Consultant	By safety management cost of the contractor
	Base course work	・Water sprinkling for dust prevention			
	Transportation	・Construction vehicles for digging works shall be maintained regularly to minimize emission gas.			
Water pollution	Piling work	・Coffer dam method may be applied and schedule construction in river areas in dry season.	Contractor	ANE/ Consultant	By safety management cost of the contractor
	Cut and embankment	・Large sandbag may be allied for erosion prevention. ・Sedimentation pond may be applied for muddy water prevention.			
Solid wastes	Construction Sites (Cut and embankment, Breakdown of existing bridges)	・Principally reuse and recycle the materials of existing bridges ・Generated waste is carried to the disposal points specified by ANE.	Contractor	ANE/ Consultant	By safety management cost of the contractor
	Camp yard	・Generated waste is carried to the disposal points specified by ANE. ・Septic tank shall be installed to toilets and other wastewater points.			
Soil pollution	Piling work	・Construction machineries are periodically checked and maintained to prevent oil contamination.	Contractor	ANE/ Consultant	By safety management cost of the contractor
Protected Areas	Construction Works (Muagamula Bridge Only)	・Monitor construction works and if additional activities are required, confirm necessary process to national park office through ANE.	Contractor	ANE, MITADER (ANAC) / Consultant	By safety management cost of the contractor
Ecosystem	Bridge work	・Observe and report wild animals around the construction areas and cases of road killing, if happened.	Contractor	ANE/ Consultant	By safety management cost of the contractor
HIV/AIDS and other infections	Labor	・Organize the seminar about the prevention of infectious disease. ・Recommend health check to construction workers.	Contractor	ANE/ Consultant	By safety management cost of the contractor
Working environment	Erection work	・Install preventive facilities such as fences at the high working place. ・ Make a safety management plan ・ Organize safety management seminar periodically.	Contractor	ANE/ Consultant	By safety management cost of the contractor
Accidents	Transportation	・ Manage driving speed of construction vehicles. ・Make a transportation plan with traffic safety ・ Organize safety management seminar periodically.	Contractor	ANE/ Consultant	By safety management cost of the contractor

1.4.12 Environmental Management Plan

1.4.12.1 Organization system

Information sharing among ANE, MITADER, surrounding communities, and etc. is quite important to secure environmental and social considerations. Figure 1-13 and Figure 1-14 show the schematic diagram of the organization system for during construction and in service. It is important to form comprehensive approaches of public participation and information disclosure process prior to the project implementation.

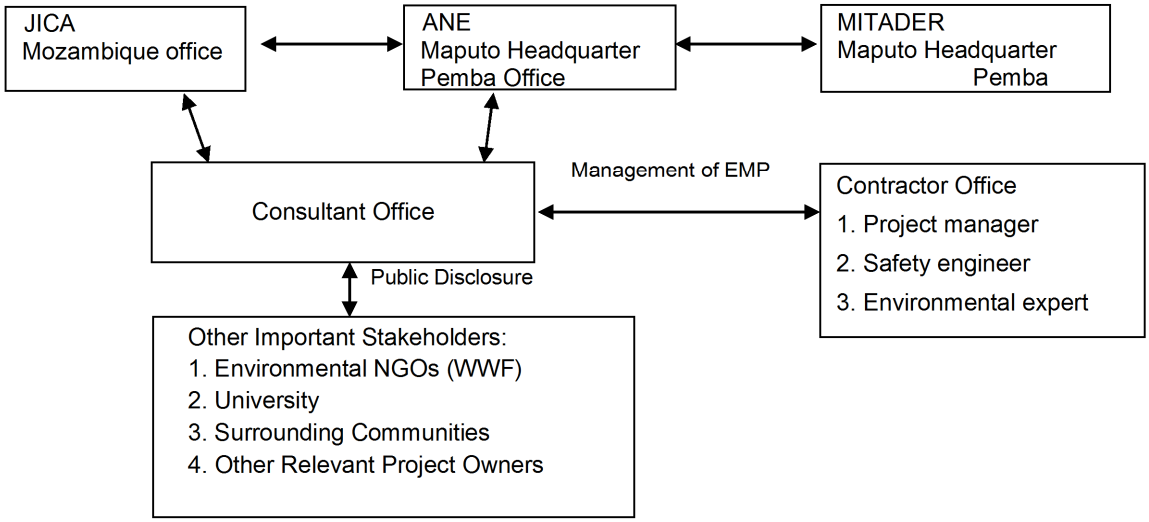


Figure 1-13 Organization system (during works)

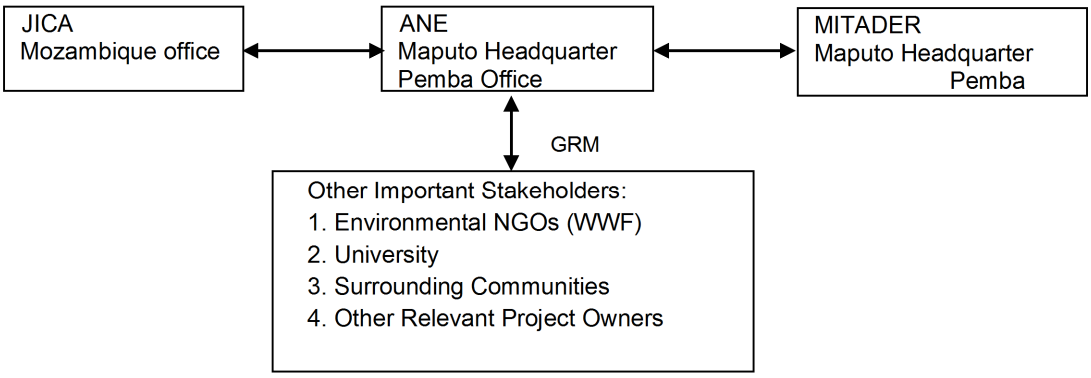


Figure 1-14 Organization system (in service)

1) ANE

ANE places a construction management engineer and manages the result of environmental monitoring. ANE report necessary information, such as monitoring report, to JICA during both construction and operation phases.

2) Contractor

The contractor carries out the following activities about an environmental management plan.

- To review an environmental management plan at the time of a bid.
- To make a list for enforcement person in charge of construction management plan due to meet the experience of similar project in a tender document.
- To review a monitoring plan before a construction start and make a construction plan.
- To set up organization system and enforce the environmental monitoring.
- To submit the monitoring plan to ANE and approved it.
- To report the result of monitoring plan to JICA and ANE in a monthly.

1.4.12.2 Environmental Monitoring

Table 1-29 summarizes the fundamental directions of environmental monitoring activities, to be implemented within environmental management plan of the proposed bridge rehabilitation project.

Table 1-29 Monitoring plan

Item	Monitoring	Location	Frequency	Responsible organization
During works				
Air pollution	SO_2, No_2, CO and Total Suspended Particles (TSP) by appropriate equipment and visual monitoring	Around the bridge sites	Monthly	Contractor
Water pollution	pH, turbidity, and erosion by appropriate equipment and/or visual monitoring	Upstream and downstream from the bridge	Monthly	Contractor
Waste	Record reviewing and visual monitoring for disposal method and water pollution	Around the bridge sites	Daily	Contractor
Soil pollution	Patrol (leaking oil from construction equipment or storage yard to ground)	Around the bridge sites	Daily or time of any changes	Contractor
Noise	Measure noise by equipment	Around the bridge sites	Daily or demand bases	Contractor
Protected Area	Confirm impact areas in the field, especially any change of construction areas	Around the bridge site (Muagamula Bridge only)	As needed	Contractor
Ecosystems	Monitoring if there is wild animal form Quirimbas National park. If roadkill on the bridge is observed, the incident shall be reported to relevant authorities, such as ANE, DEPTADER, etc. Any changes of flora including cutting tree is observed.	Around the bridge sites	Daily or as needed	Contractor
HIV/AIDS and other infections	Confirm the record of education program for labors and situation of infections.	Around the bridge sites	Every quarter or as needed	Contractor
Working Environment	Confirm the record of working environment and education and management on safety.	Around the bridge sites	Every day or month	Contractor
Accidents	Confirm the record of road safety and construction safety.	Around the bridge sites	At the beginning of construction and following every month	Contractor
In service				
Ecosystem	Monitor roadkill cases of large wild animals and regulate traffic or give education, if necessary.	Around the bridge sites	Time of accident or demand base	ANE
Accidents	Confirm and monitor the situation of traffic accident, and regulate traffic or give education, if necessary.	Around the bridge sites	Time of accident or demand base	ANE

1.4.12.3 Environmental Checklist

Based on Annex 5 of the JICA Guidelines for Environmental and Social Considerations (2010) and characteristics of this project, environmental checklist has been discussed as following table.

Table 1-30 Environmental Checklist

	Fields	Items	Check	Outlines
1.	Approval	EIA and relevant approval	✓	Approved by DEPTADER and certified.
		Explanation to local people	✓	Stakeholder meetings has been done.
2.	Pollution	Air	✓	Baseline measurement has been done and mitigation and monitoring plan has been discussed.
		Water	✓	Baseline measurement has been done and mitigation and monitoring plan has been discussed.
		Waste	✓	Mitigation and monitoring plan have been discussed.
		Soil	✓	Mitigation and monitoring plan have been discussed.
		Noise and Vibration	✓	Baseline measurement has been done and mitigation and monitoring plan has been discussed.
		Land subsidence	✓	Not expected (based on on-going phase 1 project)
		Bad odor	✓	Not expected (based on on-going phase 1 project)
		Bottom Sediment	✓	Not expected (based on on-going phase 1 project)
3.	Natural Environment	Protected areas	✓	Baseline measurement has been done and mitigation and monitoring plan has been discussed.
		Ecosystem	✓	Baseline measurement has been done and mitigation and monitoring plan has been discussed.
		Hydrological phenomena	✓	Not expected (based on on-going phase 1 project)
		Topography and geology	✓	Not expected (based on on-going phase 1 project)
		Land management after construction	✓	Not expected (based on on-going phase 1 project)
4.	Social Environment	Involuntary resettlement	✓	Not expected (confirmed through field surveys)
		Livelihood	✓	Not expected (confirmed through field surveys)
		Cultural heritage	✓	Not expected (confirmed through field surveys)
		Land scape	✓	Not expected (confirmed through field surveys)
		Ingenious People	✓	Not expected (confirmed through field surveys)
		Working environment (including labor safety)	✓	Possibly occur (based on on-going phase 1 case)
5.	Others	Impact during construction	✓	Temporal impact may occur due to detour, construction vehicles, and etc.
		Measures taken to accidents	✓	Mitigation measures, such as road safety and construction safety are confirmed.
		Monitoring	✓	Monitoring plan was confirmed.

1.4.13 Stakeholder consultations

Stakeholder consultations for the target areas of 4 bridges were organized by ANH in 2018 to provide information on project impact and to exchange opinions among stakeholders and project owner's side. Stakeholder meetings were organized at district level with representatives from DEPTADER, ANE, and local authorities as well as relevant stakeholders. Women were also participated in the meetings with ratio of 1:2 - 1:3 comparing to men.

Participants consist of officers from local government, ANE, DPTADER, and relevant residents around the bridge sites. Table 1-31 shows outline of the stakeholder consultations followed by summary of discussion in Table 1-32.

Table 1-31 Outline of the Stakeholder Meetings

Lot	Date and Time	Location	Number of Participants
Lot-A for Catipussi and Muagamura Bridge	21 November, 2018 9:00AM	Muagamula Village, Macomia District	82 Persons - Male: 59 - Female: 23
Lot-A for Catipussi and Muagamura Bridge	21 November, 2018 2:00PM	Pedreira Village, Meluco District	89 Persons - Male: 57 - Female: 32
Lot-C for Mungoe, Muera1 and Muera 2 Bridge	3 December, 2018 9:00AM	Ciracao Village, Muidumbe District	65 Persons - Male: 42 - Female: 23
Lot-C for Mungoe, Muera1 and Muera 2 Bridge	4 December, 2018 9:00AM	Oasse main Village, Mocimboa da Praia District	76 Persons - Male: 59 - Female: 16

Table 1-32 Summary of Consultation Explanation

Date and Venue	Person	Contents	Answers for Opinion/Questions
21 November, 2018 Muagamula Village (for the bridge of Muagamula)	Resident	He welcomed the project because of benefit to the local people and interested in job opportunities during the construction phase.	Local employment for the construction was explained.
	Resident	He mentioned there are risks of conflict between labors coming from other regions.	Appropriate labor management under Japanese ODA was explained.
	DPTADER	Local labor shall be prioritized for recruitment of construction.	Local employment for the construction was explained.
	ANE	At least 25% of the total number of workers of the construction exclusively reserved for women.	Just an explanation from ANE.
21 November, 2018 Pedreira Village (for the bridge of Muagamula)	Resident	During the construction phase, labor recruitment shall consider Pedreira village to avoid social conflicts.	Local employment for the construction was explained. And appropriate labor management under Japanese ODA was explained.
	Resident	Date of commencement of the project shall be disclosed.	Not yet decided and date of commencement shall be informed.
	Local authority	Local people must be honest and must not steal construction material if you want to obtain jobs during the project implementation.	Just an explanation from local authority.
	DPTADER	Education of the road safety for the kids is very important to mitigate impact after bridge construction.	Just an explanation from local authority.

3 December, 2018 Ciracao Village (for the bridges of Mungoe, Muera1 and Muera2)	Local authority	How long will be the bridge length? When the construction will be started?	Not yet decided and further information shall be informed.
	Local authority	Will the decks of the bridges being built on the spot in reinforced concrete or will they be pre-manufactured?	Not yet decided and further information shall be informed.
	Resident	In case farmlands are covered by the bypass roads layout, is the compensation guaranteed?	Construction shall be implemented within exiting ROW in principle.
	Local authority	During the recruitment process, this project shall give priority to local labor.	Local employment for the construction was explained.
	Resident	What will be the contractor requirements for labour recruitment?	Not yet decided and further information shall be informed.
	Resident	To avoid compensations for crops lost, he suggested that the works start after harvest season.	Prior notice with enough time shall be done.
	Resident	Does the project include the construction of a health center to assist the population living around the project area?	Not involved.
4 December, 2018 Oasse main Village (for the bridges of Mungoe, Muera1 and Muera2)	Resident	He urges for the inclusion of local labor during the construction phase.	Local employment for the construction was explained.
	Resident	He urges that workers and residents of Nango area, as well as the local cultures be respected before any intervention by the contractor.	Local employment for the construction was explained. And appropriate labor management under Japanese ODA was explained.
	Resident	He urges the proponent that the new bridges should have enough space for pedestrians, which is now inexistent and endangers their lives when the trucks cross the bridges.	Sidewalk with enough space shall be constructed.

1.5 Existing Bridges

The current condition was observed by the survey team, and the cause of the damage of existing bridges was investigated. The current condition shows in Table 1-33.

Table 1-33 Current Condition of Existing Bridge

No.	Bride name	Cause of damage
1	Muagamula bridge	3 spans T girder concrete bridge 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.
2	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.
3	Muera II bridge	The temporary steel truss bridge located in wetlands. A guard rail on the deck does not installed in the bridge. In January 2019, the bridge collapsed due to the passing of overloaded vehicles going south. As of February 2019, the Bailey Bridge is insalled in the same location as the truss bridge.
4	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 show the existing bridge condition based on the field investigation.

Bridge Inspection Record 1 1st of March, 2019

Bridge Name		Muagamula Bridge	Road Name		N 380
Province		Cabo Delgado	Distance & Construction year		Macomia 12km+800
Bridge Length		33.0m (Bailey)	Total Width		4.3m
Span Arrangement		-	Lane Width		4.0m
Number of Span		Single Span	Sidewalk Width		N/A
Coordinates		South 12° 8'12.81",East 40° 7'14.17"	Number of Lane		Single
Traffic	Heavy Vehicle	Many	Road Condition	Surounding Environment	No House
	Car	Most		Upstream side	Maize firm
	Bike	Few		Downstream side	No firm
	Pedestrian	Few		Sunate side	2 lane paved road
Control	Weight	20ton		Oasse side	2 lane paved road
	Height	N/A		ROW	30m from road center
	Width	4.0m	River Condition	Channel Changing	Stable
	Other	N/A		Scouring	marks of scour
Public Attachment		N/A		River Name	Muagamula River
Superstructure	Type	Bailey (11bay 3.04m)			
	Current Situation	The existing bridge has been reconstruct twice. As 1st bridge, concrete T girder bridge was constructed downstream of the present Bailey, but it was blown up. As 2nd bridge, 20m length concrete bridge was constructed at same position as the present Bailey bridge, but the abutment subsided and the bridge collapsed. At present, a new abutment and Bailey bridge has been installed.			
Substructure	Type	Abutment: Gravity type Pier: N/A			
	Current Situation	River bed is formed by sand and the center part is scoured. Since there are no piles installed under the abutment, the subsidence of the abutment due to scouring is considered to be the cause of the collapse of the bridge.			
Road	Current Situation	Horizontal alignment of the road around bridge has two slow S-curve, because Bailey brige was installed next to the 1st existing bridge.			
Others	Current Situation	1st existing bridge still remains on the downstream side of Bailey bridge. There is electrical line at about 30m upstream side from Bailey bridge.			
Evaluation	Bailey bridge has no damage, but there is high possibility of bridge collapse due to abutment subsidence caused by scouring due to floods.				

Muagamula Bridge | Photos | 1st of March, 2019

Overall View of Bridge

Front View from Sunate side

Upstream from Brige

Downstream from Bridge

Abutment of 2nd Existing Bridge

Girder of 1st Existing Bridge

Bridge Inspection Record 2

2nd of March, 2019

Bridge Name		Muera I Bridge	Road Name		N 380
Province		Cabo Delgado	Distance & Construction year		Macomia 85km+700
Bridge Length		45.0m	Total Width		7.3m
Span Arrangement		7@5.0m+2@5.0m	Lane Width		6.3m
Number of Span		9 spans	Sidewalk Width		2@0.5m
Coordinates		South 11°38'10.00", East 40° 0'56.00"	Number of Lane		Double
Traffic	Heavy Vehicle	Many	Road Condition	Surounding Environment	No House
	Car	Most		Upstream side	Banana, Maiz, Mango firm
	Bike	Few		Downstream side	Banana, Maiz, Mango firm
	Pedestrian	Few		Sunate side	2 lane paved road
Control	Weight	N/A		Oasse side	2 lane paved road
	Height	N/A		ROW	30m from road center
	Width	6.3m	River Condition	Channel Changing	Stable
	Other	N/A		Scouring	marks of scour
Public Attachment		N/A		River Name	Muera River
Superstructure	Type	RC slab bridge & temporary bridge			
	Current Situation	Temporary concrete slab was installed on temporary H shape girder after 2 spans of 9 spans RC slab bridge has collapsed. There are some crack on the temporary concrete slab.			
Substructure	Type	Abutment: Wall type Pier: Wall type			
	Current Situation	River bed is formed by sand and the pilecap of pier is exposed by scouring. Since the piers doesn't have piles under the pilecap, one pier and girders were washed away due to subsidence of pier caused by scouring due to floods. At present, temporary H shepe bents support temporary superstructure.			
Road	Current Situation	Horizontal alignment of road both side of bridge is almost straight. Vertical alignment is almost flat.			
Others	Current Situation	The bridge is located on wetland area in Muera river.			
Evaluation	The temporary pier is unstable placed on the collapsed deck. There is a high possibility of bridge collapse coused by a collision of driftwood due to flood.				

Muera I Bridge | Photos | 2nd of March, 2019

Overall view (Mar 2015)

Front View from Sunate side

Upstream from Brige

Downstream from Bridge (Mar 2015)

Temporary pier (Mar 2015)

Temporary girder (Mar 2015)

Bridge Inspection Record 3

2nd of March, 2019

Bridge Name		Muera II Bridge	Road Name		N 380
Province		Cabo Delgado	Distance & Construction year		Macomia 85km+900
Bridge Length		24.0m (Bailey)	Total Width		4.3m
Span Arrangement		-	Lane Width		4.0m
Number of Span		Single Span	Sidewalk Width		N/A
Coordinates		South 11°38'8.42",East 40° 1'3.18"	Number of Lane		Single
Traffic	Heavy Vehicle	Many	Road Condition	Surounding Environment	No House
	Car	Most		Upstream side	Banana, Maiz, Mango firm
	Bike	Few		Downstream side	Banana, Maiz, Mango firm
	Pedestrian	Few		Sunate side	2 lane paved road
Control	Weight	28ton		Oasse side	2 lane paved road
	Height	N/A		ROW	30m from road center
	Width	4.0m	River Condition	Channel Changing	Stable
	Other	N/A		Scouring	marks of scour
Public Attachment		N/A		River Name	Muera River

Superstructure	Type	Bailey (8bay 3.04m)
	Current Situation	A temporary steel truss bridge was collapsed due to overloaded vehicle in Jan 2019. The bailey (24m) was installed at the same position with the steel truss as an emergency measure.
Substructure	Type	Abutment: Wall type Pier: N/A
	Current Situation	The river bed is composed of sand and the center is eroded. It is difficult to inspect the structure due to the overgrown plants.
Road	Current Situation	Horizontal alignment of the Sunate side is straight and the Oasse side has a slow curve. Vertical alignment has about 1% ascending toward the Oasse side.
Others	Current Situation	The bridge is located at wetlands in the Muera river.
Evaluation		Bailey bridge has no damage. The tempotrary abutments may not have foundation piles and there is a risk of bridge collapse due to the scouring and settlement. Immediate removal of the collapsed truss bridge is required since it obstructs the river flow area.

Muera II Bridge | Photos | 2nd of March, 2019

Overall view

Front View from Sunate side

Upstream from Brige

Downstream from Bridge

Box culvert on the detour (currently not allowed due to erosion)

Left : Detour, Right : Bailey bridge (from Sutena side)

Bridge Inspection Record 4

1st of March, 2019

Bridge Name		Mungoe Bridge	Road Name		N 380
Province		Cabo Delgado	Distance & Construction year		Macomia 99km+200
Bridge Length		24.0m (Bailey)	Total Width		4.3m
Span Arrangement		-	Lane Width		4.0m
Number of Span		Single Span	Sidewalk Width		N/A
Coordinates		South 11°32'3.30", East 40° 1'54.61"	Number of Lane		Single
Traffic	Heavy Vehicle	Many	Road Condition	Surounding Environment	No House
	Car	Most		Upstream side	No firm
	Bike	Few		Downstream side	No firm
	Pedestrian	Few		Sunate side	2 lane paved road
Control	Weight	20ton		Oasse side	2 lane paved road
	Height	N/A		ROW	30m from road center
	Width	4.0m	River Condition	Channel Changing	Stable
	Other	N/A		Scouring	marks of scour
Public Attachment		N/A		River Name	Mungoe River

Superstructure	Type	Bailey (8bay 3.04m)
	Current Situation	The existing structure is a 4 cell pipe culvert with 15.5m length. Bailey bridge is installed above the existing structure. The pipe culvert is severely damaged.
Substructure	Type	Abutment: Gravity type Pier: N/A
	Current Situation	The river bed is composed of sand and the center is eroded. Immediate removal is required since a level different has occurred at downstream side of existing structure.
Road	Current Situation	Horizontal alignment of Oasse side has a curve. Vertical alignment has a gradient toward the Oasse side.
Others	Current Situation	River bed has about 5m level different at downstream side.
Evaluation		Bailey bridge has no damage. Immediate removal of the pipe culvert which obstruct the river flow during floods is required, since it has a risk the overflowed water damage the bailey bridge.

Mungoe Bridge | Photos | 1st of March, 2019

Overall view from downstream

Front View from Oasse side

Upstream from Brige

Downstream from Bridge

Damage of existing pipe culvert

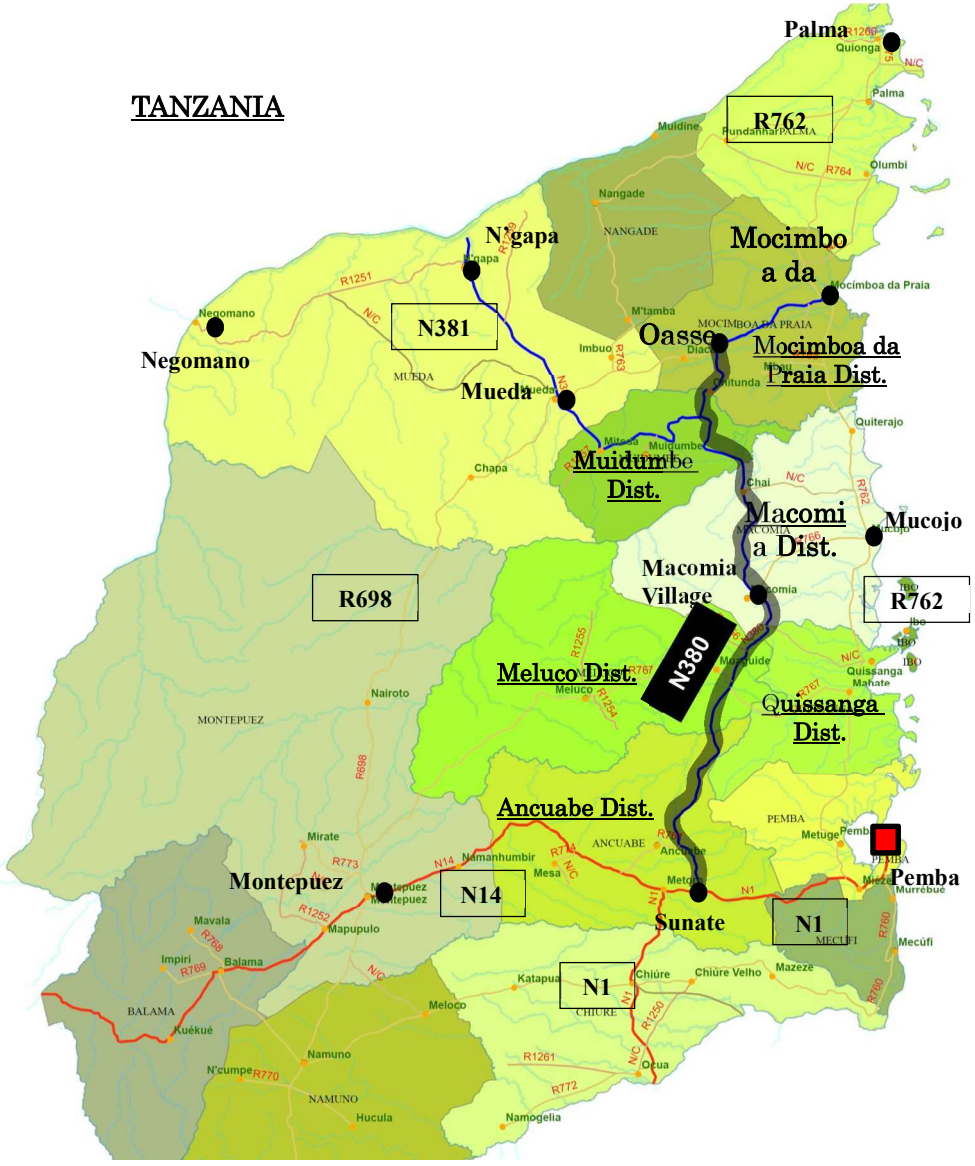
Deformation of river bed at outlet of downstram side

1. 6 Social Condition Survey

1.6.1 Outline of Cabo Delgado Province and Districts

1.6.1.1 Outline of the Project Site

Road No.380 (N380) where the target bridges are located connects Sunate and Oasse 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. On the other hand, Nacala Corridor runs from the east to the west in the south province. In this background, N380 is a very important road, because it connects both major corridors.



Source: ANE

Figure 1-15 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.

1.6.1.2 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.

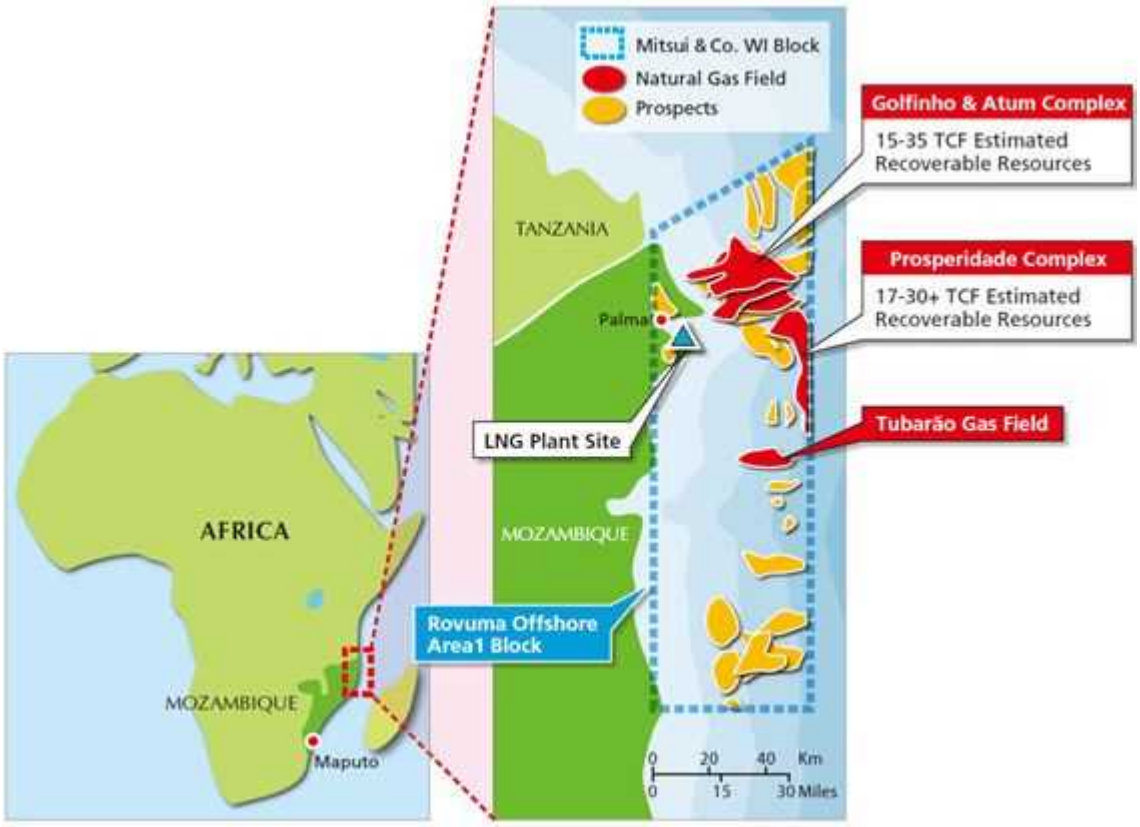
Anadarko, the operator of Area 1, and partners (interest owners of Rovuma Area 1) signed to order the basic design on construction of the plant for producing liquefied natural gas (LNG) in December, 2012. An area where the plant developed will be about 7,000ha. The plant is expected to be constructed 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. On June, 2019, Mitsui E&P with other interest owners decided final investment implementation for the Area 1 (News release from Mitsui).

Table 1-34 Interest Owners and its 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 1-16 Location of Rovuma Offshore Area 1, Gas Field and Proposed Site of LNG Plant

Source: Anadarko Petroleum Corporation

Figure 1-17 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.

1.6.1.3 Port 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

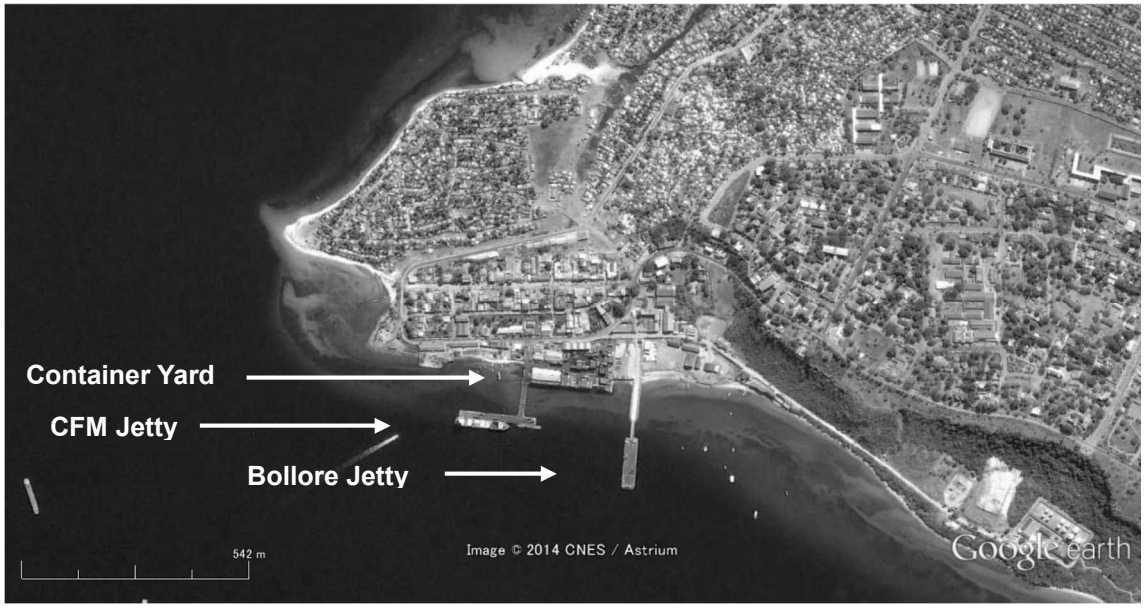
The Pemba port locates in 200km away from the north of Nacala Port. The Port and Railways Corporation (CFM) is directly responsible for the port operation and management. The Pemba port is well-sheltered inside the Pemba bay and has 20m depth. Local newspaper, Noticias, reported that CFM will extend the port to fulfill increasing demand of logistics.

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 1-18 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 1-35 below.

Table 1-35 Cargo Throughput of Pemba Port (2010 & 2011)

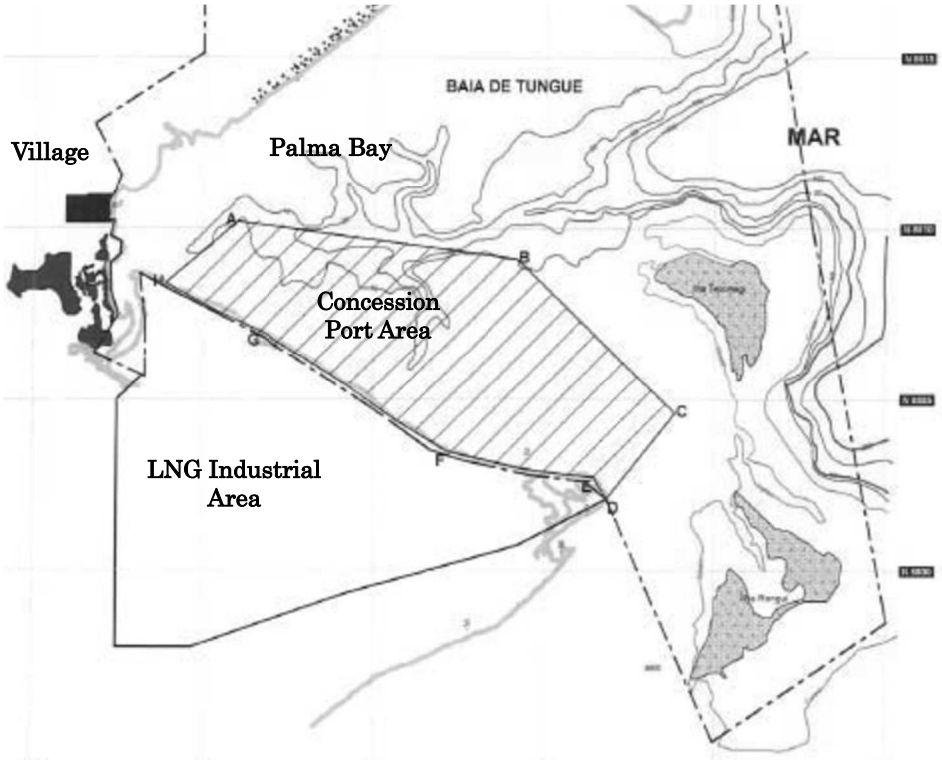
Items	Unit	2010		2011	
		Domestic Cargo	International Cargo	Domestic Cargo	International Cargo
Loading (Export)	1,000 ton	**23.4**	**65.2**	**18.9**	**89.3**
Container		3.3	65.2	0.8	88.8
Miscellaneous		20.1	0.0	18.1	0.5
Unloading (Import)		**13.1**	**29.2**	**10.4**	**51.2**
Fuel		4.9	-	3.3	-
Container		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.

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 1-19 Development Area of Palma Port and LNG

1.6.1.4 Population

(1) Past Trend of Population and Population Growth

According to the Statistical Yearbook 2017-Mozambique, total population of Mozambique is estimated as 26,424 thousand. Meanwhile, World Bank reported the total population of Mozambique in 2017 is approximately 29,669 thousand. Cabo Delgado Province where the project will be implemented has population of 1,923,264 equivalent to approx. 7.3% of total population. Among that, male cover 931,957 and female cover 991,307. Population density of the province is 23 persons/km^2 and that is lower than average of whole country (33 persons/km^2).

Table 1-36 Population of Mozambique and Cabo Delgado Province

Item	Population		
	1997	2007	2016*
Mozambique	16,075,708	20,632,434	26,423,623
Cabo Delgado	1,380,202	1,634,162	1,923,264

Source: National Statistics Institute (INE), Population and Housing Census, 1997 and 2007, *Statistical Yearbook 2017-Mozambique

(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 1-37 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 1-38 shows the population projection of the 6 districts near to N380 across, Cabo Delgado Province and Mozambique in 2010, 2011 and 2012.

Table 1-38 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

1.6.1.5 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). There has not been reported drastic changes on socio-economic situation in Cabo Delgado and Mozambique, tendency on the work force may not be changed in 2019.

Table 1-39 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. according to the report of National Institute of Statistics (INE) in 2015, unemployment rate of Mozambique is estimated as 22.3% (JETRO's publishing paper). Based on that information, unemployment rate in Cabo Delgado is estimated more than 10 percent.

1.6.1.6 Gross Domestic Product (GDP) and GDP per Capita

(1) GDP

According to the statistical data of JETRO, GDP of Mozambique in 2018 is estimated as 14,400 million USD and its growth rate is 3.30%. Meanwhile, the total GDP in Cabo Delgado Province accounted for about MT 9,199 million (equivalent to 147 million USD with condition of 1MT = 0.016 USD) in 2011 (2003 constant prices), which accounted for 4.7% of the GDP in Mozambique.

The economic growth rates are shown in Table 1-40below. As seen in the table, Mozambique and the province have marked steady high growth rates at 7-8% since 2000. Growth rate in 2016 and 2017 showed decreasing tendency of around 3%.

Table 1-40 GDP and Growth Rate of GDP

	GDP (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 Province	3,518.2	4,038.1	6,904.0	9,198.6	4.7	8.0	7.4
	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) GDP per Capita

According to the statistical data of JETRO, Mozambique's GDP per capita in 2017 is estimated as 476 USD. Meanwhile, GDP 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. GDP per capita in the province was around 60% of GDP per capita in the whole country. Economic activity in the province is rather small than the whole country.

Table 1-41 GDP per Capita of Mozambique and Cabo Delgado Province

	GDP per Capita (MT at 2003 Constant Price)		Proportion of GDP 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

1.6.1.7 Poverty and Inequality

(1) Poverty Ratio

According to the "povertydata" of World Bank, poverty ratio of living with daily expense below 1.9 USD is estimated as 62.4% (2014). The ration is decreasing if comparing to the figure in 2008, 69.1%. Meanwhile, poverty ratio in Mozambique and Cabo Delgado Province in 1997, 2003 and 2009 is shown in Table 1-42 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 1-42 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.

According to the final report of poverty profile of Mozambique by JICA (2011), 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 1-43 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 final report of poverty profile of Mozambique by JICA (2011)

1.6.1.8 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 1-44 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 poultries	2,000	10,000

(2) Size of Cultivated Farm in Cabo Delgado Province

Table 1-45 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 1-45 Cultivated Areas by Size of Farm 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

1.6.1.9 Tourism

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

Table 1-46 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 1-46 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

Table 1-47 shows the number of accommodations, rooms and beds in Cabo Delgado Province, project related 6 districts, and 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 1-47 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

1.6.1.10 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).

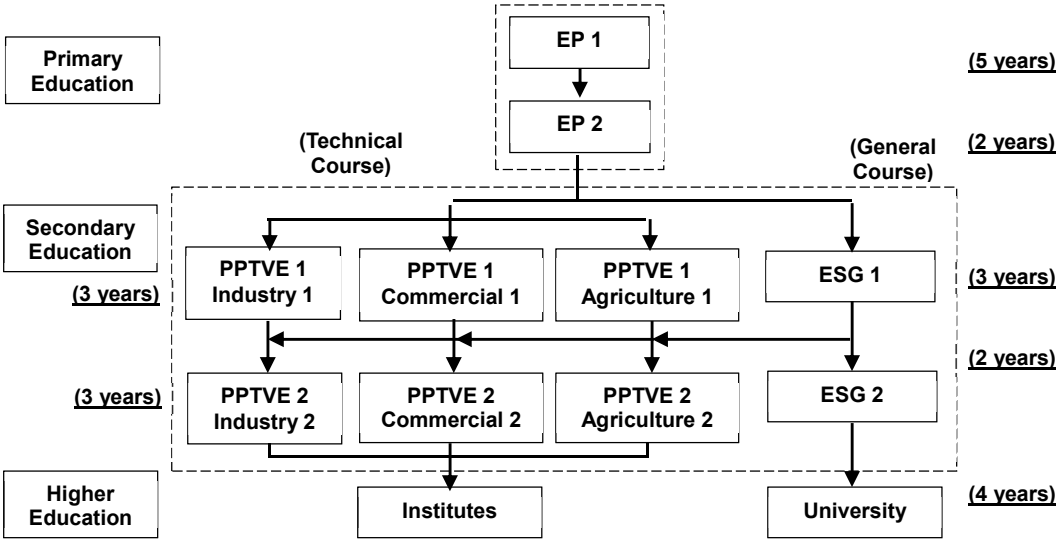


Figure 1-20 Education System

(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 1-48.

Table 1-48 No. of Education Facility (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 1-49 No. of Student, Teacher and Student 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

USAID reported literacy rate of Mozambique (47%) on its website as of 2019. Literacy rate of female (28%) is almost half of male's (60%). Meanwhile, 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.

1.6.1.11 Health 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 1-50 Health 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

Table 1-51 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 1-51 No. of Health Facility 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

(2) Number of Health Service Staff in Cabo Delgado Province

Table 1-52 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 1-52 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

1.6.1.12 Border Post in Cabo Delgado Province

(1) Number of Border Post

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.

1.6.1.13 Development Situation of Roads 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 1-53 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 1-54 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

1.6.1.14 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 1-55 Percentage of Service Population by Type of Water Facility 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

1.6.1.15 Gender

According to the "gender gap index" published by the World Economic Forum, Mozambique recorded 49 ranking in the world with score of 0.721 and the results is higher than Japan (110 ranking with 0.662). There were not big gaps in the field of health and education sectors, however, political participation shows gaps.

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 1-56 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.

Table 1-57 Gender related Indicators

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 1-58 below shows the gender related indicators in 2000, 2005, 2010 and 2013 in Mozambique.

Table 1-58 Gender related Indicators in Mozambique

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
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

The latest data from World Bank's website (Gender Statistics), comparison of index between year 2000 and 2017 is shown in the table below. Gender gaps in Mozambique becomes smaller year by year.

Table 1-59 Gender Index in 2000 and 2017

Field	Item	Sub-item	2000	2017
Economic Opportunities	Employment in agriculture (% of total number, estimated by ILO model)	Female	90.6	81.9
		Male	70.4	61.2
	Unemplyment (% of total number, estimated by ILO model)	Female	1.9	3.4
		Male	3.6	3.0
	Contributing family workers (% of employment)	Female	54.5	28.4
		Male	12.1	13.5
Health	Life expectency at birth (years)	Female	50.0	61.0
		Male	46.6	56.7
	Mortality rate under 5 years old (per 1,000 live birth)	Female	163.8	67.6
		Male	176.8	76.9
	Women's share of population ages 15+ living with HIV (%)		60.6	61.4
Education	School enrollment at primary (% net)	Female	49.8	86.2
		Male	61.3	88.8
	Lower secondary completion rate (% of relevant age group)	Female	3.0	22.7
		Male	4.6	22.4

Source: World Bank (http://datatopics.worldbank.org/gender/)

1.6.2 Social Conditions of the Study Area

1.6.2.1 Villages along N380

Forty one villages shown in Table 1-60 below exist within the section between Sunate and Oasse on N380 in 6 districts.

Table 1-60 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

1.6.2.2 Present Situation of Areas around Bridges replaced

Table 1-61 shows the name of bridges replaced and its adjacent villages.

Table 1-61 Target Bridges and Its Adjacent Villages

Bridge	Adjacent Villages
Muagamula	Aldeia da Paz and Nova Zambezia (both within Macomia District)
Muera I	Mungue (Muedumbe District) and Antadorra (Mocimboa District)
Muera II	
Mungoe	Antadorra and Chinda (both within Mocimboa District)

Source: JICA Study Team

The current situation of the surrounding areas at bridges is shown in Table 1-62 below.

Table 1-62 Existing Situation of surrounding area of the Bridges

Bridge	Existing Situation of surrounding area of a Bridge
Muagamula	● No village and house exist 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. ● In January 2019, the temporary bridge and some part of road around bridge have been damaged due to cyclone Kenneth. ● 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.
Muera I and II	● No village and house exist 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 exist 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.

Source: JICA Study Team

1.6.2.3 Present Conditions of Living Environment of Villages along N380

(1) Conditions of Housing Location

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.

(2) Design and Type of Local Houses

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

(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.

(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.

(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.

1.6.2.4 Present Situation of Education

(1) Present Situation 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 Situation on Class

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 1-63 Present Situation of School (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 – 1,001, Girl - 894)	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 - 499, Girl - 384)	14 teachers (63 pupil/teacher)

Source: JICA Study Team

Table 1-64 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
	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)	

Source: JICA Study Team

1.6.2.5 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).

Table 1-65 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)
	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

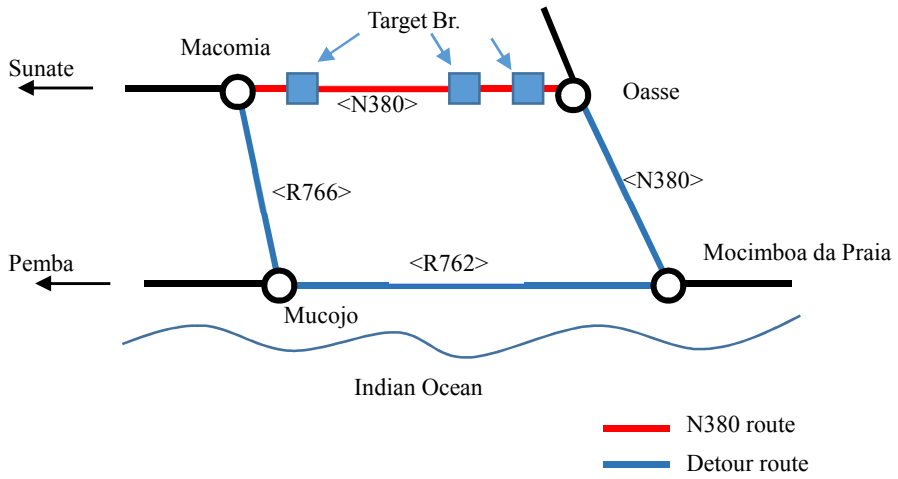
Source: JICA Study Team

1.6.2.6 Detour 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, collapse of Muera II Bridge in January, 2019 and damage of Muagamula Bridge due to Cyclone Kenneth in April, 2019. However, almost all target bridges for replacement are very old and damaged. However, the bridges are temporary bridges those have been temporarily restored, and there are high possibility that the bridge will collapse due to heavy vehicle traffic, flooding, etc., and heavy vehicle traffic is limited under 28 tons.

From such circumstances, the detour route in the case that the route between Macomia and Oasse where the target bridges are located (N 380 route) cannot be passed is examined.

Based on the condition of the surrounding road network, the detour route from Macomia to Oasse via Mucojo and Mocimboa da Praia (Via R 766 to R 380 to N 762) must be used if the target bridge becomes impassable or heavy vehicles exceeding 28 tons pass through.



Source: JICA Study Team

Figure 1-21 Detour Route of N380

Present conditions of N380 and detour route are as follows.

Table 1-66 Present Condition of N380 and Detour Route

Route	Present Conditions
N380 route	● About 100km length of the route N380 ● Entire interval of the route has already been paved. ● Vehicles and people can travel on N380 even in rainy seasons. ● Passing through Quirimbas National Park
Detour route	● About 170km length of the route passing through Mucojo, Mocimboa da Praia and Oasse (via R766,R762 and N380) ● The route running along the coast ● The route is an unpaved road and vehicles cannot pass through entire interval of the route especially at rainy seasons. ● Passing through Quirimbas National Park

Source: The Mozambique Road Network

The detour route from Macomia to Oasse via Route 762 is approximately 170 km in length. However, it is difficult to pass through the detour route throughout the year, because many of these routes are unpaved sandy roads.

According to the driver of a trailer that transported the equipment related natural gas development from Mocimboa da Praia to Pemba, no equipment was transported for about 2 months until the restoration of the Messalo Bridge was completed after closing of N380 due to flood in March 2014. This indicates that it is difficult for large vehicles to pass through Route 762 as a detour route.

If National Route 380 is interrupted, it will paralyze the local economy and adversely affect the lives of residents along the line. Therefore, it is necessary to replace bridges as soon as possible.

1.6.2.7 Benefit 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

The route from Macomia to Oasse is assumed as the target section for estimation of travel time.

i) Running speed on N380 before the replacement of the target bridges

Travel time required between Macomia and Oasse (Approximately 100 km) on the route of N380 including the target bridges, which measured in the survey, is approximately 80 minutes, and the average running speed was 75 km/h.

Since the road widening work by Portuguese government has been completed in this section of N380, the runability is good. However, the average running speed in this section is lower than the speed limit of 80 km/h due to some section where the running speed has to be reduced by the humps around the bridge and the waiting for oncoming car at the one lane bridge.

ii) Calculation of reduced travel time between Macomia and Oasse after the replacement of the target bridges

Calculate the required time after the replacement of the target bridge for the two routes (N380 Route, Detour Route (refer to 1.6.2.6)) between Macomia and Oasse.

Figure 1-22 Two Routes between Macomia and Oasse

Travel time on N380 route

The removal of the deceleration section, resulted by the replacement to two-lane bridge and the removal of humps around the bridge, will makes the travel time on N380 shorter. After completion of the target bridge construction, the running speed on N380 will be the same as the speed limit of 80 km/h, so the travel time of 100 km distance between Macomia and Oasse will be estimated about 75 minutes.

Travel time on detour route

The detour route includes over 100 km unpaved road in the coastal side and the travel distance is as long as about 170 km. Therefore, the travel time between Macomia and Oasse is estimated about 300 minutes with assuming unpaved road running speed of 30 km/h and paved road running speed of 80km/h.

As a result, the travel time will be reduced about 225 minutes compared with using a detour route due to the completion of the project.

Table 1-67 Comparison of Travel Time

Route	Distance	Travel Time	Running Speed for Estimation
N380 route (Macomia to Oasse, on N380)	Approx. 100 km	Approx. 75 mins	80 km/h
Detour route (Macomia to Oasse via Mucojo and Mocimboa da Praia, on N766 – N762 – N380)	Approx. 170 km	Approx. 300 mins	30 km/h: unpaved road 80km/h: paved road
Time Difference		Approx. 225 mins	

Source: JICA Study Team

2) Maintenance and Strengthening of Logistic 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.

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.

1. 7 Forecasting Future Traffic Volume

1.7.1 Parameters for Forcasting

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

- 8 years transition of existing traffic volume (2010-2017)／Traffic count survey (1st March, 2019 and 2nd March, 2019)
- Future estimated population
- Future estimated GDP, GRDP

1.7.2 Transition of Existing Traffic Volume

1.7.2.1 Traffic Survey by ANE

The current traffic volume is organized using the survey result from 2010 to 2017 based on the annual traffic survey conducted by ANE. The result of traffic survey of ANE is shown in Table 1-68. The location of each section and the length of section is shown in Fig 2 32 and Table 2 76.

Table 1-68 Transition of Existing Traffic Volume (cars/12hours)

Sec	Bridge	2010	2011	2012	2013	2014	2015	2016	2017
A	—	195 (101)	217 (103)	271 (94)	296 (140)	366 (104)	446 (154)	365 (115)	646 (248)
		51.8%	47.5%	34.8%	47.3%	28.4%	32.9%	31.5%	38.4%
B	—	234 (124)	224 (91)	167 (70)	204 (88)	243 (110)	309 (124)	217 (78)	257 (89)
		53.0%	40.6%	41.9%	43.1%	45.7%	40.1%	35.9%	34.6%
C	—	-	-	193 (77)	237 (98)	280 (121)	358 (136)	252 (87)	300 (98)
		-	-	39.9%	41.4%	43.2%	38.0%	34.5%	32.7%
D	Muagamula	267 (94)	165 (41)	306 (116)	323 (153)	310 (81)	388 (111)	451 (99)	350 (82)
		35.2%	24.8%	37.8%	47.4%	26.1%	28.5%	22.0%	23.4%
E	—	-	-	402 (174)	435 (231)	397 (122)	499 (166)	571 (148)	446 (125)
		-	-	43.3%	53.1%	30.7%	33.3%	25.9%	28.0%
F	—	-	-	284 (108)	215 (59)	376 (173)	399 (157)	209 (100)	306 (131)
		-	-	38.0%	27.4%	46.0%	44.3%	2447.6%	39.7%
G	Muera I,II Mungoe	255 (162)	306 (122)	347 (139)	314 (120)	255 (95)	355 (157)	225 (107)	242 (96)
		63.5%	39.9%	40.1%	38.2%	37.3%	44.3%	47.6%	39.7%
Average		238 (97)	228 (89)	281 (111)	289 (127)	318 (115)	395 (144)	327 (105)	364 (124)
		40.7%	39.1%	39.5%	43.9%	36.2%	36.5%	32.1%	34.1%

( ) : Heavy vehicle, Lower row : Heavy vehicle rate

Source : ANE

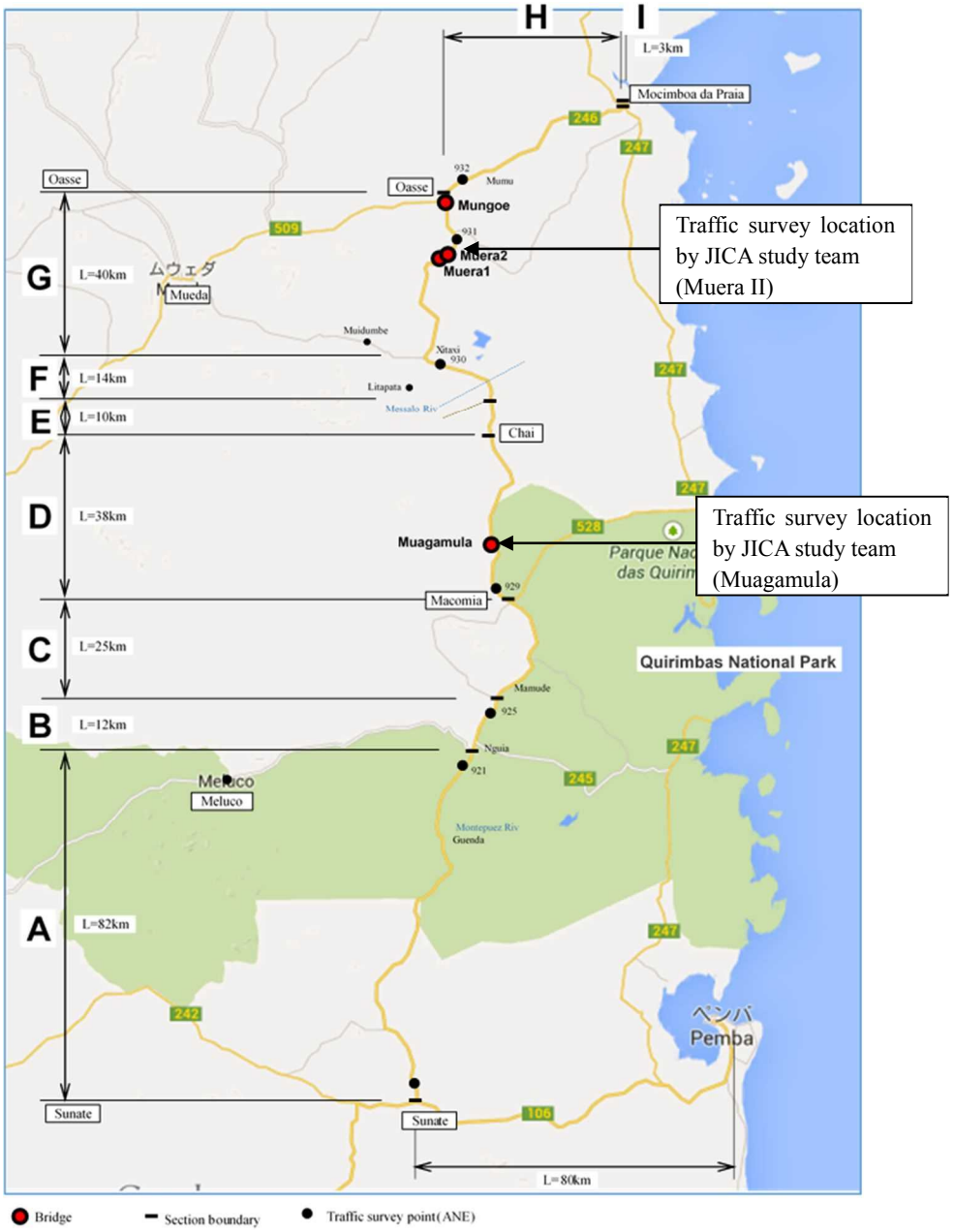


Figure 1-23 Location Map of Traffic Survey

Table 1-69 Section of Traffic Survey

Sec	Location	Length	Target Bridge
A	Sunate — Meluco	82 km	—
B	Meluco — Imbanda	12 km	—
C	Imbanda — Macomia	25 km	—
D	Macomia — Chai	38 km	Muagamula
E	Chai — Litapata	10 km	—
F	Litapata — Chitunda	14 km	—
G	Chitunda — Oasse	40 km	Muera I,II and Mungoe

Source: ANE

The traffic volume is relatively small in all sections, but heavy vehicle rate is about 30 to 45%. In the site survey, it was founded many heavy vehicles and trailers shown in Figure 1-24 were passing.

Figure 1-24 Heavy vehicles near the target bridge

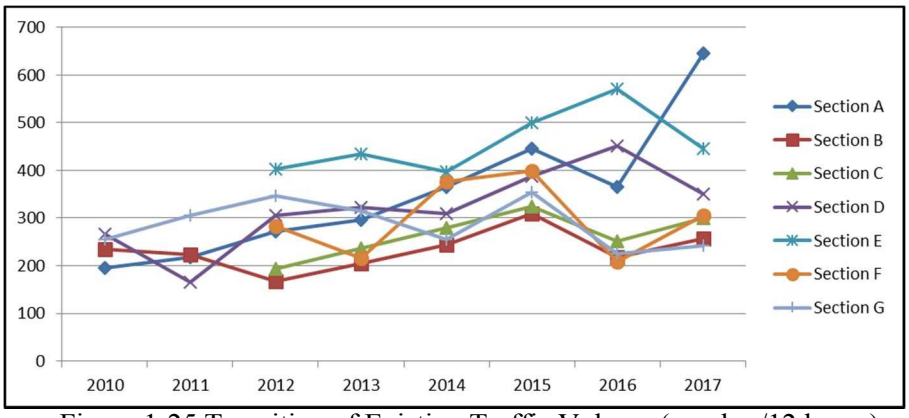


Figure 1-25 Transition of Existing Traffic Volume (number/12 hours)

The traffic volume estimation result based on the average traffic volume of all sections is shown in the figures below. Future traffic volume is forecasted from the annual growth rate estimated using the datas from 2010 to 2017. The average annual growth rate of traffic volume up to 2026 is estimated 3.7%.

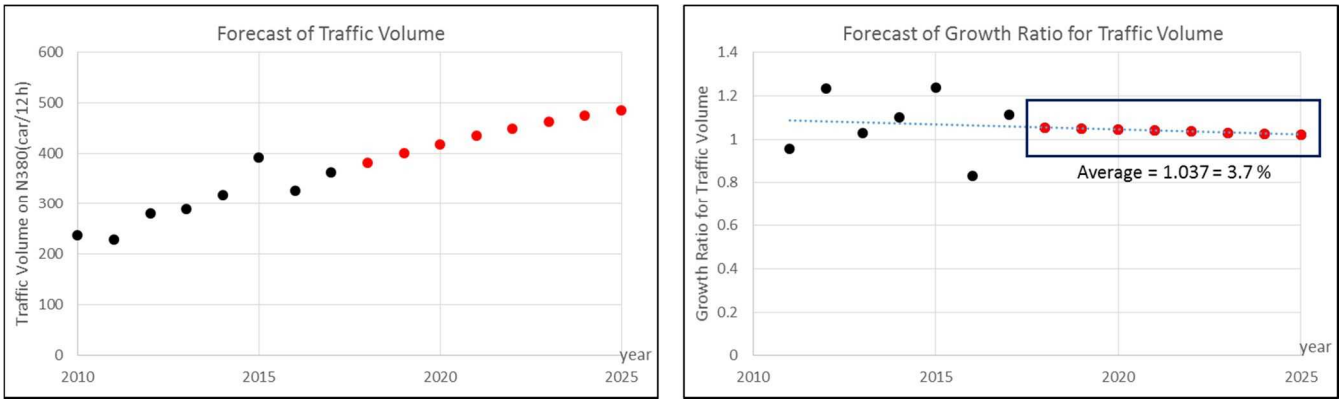


Figure 1-26 Traffic Volume Forecast based on the transition of traffic volume

1.7.2.2 Traffic Survey by JICA Study Team

Traffic count survey was implemented as following date and locations.

Survey Date & Time : 1st of March, 2019 (Weekday, 12 hours from 6:00 to 18:00)
2nd of March, 2019 (Holiday, 12 hours from 6:00 to 18:00)

Location : Muagamura Br. (Sec. D), Muera II Br. (Sec. G)

Table 1-70 Results of Traffic Survey (Weekday, car/12h)

Location	Passenger Car	Heavy Vehicle	Total	Ratio of Heavy Vehicle
Muagamura Br. (Sec. D)	163	75	238	31.5%
Muera II Br. (Sec. G)	136	85	221	38.5%

Table 1-71 Results of Traffic Survey (Holiday, car/12h)

Location	Passenger Car	Heavy Vehicle	Total	Ratio of Heavy Vehicle
Muagamura Br. (Sec. D)	108	62	170	34.6%
Muera II Br. (Sec. G)	112	82	194	42.3%

Muagamura Br. (Sec. D) Muera II Br. (Sec. G)

Figure 1-27 Implementation of Traffic Survey

Details of the traffic survey results (e.g. car type, bicycle, pedestrian) by the Study Team are shown in Appendix 7.1. Compared to ANE survey results (Table 1-68), the traffic volume counted by JICA Study Team was less at the Muamgamla Bridge location and the Muera II Bridge location was almost the same. The heavy vehicle rate also showed the same trend as traffic volume.

1.7.3 Estimated Future Population

Future population of Mozambique is estimated in “The Project for Nacala Corridor Economic Development Strategies” shown as follows.

Table 1-72 Future Population Projections (National Static Institute: NSI)

Year	2017	2020	2025	2030	2035
Population (1,000)	27,158	29,288	33,215	37,151	41,554
Increase Ratio (%)	-	2.55	2.55	2.27	2.27

Source: JICA Study Team edited PEDEC-NACALA

Future population of Mozambique estimated by United Nations is shown below.

Table 1-73 Future Population Projections (United Nations: UN)

	Growth Rate	2015	2020	2025	2030	2035
Population (1,000)	Low	27,042	31,255	35,670	40,279	45,022
	Middle		31,255	35,985	41,185	46,786
	High		31,255	36,300	42,091	48,550

Source: United Nations, Total Population - Both Sexes, 2019

Average future population based on above two projections is shown in Table 1-74. This shows an annual increase rate of the population is almost 2.7%.

Table 1-74 Future Population Projections (Average)

Item	2020	2025	2030	2035
NSI (1,000)	29,288	33,215	37,151	41,554
UN (1,000)	31,255	36,300	42,091	48,550
Average (1,000)	**30,271**	**34,758**	**39,621**	**45,052**
Average Increase Rate (%)	**-**	**2.80**	**2.65**	**2.60**

Source: JICA Study Team

On the other hand, the population increase rate of Cabo Delgado Province, where the target bridges are planned, is estimated about 2.2% in “The Project for Nacala Corridor Economic Development Strategies”as shown in Table 1-75, and it is lower than the national average.

Table 1-75 Future Population Projections in Cabo Delgado Province

Item	2014	2017	2025	2035
Population (1,000)	1,862	2,046	2,444	3,034
Average Increase Rate (%)	—	2.30	2.20	2.20

Source: JICA Study Team edited PEDEC-NACALA

1.7.4 Estimated Future GDP/GRDP

Real GDP, Nominal GDP and GDP growth rate from 2012 to 2017 are estimated in "National Accounts – Analysis of Main Aggregates" as shown in Table.

Table 1-76 Transition of GDP

Year	2012	2013	2014	2015	2016	2017
Real GDP Growth Rate (%)	7.2	7.1	7.4	6.6	3.8	3.7
Nominal GDP Growth Rate (%)	13.7	13.7	10.3	11.3	16.1	17.1
Nominal GDP (1,000MT)	424,263	482,233	531,777	591,679	687,166	804,464

Source: National Accounts - Analysis of Main Aggregates (AMA)

GRDP and growth rate estimated in "The Project for Nacala Corridor Economic Development Strategies" is shown in following table.

Table 1-77 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%		
Mozambique	177,479	275,300	506,500	1,149,200	7.8%	8.1%
Annual Growth Rate	—	7.6%	7.9%	8.5%		

Source: PEDEC-NACALA

Table 1-78 Estimated Future GRDP per capita

Year	GRDP (million 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%		
Mozambique	7.70	10.21	15.25	27.66	5.0%	5.5%
Annual Growth Rate		4.7%	5.2%	6.1%		

Source: PEDEC-NACALA

1.7.5 Result of Future Traffic Volume Forecast Estimation

The subject year for the forecast is set 2026, 3 years after the completion. The estimated future increase rates based on the ANE traffic survey, the population growth rate of Cape Delgado province, and GRDP growth rate per capita are 3.7%, 2.2%, and 7.6%, respectively. Although GDRP of Cabo Delgado province is expected to see significant economic growth in the future on the back of a natural gas development project off the coast of Rovuma, it has also been suggested that the recent deterioration in the security situation in the province can slow down economic growth of the province. Therefore, 3.7% estimated based on the actual traffic survey is adopted as the increase rate of future traffic volume.

Currently, with assistance from the African Development Bank, a project is under way to improve N381, which runs inland from Mueda to the border with Tanzania. Even after the improvement of N381, the main route that passes through Cape Delgado Province for Tanzania is N380 (To be upgraded to N1 in the future), and according to the traffic volume survey of ANE, the traffic volume on N381 is still very small. Therefore, it is considered that this project will not affect traffic volume on National Route 380.

Table 1-79 Result of Future Traffic Volume Forecast Estimation (car/12h)

Index	2017	2019	2026
Traffic Volume	364	391	**505**
Increase Rate	—	3.7%	3.7%

Source: JICA Study Team

CHAPTER 2
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CHAPTER 2. CONTENTS OF THE PROJECT

2.1 Basic Concept of the Project

2.1.1 Project Aim

Table 2-1 shows the direction of road policies corresponding to the goals and strategies of regional development described in the "Master Plan for National Highway Network of Mozambique, 2015" formulated by ANE.

The direction of road 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 Direction of Road 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 4 target bridges on N380 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 4 target bridges and their approach roads.

Table 2-2 List of Target Bridges

Item	Muagamula Br.	Muera I Br.	Muera II Br.	Mungoe Br.
Bridge location on N380	Macomia+12.8km	Macomia +85.7km	Macomia +85.9km	Macomia +99.2km
Length of target section (Bridge and Road)	790 m	400 m	370 m	480 m
Carriageway width	3.5m × 2 Lane	3.5m × 2 Lane	3.5m × 2 Lane	3.5m × 2 Lane
Shoulder width (Bridge)	0.25 m	0.25 m	0.25 m	0.25 m
(Road)	1.00 m	1.00 m	1.00 m	1.00 m
Sidewalk width (Bridge)	0.85m (each side)	0.85m (each side)	0.85m (each side)	0.85m (each side)
(Road)	N/A	N/A	N/A	N/A
Total width (Bridge)	9.90m	9.90m	9.90m	9.90m
(Road)	10.60m	10.60m	10.60m	10.60m
Bridge type	Concrete bridge	Concrete bridge	Concrete bridge	Concrete bridge
Bridge length	35.0 m	50.0 m	25.0 m	25.0 m
Span arrangement	1 @ 35.0m	2 @ 25.0m	1 @ 25.0m	1 @ 25.0m
Superstructure type	Simple span post-tension T girder	2 span continuous post-tension T girder	Simple span post-tension T girder	Simple span post-tension T girder
Substructure type	2 inversed T type abutments	2 inversed T type abutments and a wall type pier	2 inversed T type abutments	2 inversed T type abutments
Foundation type	CIP piles	CIP piles	CIP piles	CIP piles

Source: JICA Study Team

2. 2 Outline Design of the Japanese Assistance

2. 2. 1 Design Policy

2. 2. 1. 1 Basic Policy

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.

The design policy is to optimize the entire section consisting of the bridge section and the approach road section within the budget, taking into account the maintenance ability of ANE.

In addition, 30 to 40% of the passage traffic on the target route are heavy vehicles, including some overloaded vehicles. Therefore, road and bridge planning required to be carried out in consideration of flood countermeasures and heavy vehicle traffic.

As the purpose of this project is to replace a one-lane temporary structure with a two-lane permanent bridge, the first priority of flood countermeasures is to ensure safe passage on the bridge even after a flood by ensuring enough opening section area at the bridge to flow the planned flood flow and preventing overflow on the bridge, damage to the bridge, and the bridge washout. As for the approach roads, the design period will be planned as 15 years, because its aim is the adjustment for the change of the planned height due to bridge replacement. Therefore, the measures to reduce the flood level around the roads and to treat accumulated water will not be taken. This policy has been agreed with ANE to be implemented by the ANE when repairing work is needed after flooding. However, as for the abutment backside where erosion is a concern, the slope protection by installing the gabions is planned not only for the abutment circumference but also for the 10 m section on the backside road. Furthermore, the number of gabion row is planned to be increased from general 1 row to 2 rows to enhance the protection effect.

For heavy vehicle traffic, the overloaded vehicle control condition and axle load data obtained in this survey are reflected in the pavement design. In the selection of the bridge type, since the bridge deck is easily affected by heavy vehicle traffic, the durability of the deck is considered for one of the evaluation items to reflect heavy traffic conditions.

The target route is planned to be upgraded to National Highway 1 in the future, and since the design speed will be 100 km/h due to the upgrade, planning of road alignment and width should be considered the traffic safety of road users (vehicles and pedestrians). In the road alignment plan, in addition to meeting ANE's design standards, in order to prevent the deterioration of existing good road alignment due to bridge replacement, it is a policy to arrange straight sections as much as possible. The road width should be determined based on the survey results such as the necessary

width after the upgrade to National Highway 1, the bridge width on the target route, and the traffic volume.

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

2.2.1.2 Policy for Natural Environment Conditions

2.2.1.2.1 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 target 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°C on many days during the dry season, measures are also required to ensure the quality of hot weather concreting. Specifically, it is possible to prevent the temperature of the aggregate from rising by avoiding direct sunlight due to installation of a roof on the aggregate storage place, or to reduce the temperature of the aggregate by sprinkling water on the aggregate.

2.2.1.2.2 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 six items are most important for the hydrological analysis:

a) Confirmation of the entire river basin

b) Collection of rain fall data

c) Varied flow calculation (for some bridges)

d) River discharge calculation method

e) Calculation of high water level for bridge design

f) Consideration of countermeasures

2.2.1.2.3 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 2-1.

As indicated in Figure 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:

$$kH = 0.03 \times 2 = 0.06 \ (\fallingdotseq 0.10)$$

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 2-1 Seismic Intensity

2. 2. 1. 3 Policy 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 labor 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.

2.2.1.4 Concept for the Conditions and Special Circumstances in the Construction Sector

2.2.1.4.1 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.

2.2.1.4.2 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.

2.2.1.4.3 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.

2. 2. 1. 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.

2. 2. 1. 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.

2. 2. 1. 7 Bridge Design Policy

2. 2. 1. 7. 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 2-3 Bridge Design Conditions and Applied Standards

Item	Design Conditions	Applied Standards
Design discharge, return period	Return period based on hydrological analysis	- ANE's design standard
Vertical clearance under bridge girders	According to the planed flow quantity	- Cabinet order concerning structural standards for river management facilities, etc (Japan River Association)
Live load	SATCC (NA, NB-36) B live load	- SATCC - Specification for highway bridges (Japan Road Association)
Seismic load	Seismic coefficient = 0.1	- SATCC
Thermal load	+49° C～0°C	- SATCC

2. 2. 1. 7. 2 Location of New Bridges

(1) Selection Policy of Bridge Location

As for Muera I bridge, since a part of old bridge collapsed and became impassable, it was repaired temporarily.

In the other three bridges, the existing structure (concrete bridge or pipe culvert) became impassable due to damage, and restoration was done by a temporary bridge (Bailey Bridge).

Based on the situation of target bridges, selection policy of new bridge location is shown below.

i) To make the horizontal alignment of new road as straight as possible

The horizontal road alignment around the bridge is very important in order to ensure travelability of a vehicle and reduce traffic accidents. Therefore, the horizontal alignment of new road should be as straight as possible.

ii) To make the location of new road not significantly shift from the existing road.

Since the area around the approach road of all target bridges is a submerged area, it is expected the soft ground layer exists in the area. If approach road is planned in the submerged area, it will be necessary to take countermeasures against soft ground in the road embankment, and the project cost is expected to increase. Therefore, to avoid to increase the cost due to soft ground countermeasures, second policy is set to make the new road not significantly from the existing road.

The existing road alignment around the bridge is almost straight, and the trafficability is good. If approach road is shifted from the existing road, the horizontal alignment of the approach road becomes an S-shape. From the viewpoint of ensuring driving safety as 100 km/h road in the future, it is a policy to avoid as much as possible the arrangement of S-curve sections.

(2) Comparison and Study of Bridge Location

As selection policy of the bridge location, the horizontal alignment of the surrounding road including the bridge is planned as straight as possible to ensure the traffic safety. However, if the road alignment is straight and the new bridge is planned at the existing bridge, it is necessary to construct a detour to secure the traffic flow during construction.

On the other hand, when a new bridge is planned next to the existing road, the service level of the existing traffic can be maintained without a detour during construction. In this case, it is necessary to meet the specification of main article road in consideration of future upgrade to National Road 1, and as a result, the road improved length becomes longer. In addition, in order to construct the road embankment as the permanent structure in the submerged area, soft ground countermeasures are required.

In this section, the following two options are compared in terms of traffic safety and economic efficiency for the Muela I and II bridges.

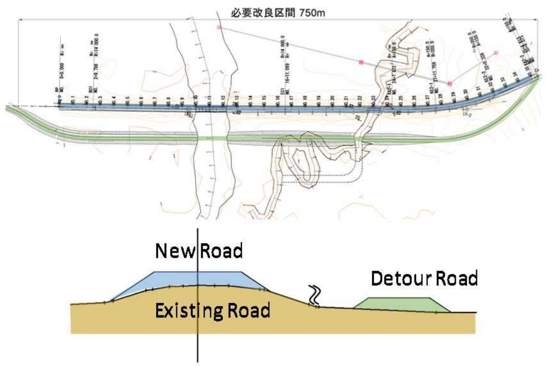
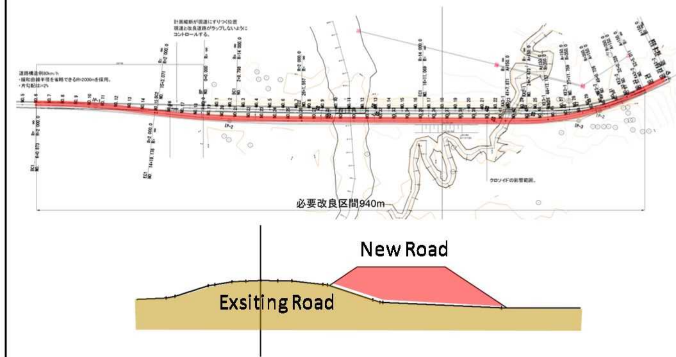
Option-1: New bridge is planned at the location of the existing bridge

Option-2: New bridge is planned next to the existing bridge

Comparison table is shown in Table 2-4. Opion-2 does not require a detour, but the road improvement length is 200 m longer than Option-1, and the embankment as a permanent structure is constructed in the submerged area. Therefore, soft ground countermeasures are required, and the construction cost of Option-2 is 1.07 times that of Option-1. In addition, while approach road of Option-1 can be planned as an almost straight without changing the existing good horizontal alignment, Option-2 road must be planned as an S-curve, which may deteriorate the existing traffic safety.

In view of the above, Option-1 which can maintain a good road alignment and is economical is adopted.

Table 2-4 Comparison Table for New Bridge Location

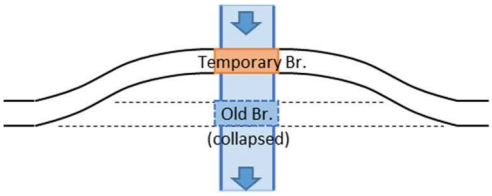
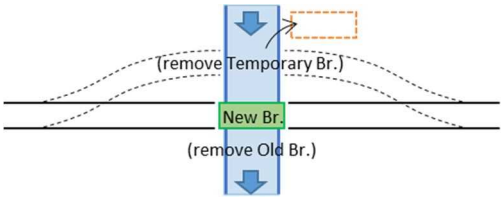
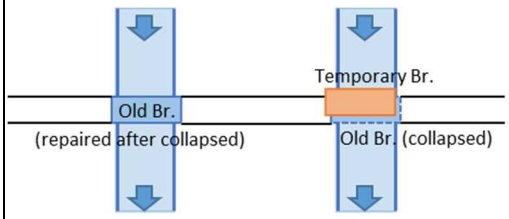
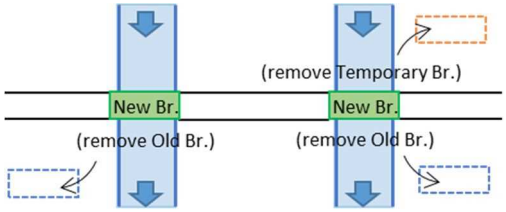
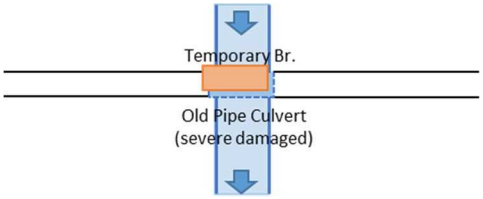
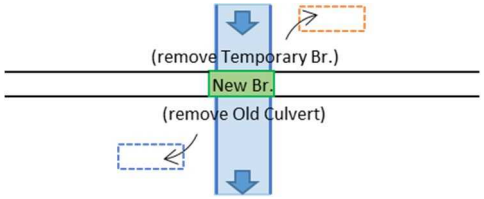
			Option-1: New bridge at the location of the existing bridge	Option-2: New bridge next to the existing bridge
				
			- New road is arranged directly above the existing road. - Soft ground countermeasure is not required, because the ground under the existing road has been enough consolidated. - Detour road is required to ensure traffic flow during construction.	- New road is planned next to the existing road. - In order to construct the permanent road embankment in the submerged area, soft ground countermeasure is required. - Detour road is not required, because the service level of the existing traffic can be maintained by using of existing road.
Perm anent	Bridge		50m + 25m	50m + 25m
	Road	Pavement	around 670m length	around 860m length
		Embankment	directly above the existing road [HWL(100year)+margin, soil quantity is smaller than Option-2]	nest to the existing road [HWL(100year)+margin, soil quantity is larger than Option-1]
		Soft ground meas	NOT required	Required
Temp orary	Removal of existing bridge		Required	NOT required
	Detour road	Pavement	Total 720m length	-
		Embankment	HWL(3year)+margin	-
		Soft ground meas	NOT required	-
Chalacteristic			- Excellent road alignment and traffic safety - Short length improved road - No need soft ground countermeasure - Need removal of existing bridge - Need detour road during construction	- Deterioration of existing road alignment and of present traffic safety - long length approach road - Need soft ground countermeasure - No need removal of existing bridge - No need detour road during construction
Construction Cost			1.00	1.07
Evaluation			**Adopt ○**	**Not adopt △**

(3) Selection Result of Bridge Location

New bridge location for each target bridge based on above comparison is shown below table. As

a result, the most rational location of new bridge in consideration of above two policies is resulted the old bridge or culvert location.

Table 2-5 New Bridge Location

Policy of bridge location selection		
a) To make the horizontal alignment of new road as straight as possible. b) To make the location of new road not significantly shift from the existing road.		
	Current Situation	New Bridge Location
Muagamula	Since old bridge collapsed, temporary bridge was installed at upstream side of old bridge as emergency restoration. 	New bridge is planned in the same location as the old bridge. The approach road can be straight and constructed on the existing road. 
Muera I Muera II	Muera I: Since a part of existing bridge collapsed, it was temporarily repaired Muera II: Since old bridge collapsed, temporary bridge was installed at same location as old bridge 	New bridge is planned in the same location as the existing bridge. The approach road can be straight and constructed on the existing road. 
Mungoe	Since existing pipe culvert was damaged by floods, temporary bridge was installed at same location as Bayley bridge. 	New bridge is planned in the same location at the Bayley bridge. The approach road can be straight and constructed on the existing road. 

※Existing bridge: bridge constructed in the past as a permanent structure, Temporary bridge: Temporary bridge constructed for restoration after old structure such as bridge and culvert has damaged or collapsed.

2. 2. 1. 7. 3 Width of Bridge

The road width should be suitable for the number of lanes of the target bridge in consideration of traffic volume, trafficability, width of the other bridges on the route, etc.

Since the length of target bridges and approach road are the small part of N380, continuity with the surrounding road plan (construction of 102 km length between Macomia and Oasse has been

completed in 2014 with the funds of the Portuguese government) is important.

In addition, since the design speed will be increased to 100 km/h by upgrading to N1, the road width should be designed in consideration of pedestrian safety.

The bridge width is shown in Figure 2-2, and the reason for adoption of the dimensions of traffic lane, sidewalk, and shoulder are shown in Table 2-6.

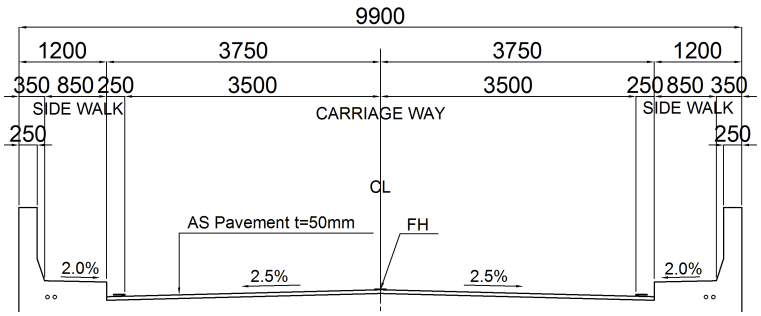


Figure 2-2 Bridge Width

Table 2-6 Bridge Width

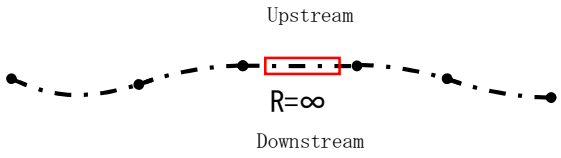
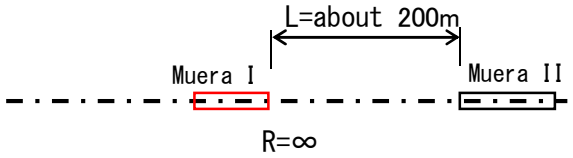
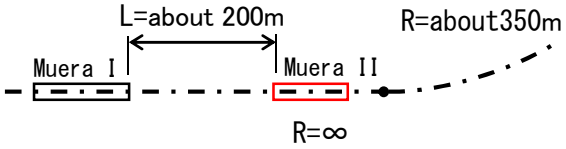
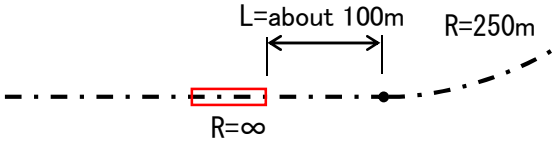
Item	Width	Remarks
Traffic Lane	3.50m	Apply width as main arterial road based on ANE's Design Standards in consideration of the future upgrading of N380 to N1.
Sidewalk	0.85m	ANE's Design Standards do not specify the sidewalk width, and sidewalks are not installed on the surrounding roads. The average sidewalk width of existing bridges on N380 is adopted.
Shoulder	0.25m	ANE's Design Standards do not specify the shoulder width. To secure space between vehicles and sidewalks, and clearly show the outside line continually with the approach roads.

2.2.1.8 Approach Road Design Concept

2.2.1.8.1 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 2-7. 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 2-7 Horizontal Alignment

Bridge Name	Horizontal Alignment	Evaluation	Location
Muagamula		Since the present temporary bridge was constructed to the upstream side at the time of the old bridge collapse, the horizontal alignment around the bridge includes S-curve section. Reconstruction to the vicinity of the old bridge is desirable.	Downstream side (Old Bridge)
Muera I		Good traffic conditions and visibility due to straight alignment	Existing Bridge
Muera II		Good traffic conditions and visibility due to straight alignment and R=350m link	Existing Bridge
Mungoe		Good traffic conditions and visibility due to straight alignment and R=250m link	Existing Bridge

2. 2. 1. 8. 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 2-3.

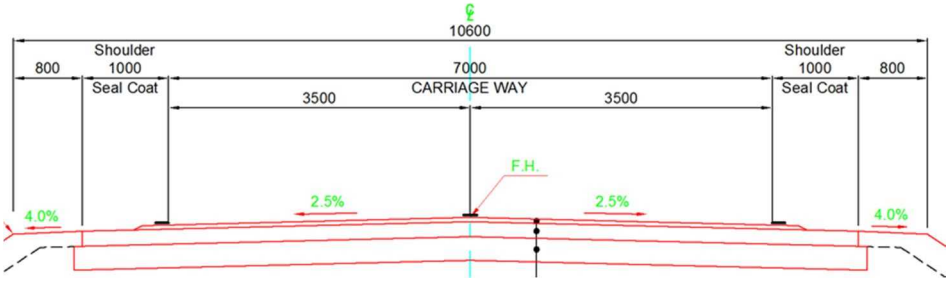


Figure 2-3 Typical Road Cross-Section

2. 2. 1. 8. 3 Policy for Construction Method and Period

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. 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 2-8 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 enable workers to learn new skills through cyclic performance of the same construction work, and to improve work efficiency.

Table 2-8 Scale of Structures

Bridge Name	Bridge Length (m)	Superstructure	Substructure	Foundation	Road length (m)
Muagamula	35	PCT-girder	Inverted T-type Abutment	Cast-in-place piles	755
Muera I	50	Ditto	Inverted T-type Abutment and Wall type Pier	Ditto	350
Muera II	25	Ditto	Inverted T-type Abutment	Ditto	345
Mungoe	25	Ditto	Inverted T-type Abutment	Ditto	455
Total	135				1,905

2. 2. 2. 2 Hydrological Analysis

2. 2. 2. 2. 1 Rainfall Data

Since rainfall data before 2014 have been already collected in the preparatory survey of phase-1 project, the data from 2015 to 2018 were collected in this survey. In the calculation of a rainfall intensity for hydrological analysis, the data which combined new and old data will be used.

2. 2. 2. 2. 2 Design Standards

Hydraulic analysis of the project is carried out based on ANE's Design Standards which is applied for all of the road, bridge and drainage structure in Mozambique. In the past bridge construction project in Mozambique, ANE requested to applied this standard for Hydraulic analysis.

2. 2. 2. 2. 3 Hydraulic Analysis Results

The design discharge, flow velocity and design water level based on hydraulic analysis results are shown in Table 2-9.

Table 2-9 Hydraulic Analysis Results

Bridge Name	Design Discharge (m^3/s)	Velocity (m/s)	Water Level(m)
Muagamula	537	2.76	144.8
Muera I & II	963	2.43	90.1
Mungoe	290	3.35	151.4

2. 2. 2. 2. 4 Vertical Clearance

It is necessary to safely flow down the driftwood with flood at the bridge section. Based on the situation, 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.

2. 2. 2. 3 Bridge Design Conditions

2. 2. 2. 3. 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.

2. 2. 2. 3. 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 2-11.

Table 2-10 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 2-11 Design Strength of Reinforcing Bars

Member	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Member
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 2-12 Design Strength of PC cables

Nominal size (mm)	Nominal area (mm^2)	Specified characteristic force (kN)	Minimum 0.2% proof force (kN)	Cable type
12.7mm	98.7	183	156	SWPR7BL

2. 2. 2. 4 Selection of Bridge Length

The history of the present situation of the target bridges are shown below.

- The old bridges and pipe culvert were damaged by the flood, and a temporary bridge was installed for emergency restoration.
- The amount of rainfall in this area has been increasing due to changes in weather conditions in recent years.

- Since the area around the river where the bridge crosses is flat and no topographic relief, setting the river width is an issue.

Based on the above situation, "Ensuring resilience against flood disasters" should be regarded as the most important bridge performance in the examination of bridge length, and the bridge length should satisfy the following conditions.

Condition 1: Ensure a water flow section more than the present bridge.

Condition 2: Ensure a water flow section that allows the discharge of flood water.

In addition, in order to rationalize the use of materials and equipment in the construction, the span length would be standardized as much as it is possible to secure the necessary bridge length.

Condition for decision of span length: Standardize span length as much as possible

Based on the above, the bridge length and span length of target bridges are determined according to the following flow chart.

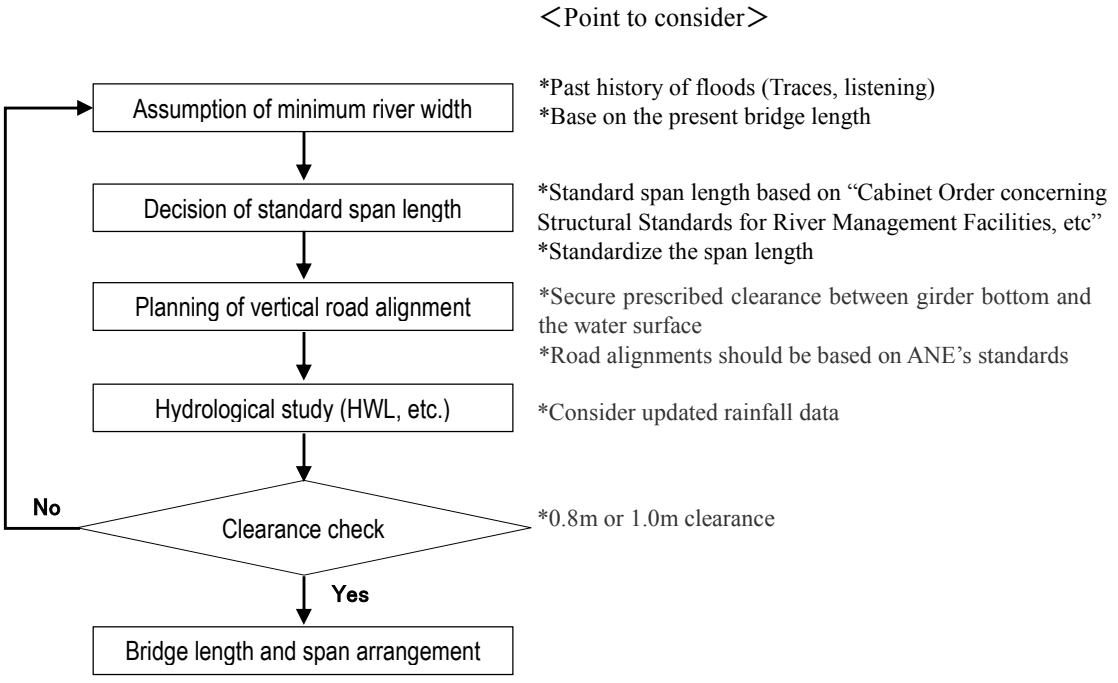


Figure 2-4 Flow Chart for Selection of Bridge Length and Span Length

2. 2. 2. 4. 1 Assumption of Minimum River Width

Length of the present bridge is assumed as minimum river width, and length of new bridge is set more than the minimum river width.

Table 2-13 Length of the Present Bridge and New Bridge

No.	Bridge Name	Present Bridge		New Bridge
		Type	Length	Length
1	Muagamula	Bailey Br.	33.0m	35.0m
2	Muera I	Concrete Br.	45.0m	50.0m
3	Muera II	Bailey Br.	24.0m	25.0m
4	Mungoe	Bailey Br.	24.0m	25.0m

2. 2. 2. 4. 2 Standard Span Length and Arrangement

Each planning discharge of 4 target bridges is less than 1,000m3/s. According to “Cabinet Order concerning Structural Standards for River Management Facilities, etc”, required span length corresponding the planning discharge is 20+0.005Q=25m. Therefore, 25m is adopted as minimum span length. 25m and 35m span lengths are adopted as standard span length considering the arrangement of spans in bridge length and standardization of span length.

Table 2-14 Required Span Length and Span Arrangement

No.	Bridge Name	Required Span Length		New Bridge	
		Quantity of Flow	Span Length	Bridge Length	Span Arrangement
1	Muagamula	537m3/s	22.7m	35.0m	—
2	Muera I	963m3/s	24.8m	50.0m	2@25.0m
3	Muera II	172m3/s	20.9m	25.0m	—
4	Mungoe	290m3/s	21.5m	25.0m	—

2. 2. 2. 5 Selection of Superstructure Type

2. 2. 2. 5. 1 Present Situation of Target Bridges

Present situation of target bridges is shown below.

- This project is a construction project of multiple bridges (4 Bridge).
- It is desirable to construct the pile and substructure in the dry season.
- Bridge type with less maintenance work is desired.

- Mostly cause of the collapse of the old bridges is damage due to floods.

2. 2. 2. 5. 2 Policy of Superstructure Type Selection

Based on the above situation where the target bridge is placed, the selection policy for the superstructure type of the target bridge are shown below.

i) Standardize structural type

Standardize the structure as much as possible in order to rationalize construction by sharing and converting temporary materials and construction equipment.

ii) Construction method which is not affected by the under girder condition

The superstructure is expected to be constructed in rainy season. The construction method which does not use the water flowing part under the girder as much as possible such as the erection by crane, portal crane or erection girder is prioritized.

iii) Minimal maintenance

In order to reduce the life cycle cost of maintenance, the superstructure shall be maintained with minimum inspection.

iv) Ensure resilience to floods

Since many bridges collapsed due to flood damage, superstructures type that will not be easily washed away even if unexpected floods occur should be adopted.

2. 2. 2. 5. 3 Evaluation Index of Superstructure Type Selection

In the selection of superstructure type, the evaluation is based on following indexes.

i) Structural Ability (reliability, durability, resilience to flood)

Reliability is evaluated based on construction experience in Mozambique. Durability is evaluated for the slab structural type (PC, RC), because fatigue durability is often a problem for slab by passage of large vehicles. Resilience against flood is evaluated by the weight of superstructure.

ii) Constructability (construction difficulty against the structural type or the weather)

The difficulty of the construction method of the superstructure is evaluated. The difficulty is the lowest for supporting method and the difficulty is high for cantilever method, etc.

Since the superstructure construction is expected during rainy season, the superstructure using cast-in-place concrete is easily affected by the weather. Therefore, the difficulty of construction against the weather is evaluated by the application range of cast-in-place concrete.

iii) Maintenance (existence of re-painting, replacement of bearings)

Surface painting and repainting are not necessary for concrete bridges. On the other hand, steel bridges must be repainted. Repainting work requires not only cost but also judgment of appropriate timing. Therefore, the existence of repainting is evaluated.

As for bearings, replacement during service is basically unnecessary, but when replacement is carried out due to unexpected damage, etc., jacking up of superstructure is required, and repair work becomes difficult and costly. Therefore, the number of bearing is evaluated.

iv) Environment and social considerations

Since target bridges are constructed over a river, there is a concern about water pollution caused by the falling of ready-mixed concrete during construction. Therefore, the effect on the environment is evaluated by the casting amount of concrete above the river.

v) Cost

The construction cost including superstructure, pier, abutments and foundations is evaluated.

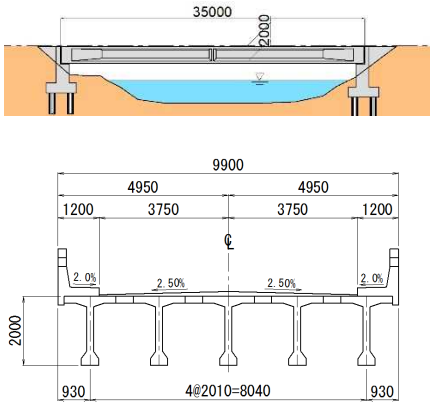
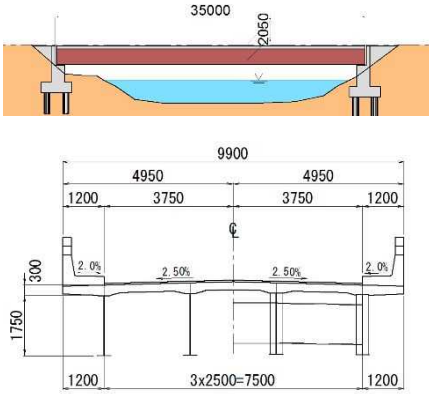
2. 2. 2. 5. 4 Selection and Comparison of Superstructure Type

(1) Selection of Superstructure Type for 35m Span

The superstructure type applicable to the span length of 35 m is shown below.

Option-1: PCT Girder / Option-2: Steel I Girder

Table 2-15 Comparison Table of Superstructure Type for Bridge with 35m Span

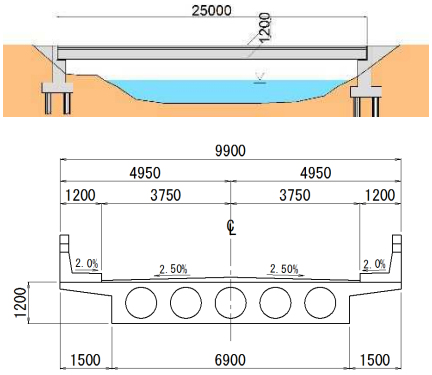
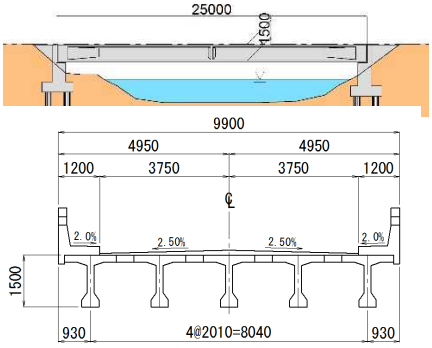
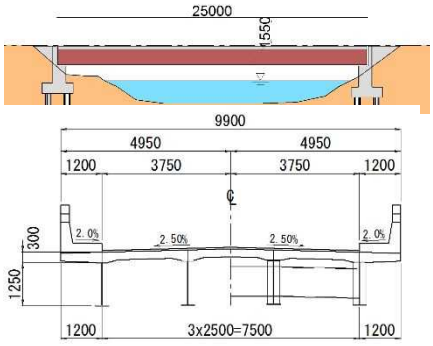
	Elavation & Girder Section	Evaluation		
Option-1 PCT Girder		Structure	-Extensive construction experience in Mozambique -PC slab with excellent durability -Heavy weight and better stability against floods	○
		Construct ability	-Easy construction using erection girder -No impact from weather	○
		Maintenance	-Lower maintenance cost -10 bearings	○
		Environmental Social Consideration	-Lower effect to water pollution due to the falling of ready-mixed concrete	○
		Cost	-Lower construction and maintenance cost	○
		Total	Excellent in durability and resistance against flood. It also enables the effective use of locally procured material and reduces initial costs. In addition, since maintenance is not costly, life cycle costs are also lower.	○
Option-2 Steel I Girder		Structure	-Few construction experience in Mozambique -RC slab with lower durability than PC slab -Light weight and less stability against floods	×
		Construct ability	-Incremental launching method is complicated -Weather affects deck work	△
		Maintenance	-Periodical re-paint is needed -8 bearings	△
		Environmental Social Consideration	-Large amount of casting concrete for slab might affects water pollution due to the falling of ready-mixed concrete	△
		Cost	-Higher construction and maintenance cost	△
		Total	It is inferior in durability and resistance against flood. The initial cost is high because of the procurement from Japan. In addition, it is inferior to option-1 in the life cycle cost, because periodic maintenance (Repainting, etc.) is indispensable.	△
Conclusion	The optimum superstructure type is PCT girder, which not only meets the selecting conditions but also has extensive construction experience and is excellent in economy.			

(2) Selection of Superstructure Type for 25m Span

The superstructure type applicable to the span length of 25 m is shown below.

Option-1: PC Hollow Slab / Option-2: PCT Girder / Option-3: Steel I Girder

Table 2-16 Comparison Table of Superstructure Type for Bridge with 35m Span

	Elavation & Girder Section	Evaluation		
Option-1 PC Hollow Slab		Structure	-Few construction experience in Mozambique -Small girder height makes approach road short -RC slab with lower durability than PC slab	△
		Constructability	-Weather affects concrete casting work	×
		Maintenance	-Lower maintenance cost -4 bearings	○
		Environmental Social	-Large amount of casting concrete for all superstructure might affects water pollution due to the falling of ready-mixed concrete	×
		Cost	-Lower construction and maintenance cost -Standardization of bridge types cannot be achieved.	△
		Total	Although the approach road length can be shortened, there are some issues in the construction (Use of under girder, weather, environmental, etc.).	△
Option-2 PCT Girder		Structure	-Extensive construction experience in Mozambique -Large girder height makes approach road long -PC slab with excellent durability	○
		Constructability	-Easy construction using erection girder -No impact from weather	○
		Maintenance	-Lower maintenance cost -10 bearings	△
		Environmental Social	-Lower effect to water pollution due to the falling of ready-mixed concrete	○
		Cost	-Lower construction and maintenance cost	○
		Total	The structure and constructability are excellent, and the cost is almost same as Option-1. Standardization of bridge types makes quality control easy.	○
Option-3 Steel I Girder		Structure	-Few construction experience in Mozambique -Large girder height makes approach road long -RC slab with lower durability than PC slab	×
		Constructability	-Incremental launching method is complicated -Weather affects deck work	×
		Maintenance	-Periodical re-paint is needed -8 bearings	×
		Environmental Social	-Large amount of casting concrete for slab might affects water pollution due to the falling of ready-mixed concrete	△
		Cost	-Higher construction and maintenance cost	×
		Total	High initial cost due to the procurement from Japan. In addition, it is inferior in the life cycle cost, because periodic maintenance (Repainting) is indispensable.	×
Conclusion	The optimum superstructure type is PCT girder, which not only meets the selecting conditions but also has extensive construction experience and is excellent in economy.			

2. 2. 2. 6 Substructure

2. 2. 2. 6. 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.

2. 2. 2. 6. 2 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 20m to 50m below the ground and consists of silt or mud 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. 6. 3 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. 6. 4 Structure Height

(1) Abutment

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) Pier

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 2-17.

Table 2-17 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. 7 Road Design Policy

2. 2. 2. 7. 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 2-18 and Table 2-19.

Table 2-18 Road Category (ANE's 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 road.	• Provincial road connection between city and city. • Connecting road from/to main city and arterial road.	• Connecting road from/to main local city and main productive center.	• Connecting road between local cities.
Traffic Volume (p.c.u.)	500－20,000	100－500	30－100	0－50

Table 2-19 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

2. 2. 2. 7. 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: 0.8m

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

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

6) Figure 2-5 shows the typical cross-section

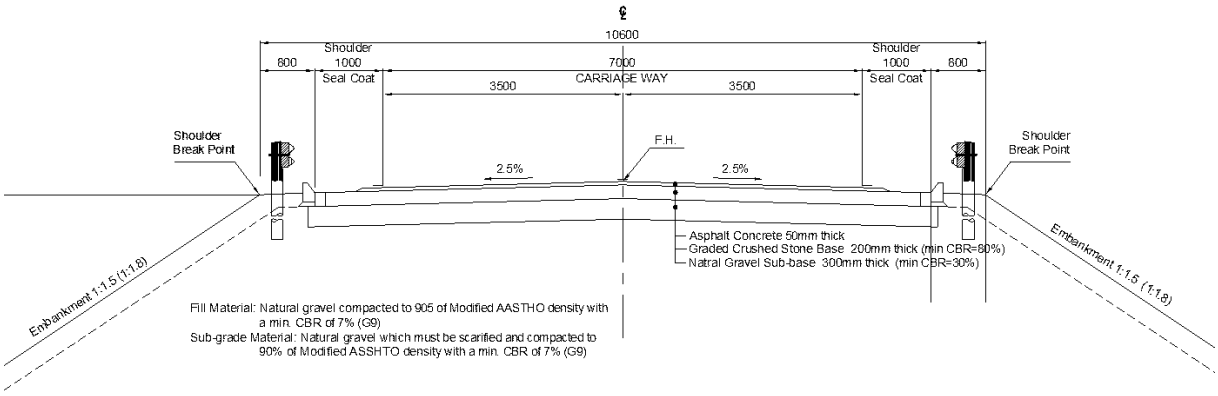


Figure 2-5 Typical Cross-Section of the Project Road

2. 2. 2. 7. 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

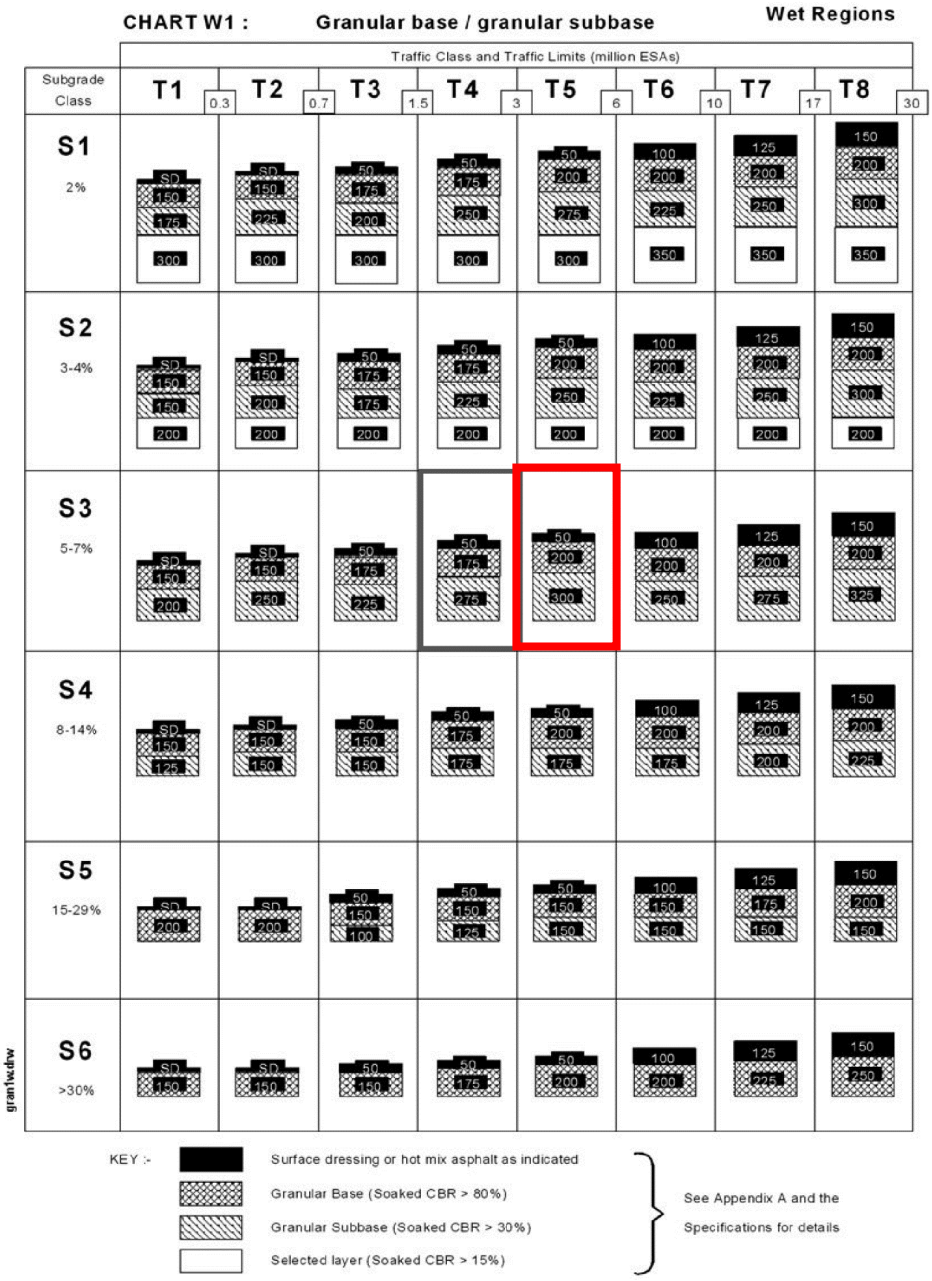
2) Traffic class: ESA=3.24×106（Class T5）

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

4) Climate: WET

5) Pavement composition: SATCC chart (Chart W1、Table 2-20)

Table 2-20 Pavement Content Chart



Source: SATCC Draft Code of Practice for the Design of Road Pavements

2. 2. 2. 7. 4 Drainage Facilities

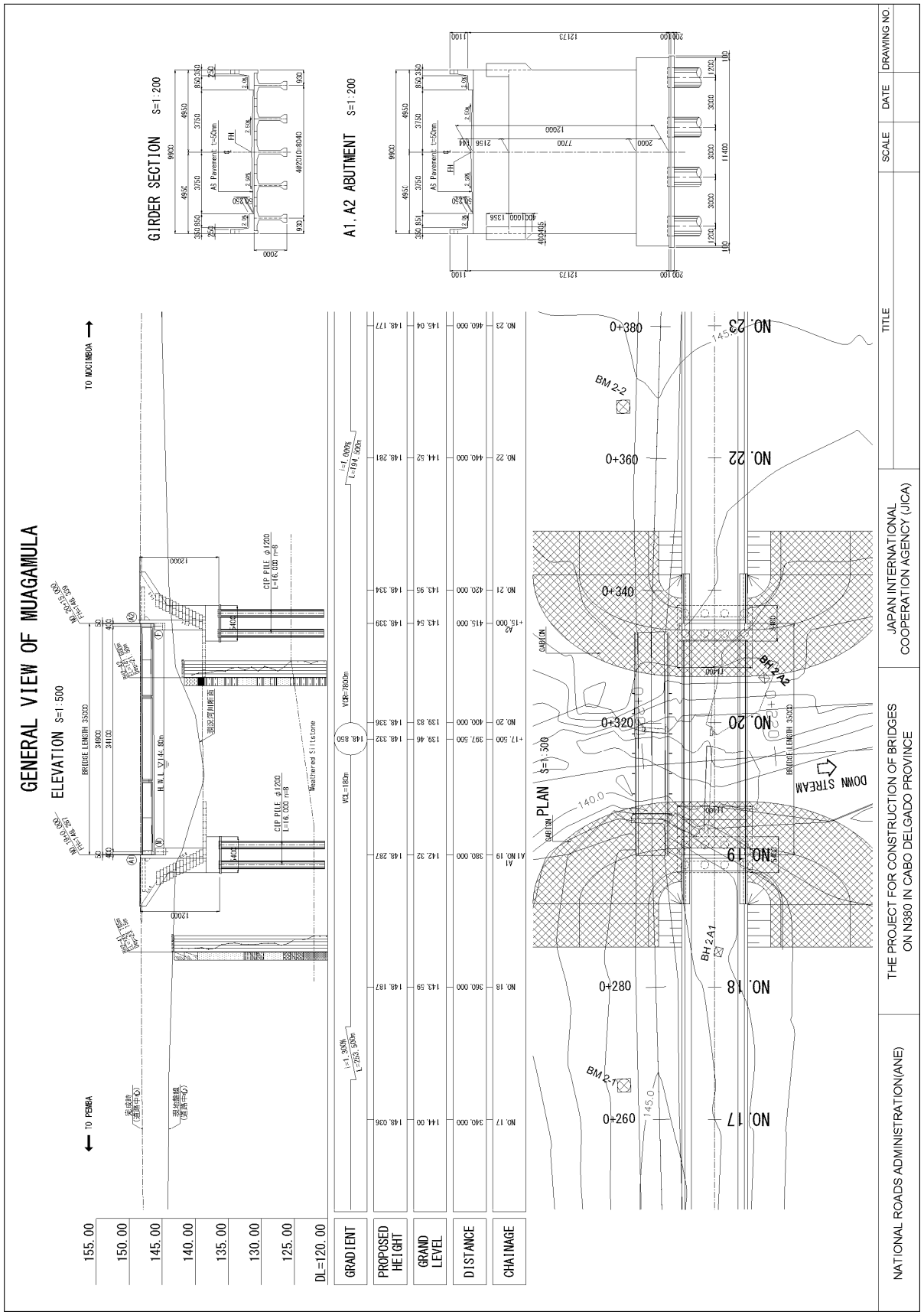
For road surface drainage, a concrete curve will be installed in the edge of the shoulder for prevention of erosion on the embankment slope. The drainage water collected by the vertical gutter will be drained to the river through the line gutter installed in the bottom of the embankment.

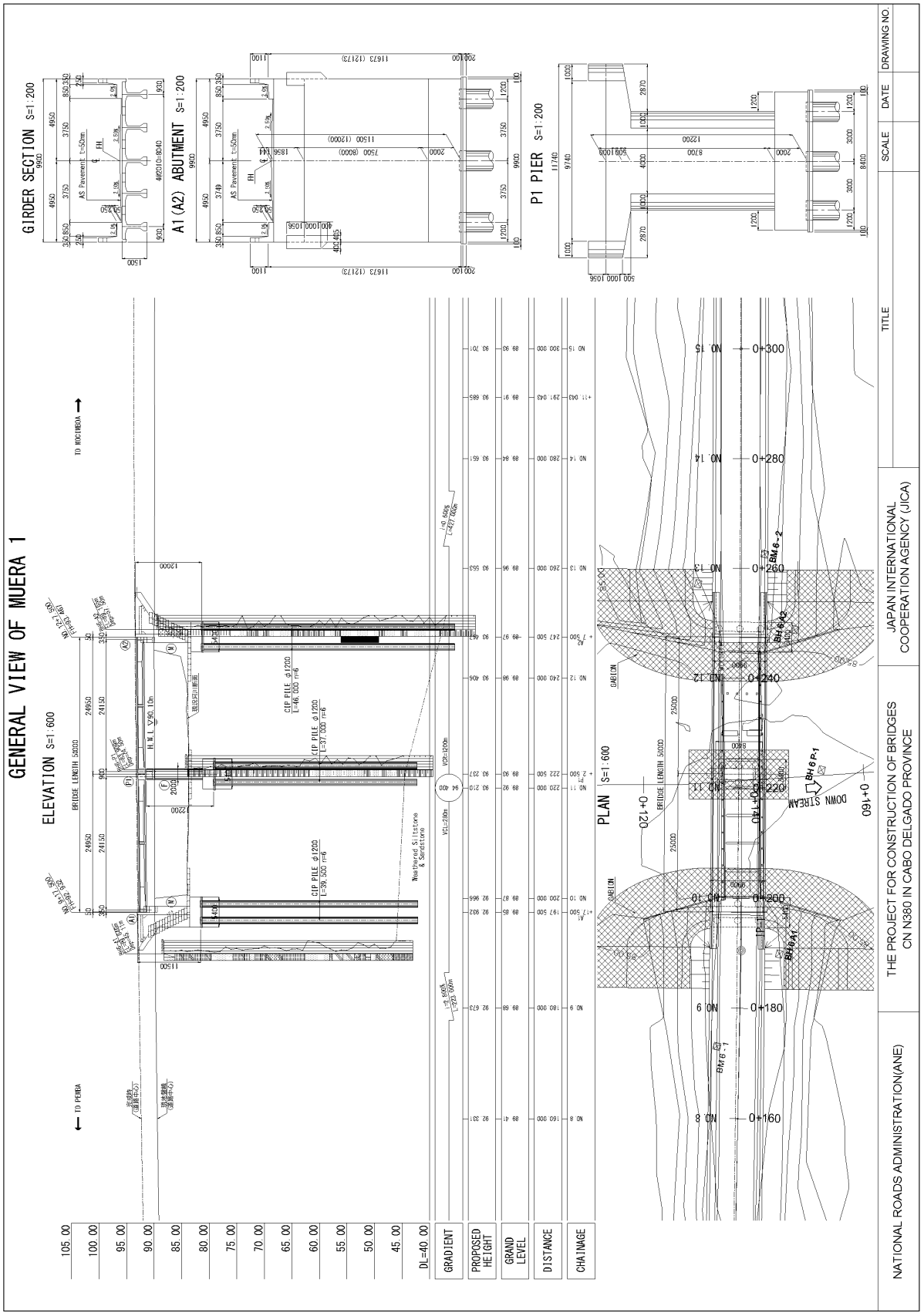
For Muera I and II where the bottom of embankment will be flooded in rainy season, a gabion mat is installed as an apron at the bottom of embankment and let it permeate into ground without the line gutter.

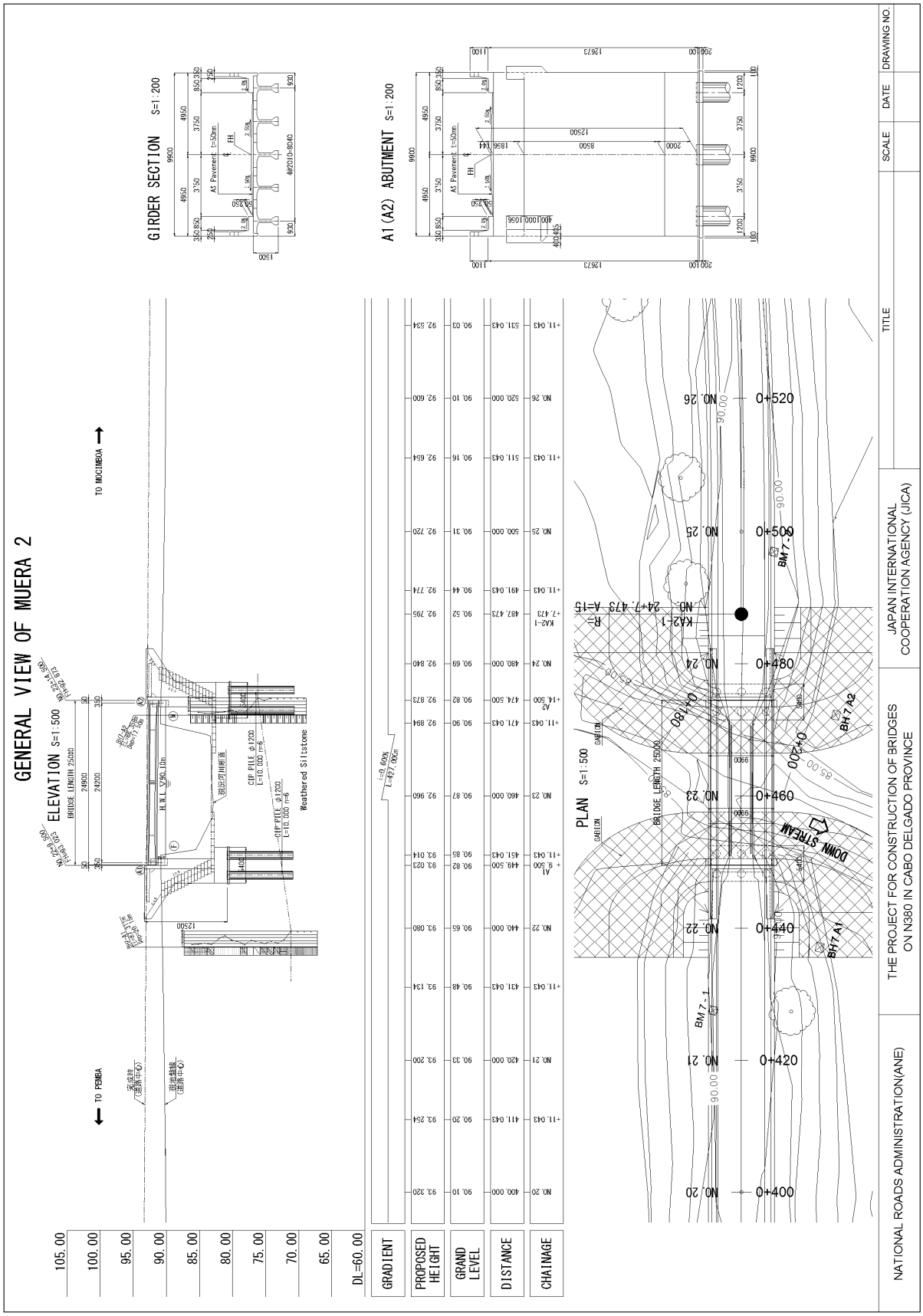
2. 2. 2. 7. 5 Road Safety Facilities

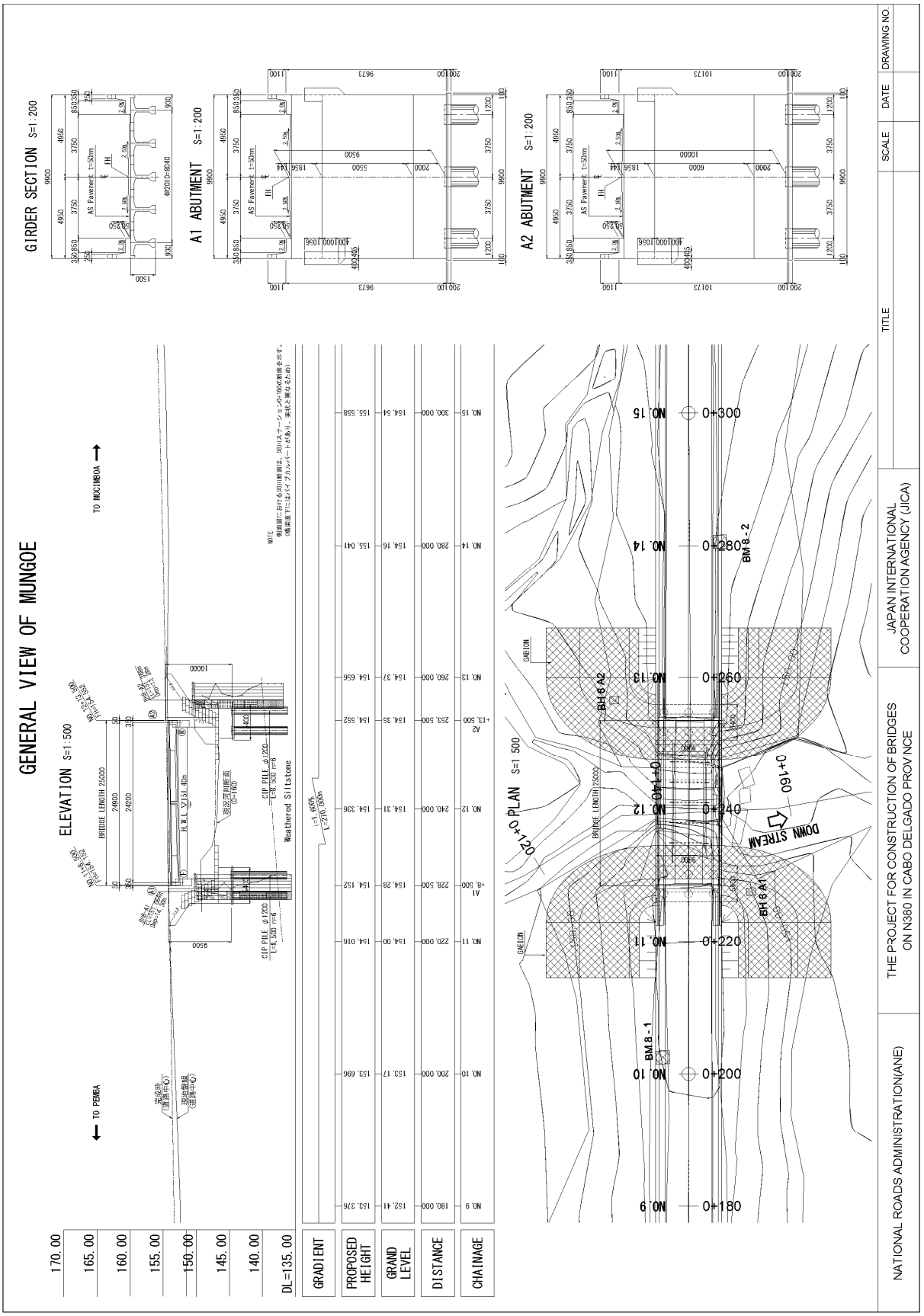
Road marking rivets (reflective type) will be installed on the road to help prevent traffic accidents during the night. Road signs to indicate the bridge ahead in advance and curved alignment sections at the front of curve lines on each way will be installed.

2.2.3 Outline Design Drawings




GENERAL VIEW OF MUERA 1
GIRDER SECTION S=1:200
A1(A2) ABUTMENT S=1:200
P1 PIER S=1:200
ELEVATION S=1:600
PLAN S=1:600
TO MOCIMBOA
TO PEMBA
DOWN STREAM
BRIDGE LENGTH 300.00
CIP PILE φ1200 L=46.000 n=6
CIP PILE φ1200 L=37.500 n=6
CIP PILE φ1200 L=36.500 n=6
Weathered Siltstone & Sandstone
GRADIENT
PROPOSED HEIGHT
GRAND LEVEL
DISTANCE
CHAINAGE
NO.15 0+300
NO.14 0+280
NO.13 0+260
NO.12 0+240
NO.11 0+220
NO.10 0+200
NO.9 0+180
NO.8 0+160
0+120
BM6-2
BM6-1
BM6A1
BH6P1
TITLE
SCALE
DATE
DRAWING NO.
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE PROJECT FOR CONSTRUCTION OF BRIDGES CN N380 IN CABO DELGADO PROVINCE
NATIONAL ROADS ADMINISTRATION(ANE)


GENERAL VIEW OF MUERA 2
GIRDER SECTION S=1:200
A1(A2) ABUTMENT S=1:200
ELEVATION S=1:500
PLAN S=1:500
TO MOCIMBOA
TO PEMBA
DOWN STREAM
BRIDGE LENGTH 25000
CIP PILE ø1200 L=10.000 n=6
Weathered Siltstone
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.
GRADIENT
PROPOSED HEIGHT
GRAND LEVEL
DISTANCE
CHAINAGE


GENERAL VIEW OF MUNGOE
GIRDER SECTION S=1:200
A1 ABUTMENT S=1:200
A2 ABUTMENT S=1:200
ELEVATION S=1:500
PLAN S=1:500
TO MOCIMBOA
TO PEMBA
BRIDGE LENGTH 25000
Weathered Siltstone
GRADIENT
PROPOSED HEIGHT
GRAND LEVEL
DISTANCE
CHAINAGE
DL=135.00
BM8-1
BM8-2
BH8A1
BH8A2
DOWN STREAM
TITLE
SCALE
DATE
DRAWING NO.
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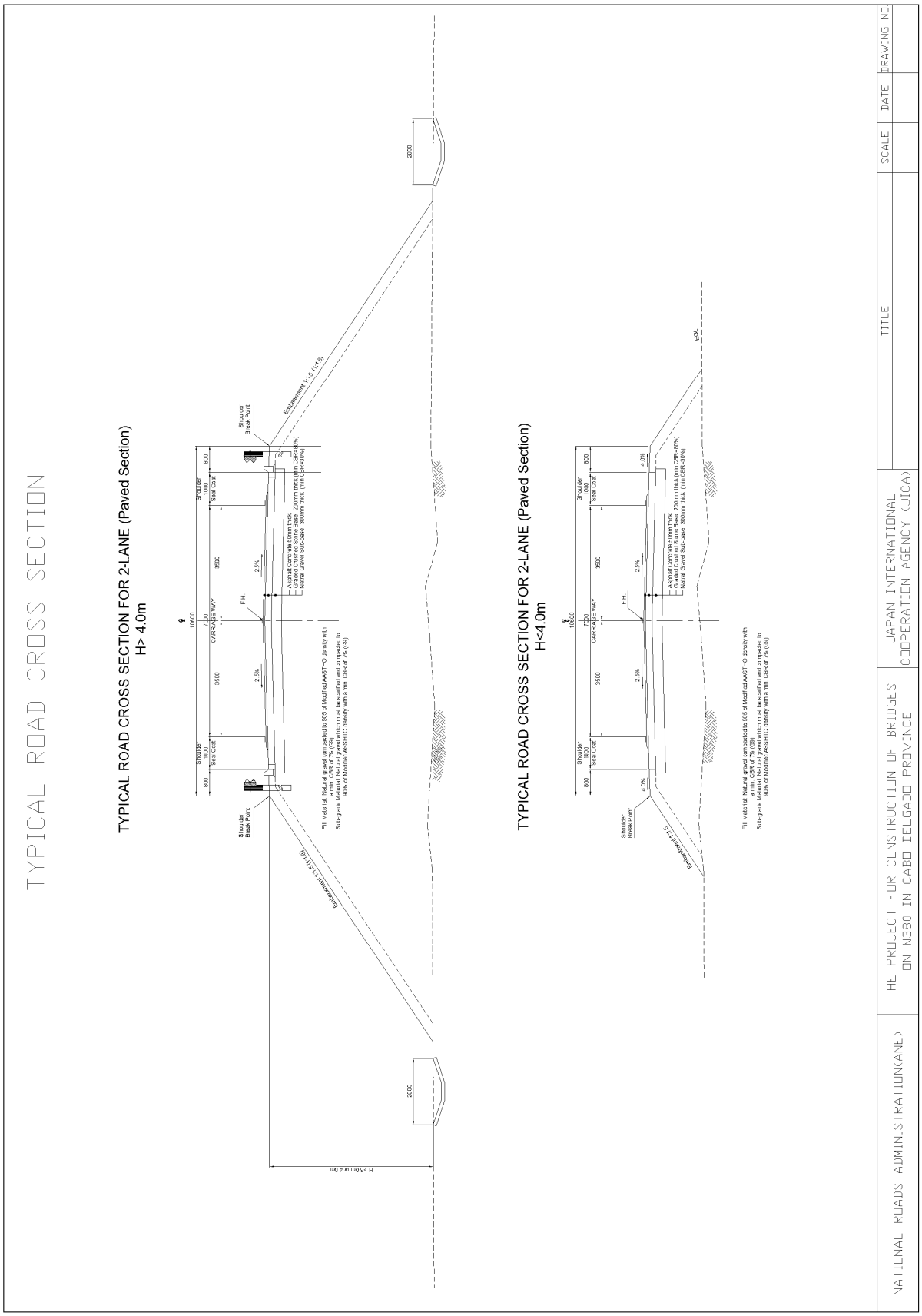
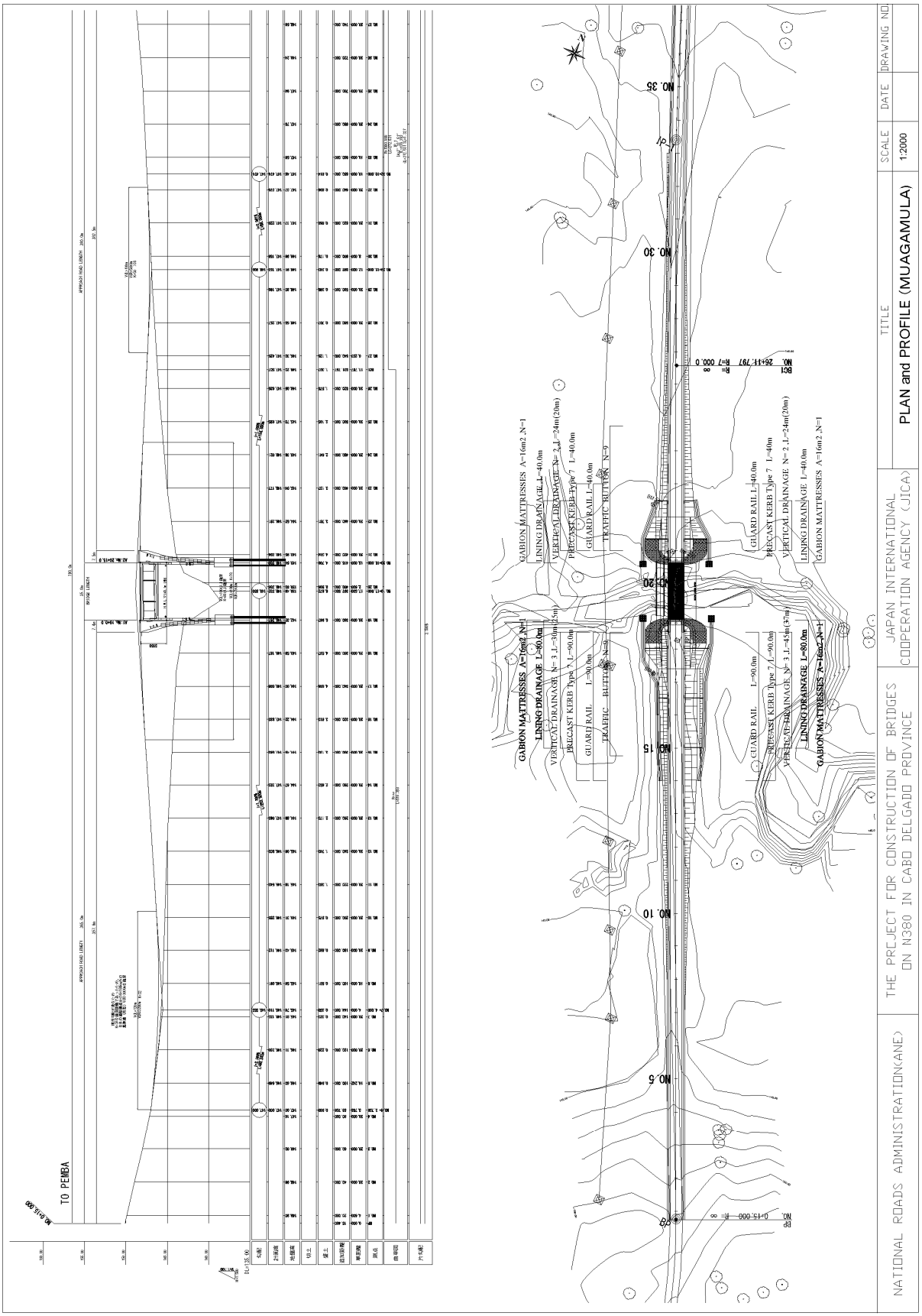
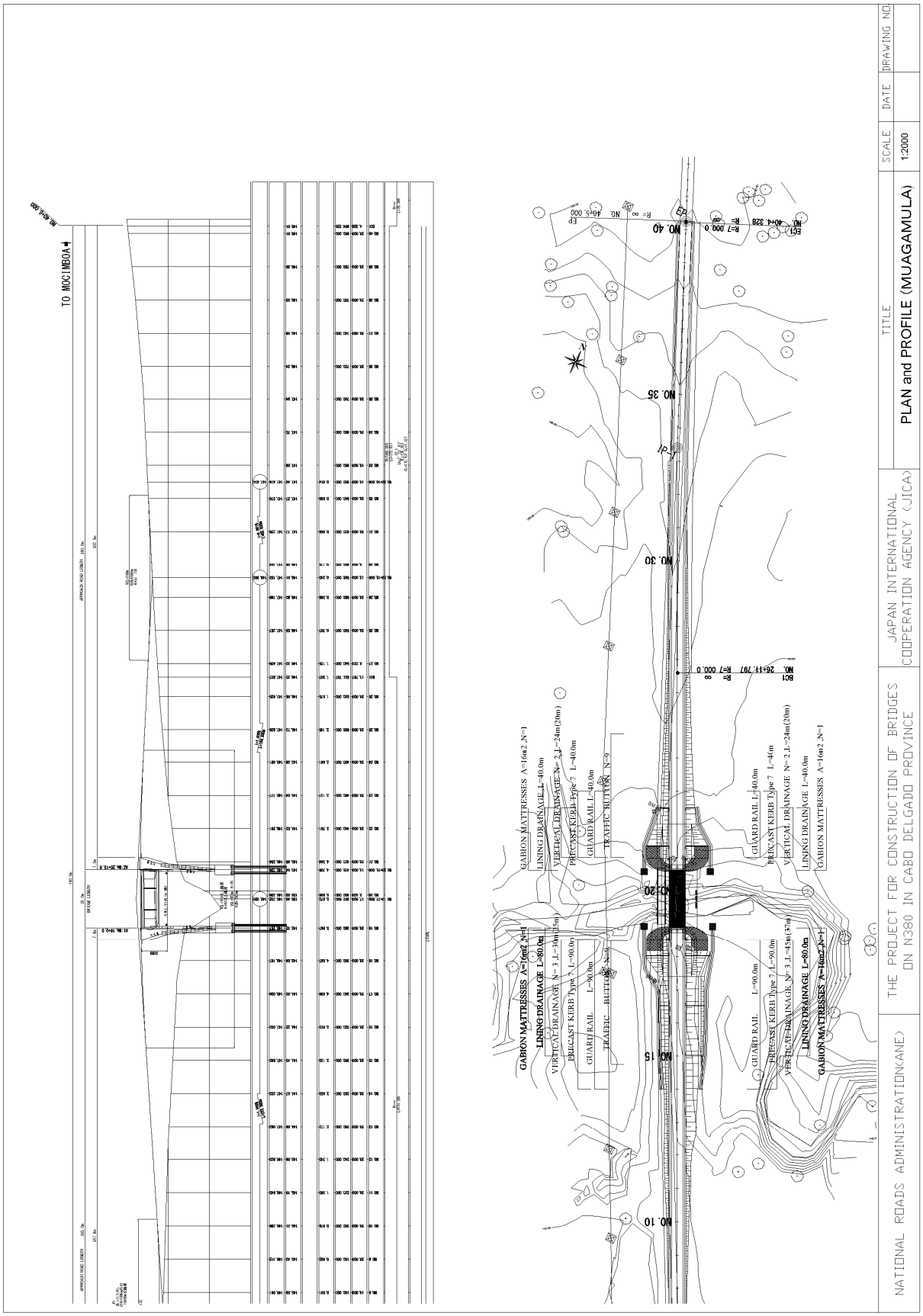
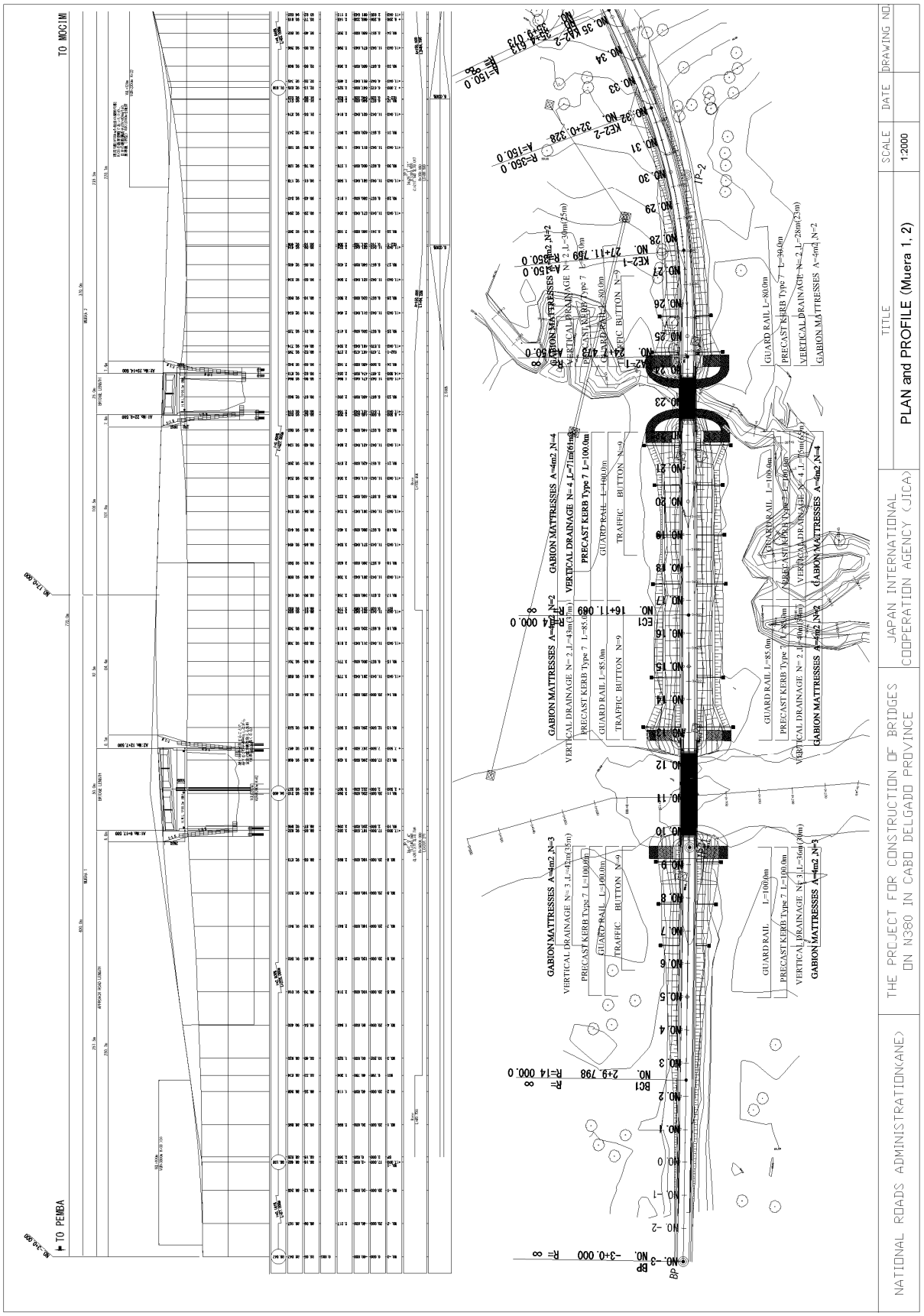
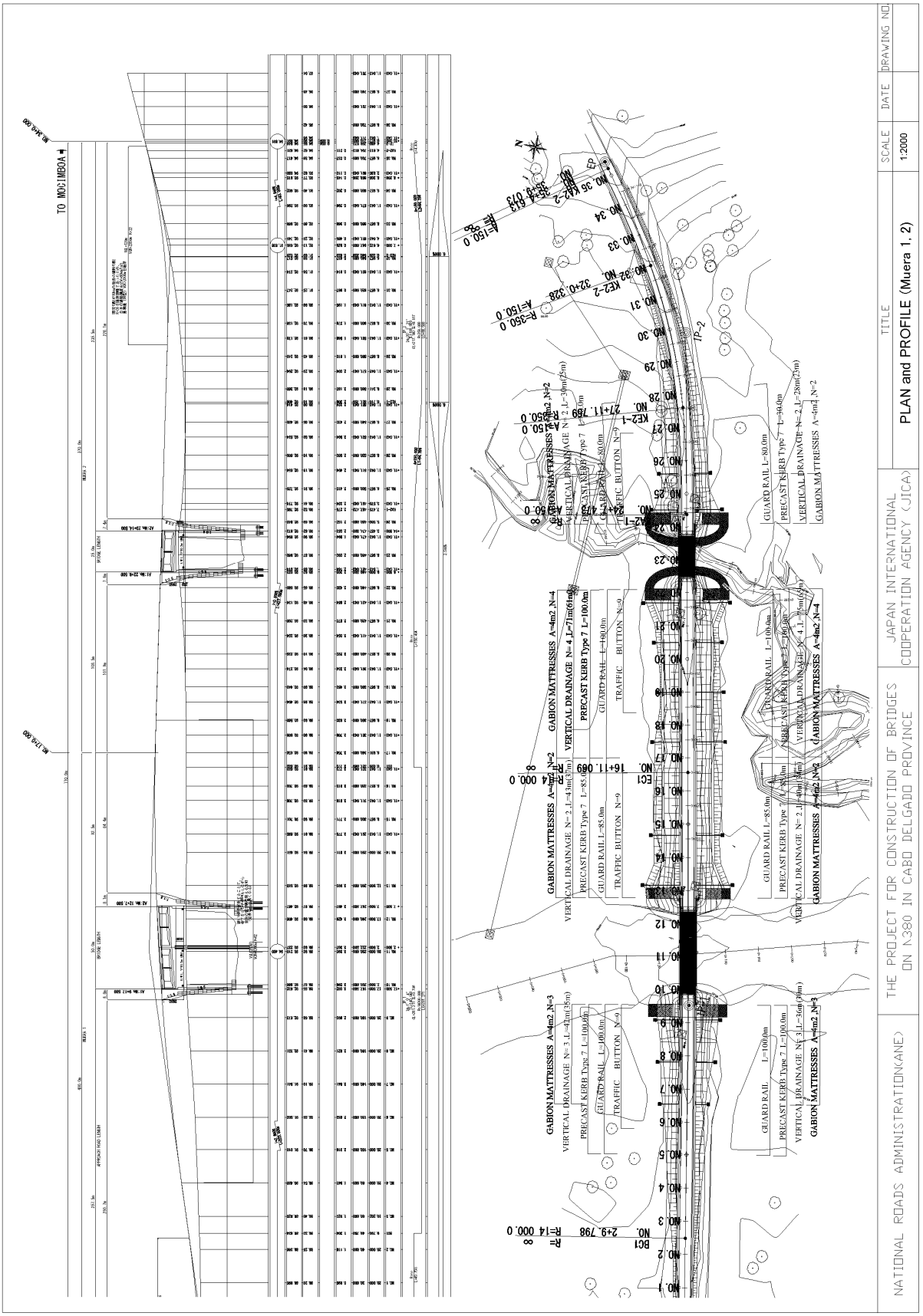
THE PROJECT FOR CONSTRUCTION OF BRIDGES ON N380 IN CABO DELGADO PROVINCE
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)


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)
H<4.0m
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


TO PEMBA
NO. 35
NO. 30
NO. 25
NO. 20
NO. 15
NO. 10
NO. 5
NO. 0
GABION MATTRESSES A=16m2 ,N=1
LINING DRAINAGE L=40.0m
VERTICAL DRAINAGE N= 2 ,L=24m(20m)
PRECAST KERB Type 7 L=40.0m
GUARD RAIL L=40.0m
TRAFFIC BUTTON N=9
GABION MATTRESSES A=16m2 ,N=1
LINING DRAINAGE L=80.0m
VERTICAL DRAINAGE N= 3 ,L=30m(25m)
PRECAST KERB Type 7 L=90.0m
GUARD RAIL L=90.0m
TRAFFIC BUTTON N=9
GABION MATTRESSES A=16m2 ,N=1
LINING DRAINAGE L=80.0m
VERTICAL DRAINAGE N= 3 ,L=45m(37m)
PRECAST KERB Type 7 L=90.0m
GUARD RAIL L=90.0m
TRAFFIC BUTTON N=9
GABION MATTRESSES A=16m2 ,N=1
LINING DRAINAGE L=40.0m
VERTICAL DRAINAGE N= 2 ,L=24m(20m)
PRECAST KERB Type 7 L=40m
GUARD RAIL L=40.0m
TRAFFIC BUTTON N=9
GABION MATTRESSES A=16m2 ,N=1
LINING DRAINAGE L=40.0m
BC1
NO. 26+11.797
R=7.000.0
BP
NO. 0+13.000
R=∞
NATIONAL ROADS ADMINISTRATION(ANE)
THE PROJECT FOR CONSTRUCTION OF BRIDGES ON N380 IN CABO DELGADO PROVINCE
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
TITLE
PLAN and PROFILE (MUAGAMULA)
SCALE 1:2000
DATE
DRAWING NO


TO MOCIMBOA
NO. 40
NO. 35
NO. 30
NO. 25
NO. 20
NO. 15
NO. 10
GABION MATTRESSES A=16m2, N=1
LINING DRAINAGE L=80.0m
VERTICAL DRAINAGE N= 3 ,L=30m(15m)
PRECAST KERB Type 7 L=90.0m
GUARD RAIL L=90.0m
TRAFFIC BUTTON N=9
LINING DRAINAGE L=40.0m
VERTICAL DRAINAGE N= 2 ,L=24m(20m)
PRECAST KERB Type 7 L=40.0m
GUARD RAIL L=40.0m
VERTICAL DRAINAGE N= 3 ,L=45m(37m)
NATIONAL ROADS ADMINISTRATION(ANE)
THE PROJECT FOR CONSTRUCTION OF BRIDGES ON N380 IN CABO DELGADO PROVINCE
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
TITLE
PLAN and PROFILE (MUAGAMULA)
SCALE 1:2000
DATE
DRAWING NO


TO MOCIMBOA
TO PEMBA
NATIONAL ROADS ADMINISTRATION(ANE)
THE PROJECT FOR CONSTRUCTION OF BRIDGES ON N380 IN CABO DELGADO PROVINCE
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
TITLE
PLAN and PROFILE (Muera 1, 2)
SCALE
1:2000
DATE
DRAWING NO.
GABION MATTRESSES A=4m2 N=4
VERTICAL DRAINAGE N= 4 L=71m(61m)
PRECAST KERB Type 7 L=100.0m
GUARD RAIL L=100.0m
TRAFFIC BUTTON N=9
GABION MATTRESSES A=4m2 N=2
VERTICAL DRAINAGE N= 2 L=43m(37m)
PRECAST KERB Type 7 L=85.0m
GUARD RAIL L=85.0m
GABION MATTRESSES A=4m2 N=3
VERTICAL DRAINAGE N= 3 L=42m(35m)
PRECAST KERB Type 7 L=100.0m
GUARD RAIL L=100.0m
GUARD RAIL L=80.0m
PRECAST KERB Type 7 L=80.0m
VERTICAL DRAINAGE N= 2 L=28m(25m)
GABION MATTRESSES A=4m2 N=2
VERTICAL DRAINAGE N= 3 L=34m(30m)
GABION MATTRESSES A=4m2 N=3
IP-2
BP
EP
R=∞
R=14 000.0
R=150.0
R=350.0
A=150.0
A=350.0
A1-1
A2-1
KE2-1
KE2-2
BC1
EC1
NO. -3+0.000
NO. 2+9.798
NO. 16+11.069
NO. 27+11.758
NO. 32+0.328
NO. 35+9.043


TO MOCIMBOA
NO.1
NO.2
NO.3
NO.4
NO.5
NO.6
NO.7
NO.8
NO.9
NO.10
NO.11
NO.12
NO.13
NO.14
NO.15
NO.16
NO.17
NO.18
NO.19
NO.20
NO.21
NO.22
NO.23
NO.24
NO.25
NO.26
NO.27
NO.28
NO.29
NO.30
NO.31
NO.32
NO.33
NO.34
NO.35
NO.36
BC1
EC1
BC2
EC2
IP-1
IP-2
R=14 000.0
R=150.0
R=350.0
GABION MATTRESSES A=4m2, N=4
VERTICAL DRAINAGE N= 2, L=4.3m(3m)
PRECAST KERB Type 7 L=85.0m
GUARD RAIL L=85.0m
TRAFFIC BUTTON N=9
VERTICAL DRAINAGE N= 4, L=7m(6m)
PRECAST KERB Type 7 L=100.0m
GUARD RAIL L=100.0m
GABION MATTRESSES A=4m2, N=3
VERTICAL DRAINAGE N= 3, L=4.3m(3.5m)
GUARD RAIL L=1000m
VERTICAL DRAINAGE N= 3, L=5m(4.0m)
VERTICAL DRAINAGE N= 2, L=10m(7.5m)
VERTICAL DRAINAGE N= 2, L=28m(25m)
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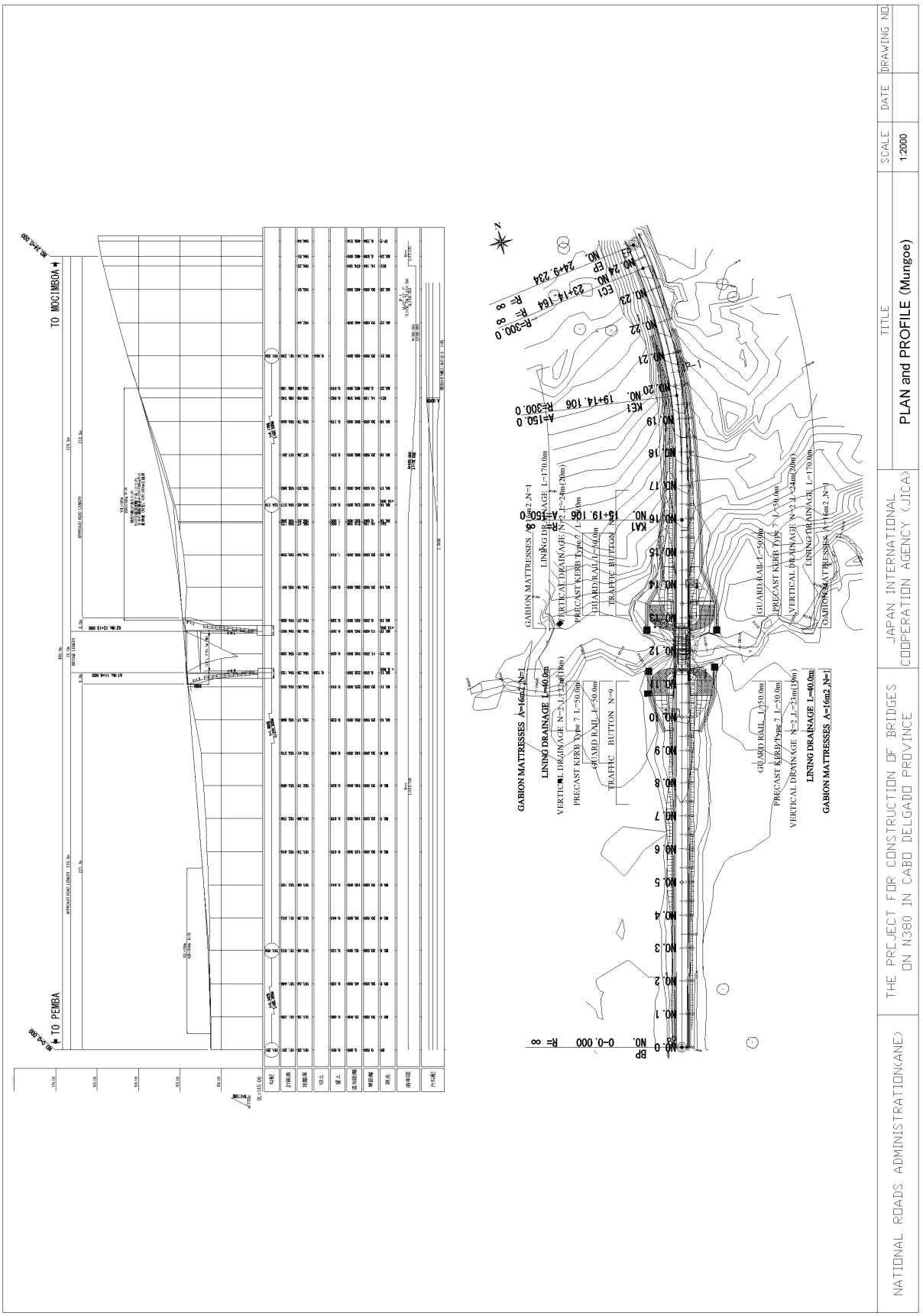
GUARD RAIL L=80.0m
TITLE
PLAN and PROFILE (Muera 1, 2)
SCALE
1:2000
DATE
DRAWING NO.
NATIONAL ROADS ADMINISTRATION(ANE)
THE PROJECT FOR CONSTRUCTION OF BRIDGES ON N380 IN CABO DELGADO PROVINCE
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)


TO MOCIMBOA
TO PEMBA
NO.0-0.000
NO.24+0.000
GABION MATTRESSES A=16m2 N=1
LINING DRAINAGE L=40.0m
VERTICAL DRAINAGE N=2 L=22m(18m)
PRECAST KERB Type 7 L=50.0m
GUARD RAIL L=50.0m
TRAFFIC BUTTON N=9
LINING DRAINAGE L=170.0m
VERTICAL DRAINAGE N=2 L=24m(20m)
GUARD RAIL L=50.0m
PRECAST KERB Type 7 L=50.0m
VERTICAL DRAINAGE N=2 L=23m(19m)
LINING DRAINAGE L=40.0m
GABION MATTRESSES A=16m2 N=1
LINING DRAINAGE L=170.0m
GABION MATTRESSES A=16m2 N=1
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R= ∞
A=150.0
R=300.0
A=150.0
R= ∞
BP NO. 0-0.000 R= ∞
NO.0
NO.1
NO.2
NO.3
NO.4
NO.5
NO.6
NO.7
NO.8
NO.9
NO.10
NO.11
NO.12
NO.13
NO.14
NO.15
NO.16
NO.17
NO.18
NO.19
NO.20
NO.21
NO.22
NO.23
NO.24
EC1
EC2
KA1
KE1
19+14.106
15+19.106
23+14.164
24+9.234
NATIONAL ROADS ADMINISTRATION(ANE)
THE PROJECT FOR CONSTRUCTION OF BRIDGES ON N380 IN CABO DELGADO PROVINCE
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
TITLE
PLAN and PROFILE (Mungoe)
SCALE 1:2000
DATE
DRAWING NO.

2. 2. 4 Implementation Plan

2. 2. 4. 1 Implementation and Procurement Policy

2. 2. 4. 1. 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. 1. 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 neighboring 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.

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.

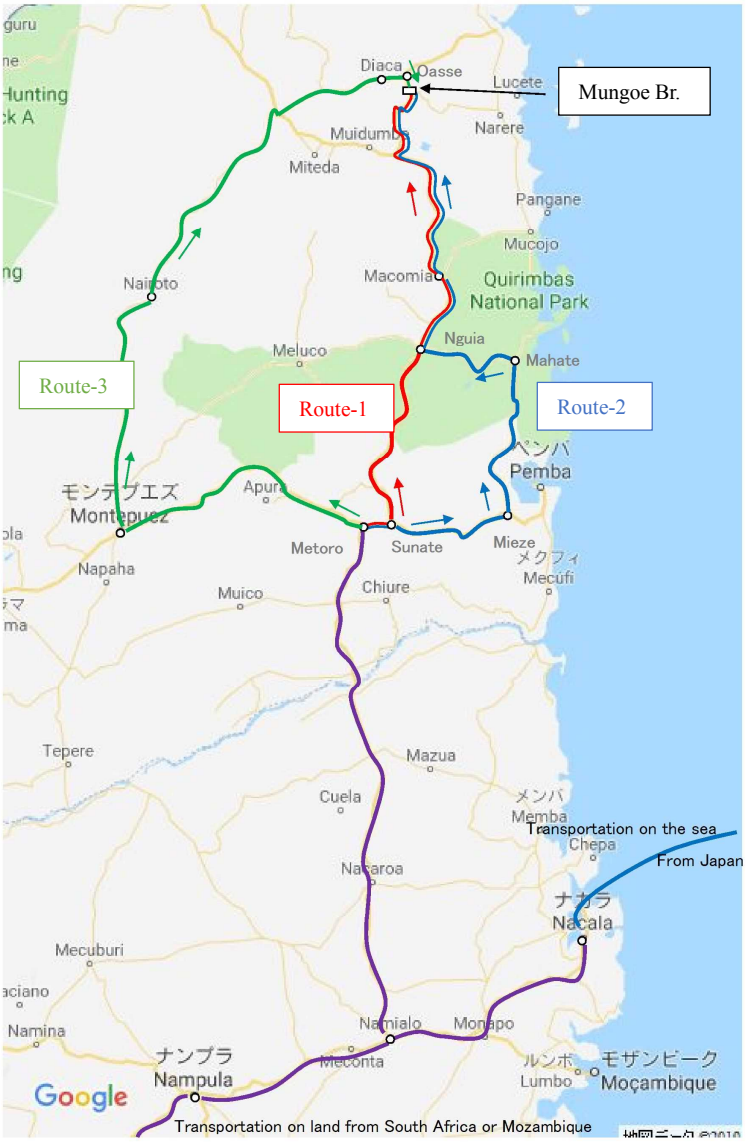


Figure 2-6 Transportation Route

2. 2. 4. 2 Implementation Conditions

2. 2. 4. 2. 1 Construction Yard

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

The construction yard should be built on an appropriate level higher than the planned high water level in the case of the dyke road has possibility of overflowed in the rainy season.

2. 2. 4. 2. 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 planned as embankment structure with corrugated pipes for water flow or Bailey bridge used for the existing bridge. In the case of bailey bridge will be used, the bailey bridges are supposed to be accommodated by ANE, while they will be erected and removed by the contractor of the project.

(1) Muagamula Bridge

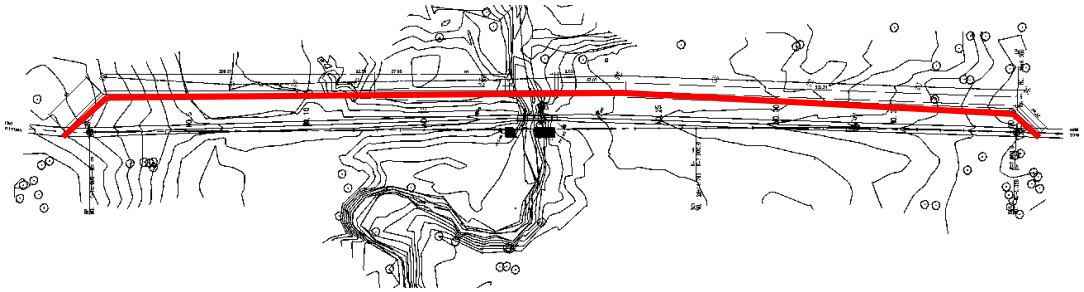


Figure 2-7 Temporary Detour Plan of Muagamula

(2) Muera I and Muera II Bridge

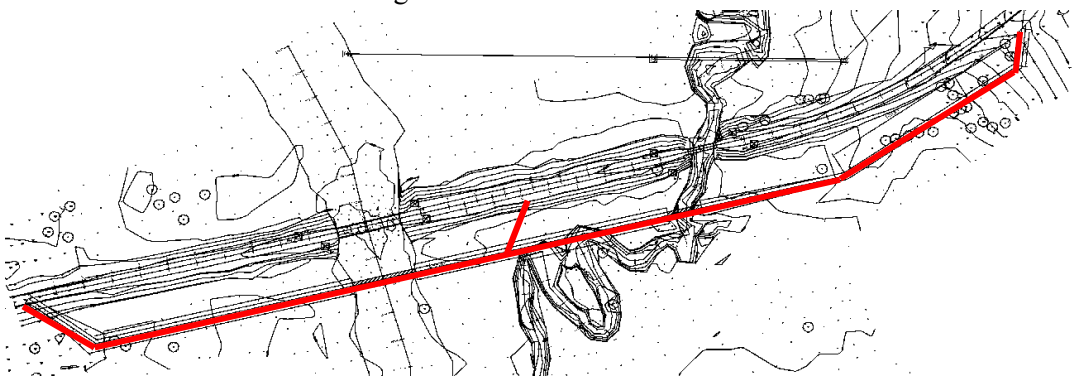


Figure 2-8 Temporary Detour Plan of Muera I and II

(3) Mungoe Bridge

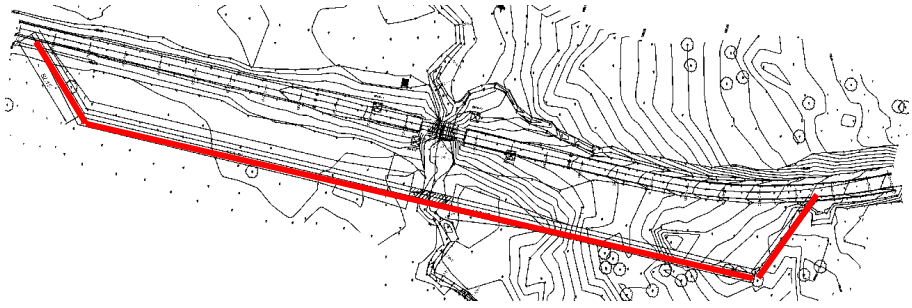


Figure 2-9 Temporary Detour Plan of Mungoe

2. 2. 4. 2. 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.

2. 2. 4. 2. 4 Ensuring safety in accordance with the security situation

The security situation in Cape Delgado province was unstable. In the construction of phase-1 project, the following security countermeasures has been taken in the camp yard. Since this project is in the same region as phase-1 project and the security situation is the same as phase-1, similar safety countermeasures will be taken for this project.

- Establishment of a system for information gathering and liaison and consultation with project implementing agencies and security authorities
- Construction of defensive battle at the camp yard (2.5 m high exterior walls, barbed wire, steel gate doors, etc.)
- Security at camp yard and construction sites (Private security guards, army deployment, surveillance towers, etc.)
- Collection of safety information from companies specializing in security measures

Concrete wall (2.5m high) and Scorpion

steel gate at the vehicle entrance

Figure 2-10 Security Countermeasure taken for Camp Yard of Phase-1 Project

2. 2. 4. 2. 5 Existing Utilities

Although there exists telecom poles for optical fiber cables parallel to the targeted bridges, they don't need to be relocated because adequate separation is secured enough.

2. 2. 4. 2. 6 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 2-21 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 2-22 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

2. 2. 4. 2. 7 Value Added Tax

(1) Relevant laws and regulations, and implementing agencies

In November 2017, a Decree (Decreto n. 66/2017) was put into effect to allow government projects through international finance to be substantially tax-exempt from value-added tax (Imposto sobre o valor acrescentado: IVA) payments by applying certificates. The Decree is intended to pay value-added tax deductions for the procurement of goods and services related to public projects funded by international financial institutions and development partners, and the implementing agency is the Ministry of Economy and Finance (Ministério da Economia e Finanças).

(2) Procedure

The main procedures are approval of project eligibility and issuance of VAT certificate (Certificado de IVA). Approval of project eligibility needs to be submitted to and requested by National Taxation Bureau (Direcção Nacional de Tesouro :DNT) through ANE. VAT certificate needs to be issued by Tax Office (Direccao-geral de impostos: DGI) after its eligibility is confirmed. By submission of VAT certificate, goods and services can be procured with exemption of VAT. Detailed procedure is shown below.

1) Request to National Tax Bureau by Project Manager
2) Verification of the project eligibility by the National Tax Bureau
3) Contract for provision of products and services
4) Submission; a list of invoices for the goods and services in which each provider's name is listed / invoice number and date / tax ID numbers of supplier and purchaser / invoice amount / value-added tax amount
5) Copies of the invoices of the suppliers of goods and services
6) Completion and sign to approved VAT certificate form by Project Manager
7) Submission of a promise document that the goods and services purchased will be used only in the project

(3) Items and services not covered

The time limit for issuing a certificate shall be 10 business days from the date of request pursuant to the provisions of Article 6. According to Article 2 of this Law, the following goods and services are not applicable.

1) Water, gas, electricity, telephone
2) Foods, including beverages
3) Food Service
4) Cost of small passenger cars
5) Housing service

2. 2. 4. 2. 8 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 Decree No. 37/31 August 2016, Article 10, the following documents are required to be submitted.

1) Two copies of the form whose model is attached hereto, communicating the admission of the foreign citizen and the degree of fulfillment of the quota
2) Three copies of the employment contract;
3) Certificate of academic qualifications or technical skills, together with the corresponding certificate of equivalence issued by the entity responsible for education regarding the level achieved overseas or document proving his work experience;
4) Quittance Certificate issued by the entity responsible for finance, valid for 30 days from the date of issue;
5) Payroll for the calendar year, detailing the nationalities of the workers;
6) Certified copy of passport or Residence Identification Document for foreign nationals;
7) Proof of payment of a fee corresponding to five minimum wages in force in the sector of activity the company is involved.

2. 2. 4. 3 Scope of Works

The general scope of works for both the Japanese and the Mozambique side on this project is shown in Table 2-23.

Table 2-23 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 (1) 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. 4 Construction Supervision

2. 2. 4. 4. 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. 2. 4. 4. 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. 5 Quality Control Plan

Quality control shall be managed by the items showed in Table 2-24 in accordance with relevant standards.

Table 2-24 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. 6 Procurement Plan

2. 2. 4. 6. 1 Construction Material

The procurement source plan of major construction materials is shown in Table 2-25.

Temporary steel products (H-section steel, sheet piles), reinforcing bars, admixtures of concrete, and asphalt mix are planned to be imported from South Africa since they are not manufactured in Mozambique as well as to ensure good quality. In particular, PC steel materials, expansion joints, and bearings are planned to be imported from Japan.

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 2-25 Procurement Sources of Major Construction Materials

Material	Mozambique	Japan	Third Country (South Africa)
Reinforcing Bar			○
Temporary Steel			○
PC Cables		○	
Gabion			○
Portland Cement	○		
Quarry, Sand, Soil	○		
Concrete Admixture			○
Plywood	○		
Asphalt mix			○
Fuel (diesel, gasoline)	○		
Concrete Product	○		
Expansion Joint		○	
Bearing		○	

2. 2. 4. 6. 2 Construction Equipment

The procurement source plan for main equipment is shown in Table 2-26.

General construction machines such as dump trucks are planned to be procured from local contractors on the project.

However, large crawler cranes (65 tons or more), equipment for tensioning work of PC tendon, and erection equipment for girder are planned to be procured from Japan in consideration of the condition of maintenance and amount of procurement.

The procurement of construction equipment is planned from Japan and should therefore consider

the transportation period and customs period for each construction item.

Table 2-26 Procurement Sources of Major Construction Equipment

Equipment	Mozambique	Japan	Third Country	Note
Bulldozer	○			
Excavator	○			
Dump truck	○			
Truck Crane	○			
Crawler Crane ～50ton	○			
Crawler Crane 65ton～		○		Difficult to procure
Vibration hammer	○			
Motor Grader	○			
Wheel Loader	○			
Concrete Plant	○			
Asphalt Plant	○			
Asphalt finisher	○			
Concrete Breaker	○			
Agitator truck	○			
Pile excavator		○		Difficult to procure
Erection Girder		○		Difficult to procure
Portal Crane		○		Difficult to procure

2. 2. 4. 7 Implementation Schedule

The tentative implementation schedule is shown in Figure 2-11.

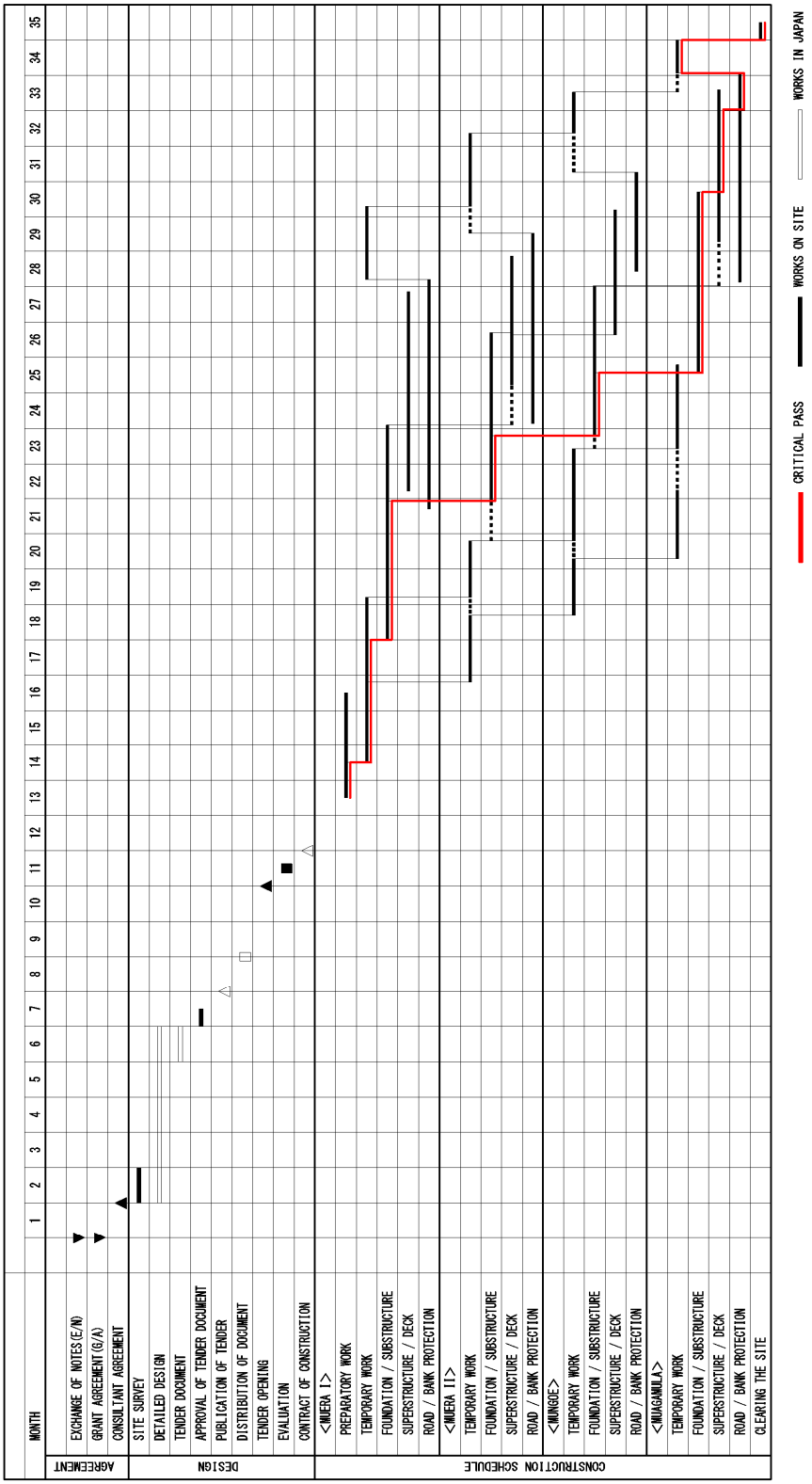


Figure 2-11 Implementation Schedule

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

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 2-27. 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 2-27 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 10.58 million MZN as summarized in Table 2-28. These costs are estimated under the conditions shown in Table 2-29.

2.5.1.1 Project Costs to be Borne by the Mozambique Side

Table 2-28 Project Cost to be Borne by the Mozambique Side

Item	Cost (MZN)	Equivalent (Mil. JPY)
Environmental license examination fee	2,000,000	4
Payment of bank service charges for bank arrangement (B/A) and authorization to pay (A/P)	2,217,295	4
Customs duties & value added tax (IVA) exemptions	6,360,000	11
Total	**10,577,295**	**19**

2.5.1.2 Cost Estimate Condition

Table 2-29 Cost Estimation Condition

Item	Condition
1. Time of estimate	March 2019
2. Exchange rate	1 USD = 111.62 JPY 1 MZN = 1.804 JPY
3. Construction period	22 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 2-30.

Table 2-30 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	590,000
Pavement rehabilitation	Once per 5 years	Surface	Overlay	670,000
Revetment repair	Once per year	River bed in front of abutments	Gabions	3,364,000
Total				4,624,000

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

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. The environmental license for the project was acquired in July 2019. (The license will be expired in July 2021)

(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.

(4) Bridge Construction Licenses

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

(5) 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.

(6) 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.

(7) Exemption of Taxes

Since it is needed procedure to exemption of value-added tax, 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.

(8) Visas

Since the construction period for the bridges is approximately 2 to 3 yearss, 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.

(9) 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.

(10) 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 Necessary Input by the Recipient Country

(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

(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) Vehicle Weight Inspection System on N380

In January 2019, an overloaded vehicle ran over a bridge on N380, causing the bridge to collapse and rendering the national route impassable.
The installation of facilities to control overloaded vehicles at the confluence with the National Highway will not only ensure smooth traffic on the entire route, but also ensure the safety and security of traffic, and is expected to further enhance the effectiveness of this project. Therefore, early completion of the installation of a vehicle weight inspection facility on this section is impotant to achieve the project purpose.

3.4 Project Evaluation

The appropriateness and effectiveness have been evaluated to show the benefits expected to come from implementing the Project.

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

Formulation of a trunk road network has a high priority in the Economic and Social Plan Integrated Road Sector Program 2016 (PRISE) prepared by ANE. 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 3.7% every year according to the traffic survey which ANE carried out between 2010 and 2017. The percentage of heavy vehicle traffic exceeds 50.0% 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 505 cars /12hours in 2026 from 391 cars/12 hours in 2019.

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 Bailey bridge between Maccomia and Oasis on National Route 380 has load restrictions. For this reason, a heavy vehicle full of luggage will use a detour (Macomia-Mucojo-Oasse) from Macomia to the coast. In this case, the travel time is about 300 minutes because the distance is longer than that of N380 and the road is unpaved. After the project, it will be possible to travel to Oasse using N380, so the travel time will be approximately 75 minutes and the travel time will be shortened by approximately 225 minutes.

Table 3-1 Quantitative Outputs

Index	Initial Value (2019)	Target Value (2026) 【3 years after completion】
Traffic volume (12 hours)	391	505
Travel time for heavy vehicles(Macomia-Oasse)	300 minutes	75 minutes
Passenger volume （paasenger/year） （12hour, 6:00-18:00）	496,000	640,000
freight flows （ton/year）	273,000	353,000

(2) Qualitative Outputs

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

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

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 Study Team

(1) 1st Site Survey (15th February, 2019～26th March, 2019)

	Position	Name	Organization	Period
(1)	Team Leader	Satoshi UMENAGA	JICA	3/ 4 - 3/13
(2)	Planning Coordinator	Kanako SENDA	JICA	3/ 4 - 3/10
(3)	Project manager / Bridge plan	Jun MORISITA	CHODAI CO.,LTD.	2/15 - 3/13
(4)	Deputy project manager / Bridge design	Daisuke HAMAZAKI	CHODAI CO.,LTD.	2/15 - 3/13
(5)	Natural condition survey / Traffic survey	Joonho PARK	CHODAI CO.,LTD.	2/21 - 3/26
(6)	Construction plan / Procurement / Cost Estimate	Yoshinori UCHIUMI	CHODAI CO.,LTD.	2/21 - 3/26
(7)	Social environmental considerations	Akira YAMASHITA	CHODAI CO.,LTD. (ESIC CO.,LTD.)	2/24 - 3/13

(2) 2nd Site Survey (12th ～22nd November, 2019)

	Position	Name	Organization	Period
(1)	Project manager / Bridge plan	Jun MORISITA	CHODAI CO.,LTD.	11/12 - 22

2. Study Schedule

(1) 1st Site Survey (15th February, 2019～26th March, 2019)

		総括	企画調査員	業務主任/橋梁計画	副業務主任/橋梁設計	自然条件調査/交通量調査	施工計画/調達事情/積算	社会状況調査/環境社会配慮
		Team Leader	Planning Coodinator	Project Manager/ Bridge Planning	Co-Project Manager/ Bridge Design	Natural Condition Survey/ Traffic Survey	Constructino Planning/ Procurement Survey/ Cost Estimation	Environmental and Social Considerations
		Mr. Satoshi UMENAGA	Ms. Kanako SENDA	Mr. Jun MORISHITA	Mr. Daisuke HAMAZAKI	Mr. Joonho PARK	Mr. Yoshinori UCHIUMI	Mr. Akira YAMASHITA
14-Feb	Thu			Narita → Hong Kong → Johannesburg → Maputo Arrival : 10:40				
15-Feb	Fri			Meeting with ANE Meeting with JICA Mozambique Office				
16-Feb	Sat			Visit to Local Company (Env) Data Collection in ANE				
17-Feb	Sun			Data Collection				
18-Feb	Mon			Meeting with ANE Monitoring Dept. Visit to Local Company (Env/Geo)				
19-Feb	Tue			Data Collection in ANE Visit to Local Company(Geo)				
20-Feb	Wed			Cost Openning for Geobgical Survey ICR Explanation for ANE Visit to Local Company (Env)		Narita → Hong Kong → Johannesburg → Maputo Arrival : 10:40		
21-Feb	Thu			Deta Collection in ANE				
22-Feb	Fri			Visit to Local Company (Env) Cost Openning for Environmental Surveyat JICA office Data Collection in ANE		Visit to INAM Visit to Weigh Bridge in Motola	Visit to Local Constractor	
23-Feb	Sat			Data Collection in ANE	Bridge Site Survey in Maputo			Narita → Hong Kong → Johannesburg → Maputo Arrival : 10:40
24-Feb	Sun			Documentation	Documentation	Documentation	Documentation	Document Arrangement
25-Feb	Mon			Meeting with ANE Monitoring Dept. Negotiation and Contract with Local Company (Env) Data Collection in ANE		Data Collection	Data Collection	Meeting with ANE Negotiation and Contract with Local Company (Env)
26-Feb	Tue			Meeting with ANE Monitoring Dept.	Flood Data Collection (Fews NET, INGC, CENOE)		Data Collection	Meeting with ANE Monitoring Dept.
27-Feb	Wed			Maputo → Pemba Arrival: 11:20 Meeting with Traffic Surveyer				SEA Report Analisis
28-Feb	Thu			Site Survey Visit to Weigh Bridge in Sunate		Traffic Survey/Rehearsal		Meeting with ANAC
1-Mar	Fri			Site Survey Traffic Survey				SEA Report Analisis / Meeting with Assistant
2-Mar	Sat			Site Survey Traffic Survey				SEA Report Analisis
3-Mar	Sun	Narita → Maputo		Pemba → Maputo Arrival: 16:30	Documentation	Documentation	Documentation	
4-Mar	Mon			Visit to Loca Company(Topo)	Overload Data Collection (ANE-Pemba) Visit to Weigh Bridge in Pemba		Data Collection	Drafting Meeting Memo with JICA
		Meeting with JICA Mozambique Office						Meeting with JICA
5-Mar	Tue	Maputo → Pemba Arrival: 11:35			River Data Collection (ARA-Norte)		Data Collection	Maputo → Pemba Arrival: 11:35
		Meeting with ANE-Pemba						Meeting with ANE-Pemba
6-Mar	Wed	Site Survey			River Data Collection (ARA-Norte)		Data Collection	Site Survey
7-Mar	Thu	Pemba → Maputo			Deta Collection		Data Collection	Reporting with Field Data
		Meeting with ANE						
8-Mar	Fri	Meeting with ANE			Deta Collection (ANE-Pemba)	Data Collection	Data Collection	Meeting with DPTADER
9-Mar	Sat	Documentation	Documentation	Documentation	Pemba → Maputo Arrival: 20:55			
10-Mar	Sun	Documentation	Maputo → Narita	Documentation	Documentation	Documentation	Documentation	Documentation
11-Mar	Mon	MD Disicussion and Signing with ANE		MD Disicussion and Signing with ANE		Data Collection (Visit INAM and CENOE)	Data Collection	MD Disicussion and Signing with ANE
						Team Meeting		
12-Mar	Tue	Report to EoJ		Documentation	Meeting with Env. Consultant	Data Collection (Visit INAM and CENOE)	Data Collection	Meeting with Env. Consultant
				Report to EoJ				Reporting
13-Mar	Wed	Maputo → Narita		Documentation	Meeting with UNESCO	Data Collection (Visit to INGC CENOE)	Data Collection	Meeting with UNESCO
14-Mar	Thu			Maputo → Johannesburg → Hong Kong → Haneda Departure: 16:05		Data Collection(ANE, CENOE)	Visit to Local Constractor	Maputo → Johannesburg → Hong Kong → Haneda Departure: 16:05
15-Mar	Fri					Data Collection(ANE)	Visit to Local Constractor	
16-Mar	Sat					Maputo → Pemba Arrival: 11:45		
17-Mar	Sun					Documentation		
18-Mar	Mon					Pemba → Maputo Arrival: 16:30	Meeting with ANE-Pemba	
19-Mar	Tue					Documentation	Site Inspection (Geo)	
20-Mar	Wed					Data Collection (ANE, CENOE)	Site Inspection (Topo, Geo)	
21-Mar	Thu					Data Collection (ANE, CENOE)	Site Inspection (Geo)	
22-Mar	Fri					Data Collection (ANE,Shipment Compny)	Site Inspection (Geo)	
23-Mar	Sat					Documentation	Site Inspection (Geo)	
24-Mar	Sun					Documentation	Documentation	
25-Mar	Mon					Data Collection	Site Inspection (Geo)	
26-Mar	Tue					Data Collection	Camp Yard (Phase-1)	
27-Mar	Wed					Maputo → Johannesburg → Hong Kong → Haneda Departure: 16:05	Camp Yard (Phase-1)	
28-Mar	Thu						Camp Yard (Phase-1)	
29-Mar	Fri						Camp Yard (Phase-1)	
30-Mar	Sat						Camp Yard (Phase-1)	
31-Mar	Sun						Pemba → Maputo Arrival: 16:30	
1-Apr	Mon						Maputo → Johannesburg → Hong Kong → Haneda	
2-Apr	Tue							
3-Apr	Wed							

(2) 2nd Site Survey (12th ～22nd November, 2019)

		Project Manager/ Bridge Planning
		Mr. Jun MORISHITA
12-Nov	Tue	Narita to South Africa
13-Nov	Wed	South Africa to Maputo Meeting with JICA Mozambique Office
14-Nov	Thu	Meeting with ANE
15-Nov	Fri	Meeting with ANE
16-Nov	Sat	Data collection
17-Nov	Sun	Data collection
18-Nov	Mon	Meeting with ANE
19-Nov	Tue	Signing on Technical Note, and Report to JICA Mozambique Office
20-Nov	Wed	Meeting with ANE
21-Nov	Thu	Maputo to Hong Kong
22-Nov	Fri	Hong Kong to Narita

3. List of Parties Concerned in the Recipient Country

Organization	Position / Occupation	Name
Administrasao Nacional De Estradas (ANE)	Director General	Mr. Cesar Macuacua
	Director of Projects	Mr. Cremildo Mucavele
	Civil Engineer	Mr. Evaristo Mussupai
	Civil Engineer	Ms. Violeta Ngale
	Civil Engineer	Ms. Esmirna Chambal
	Head of Monitoring Department	Ms. Emilia Tembe
	Officer of Monitoring Department	Mr. Virginia Albento Chiahungo
	Director of Administration and Finance	Roul Cossa
	Duputy Director of Contract Management	Mr. Antonio Devesse
Administrasao Nacional De Estradas Pemba (ANE)	Director General	Mr. Robate Tomás Jane
	Civil Engineer	Mr. Alfledo Cisanto António
	Civil Engineer	Mr. Cláudio Bento João
Institute Nacional de Meteoroloy (INAM)	Meteorologist of Research & Application Department	Mr. Gonzalves Junior
	Chef of Research Department	Mr. Isaias Gabriel A. Raiva, Msc
	Technician	Ms. Violeta Costantino Cambane
National Directorate of Water Department of Water Resources (Ministry of Public Works and Housing)	Hydro-Geologist	Mr. Egidio Lucas Govate
	Operational W. Resource Manager	Mr. Isac Filimone
National Institute of Disaster Management (INGC/CENOE)	Vice - director of INGC	Ms. Rita Almado
	Director of CENOE	Ms. Ana cristina
	Engineer	Mr. Cesar
Fews Net	Manager	Mr. Antonio Mavie
ARA-Norte	Director General	Mr. Eurico Felisberto Saize
	Technician	Mr. Cassiano Cosme Mpwachele
	Technician	Mr. Santos David Johane Gulia
Matola Weigh Bridge (ANE-TRAC)	Boane LCC Admin Controller	Mr. Herminio Lipanga
	LCC Manager	Mr. Bachir Calia
UNESCO Mozambique Office	Country Director,	Ms Anabela Rodrigues

National Administration of Conservation Areas (ANAC)	Director of Conservation and Community Development Service	Mr. Armindo Araman
Provincial Department for Land, Environmental and Rural Development (DPTADER)	Official of Environment Office	Mr. Mario Parwa
Road Fund	Chairman	Mr. Angelo Antonio Macuacua

4. Minutes of Discussions

Minutes of Discussions
on the Preparatory Survey for the Project for
Construction of Bridges on N380 in Cabo Delgado Province (Phase 2)

In response to the request from the Government of the Republic of Mozambique (hereinafter referred to as "Mozambique"), Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team") of the Project for Construction of Bridges on N380 in Cabo Delgado Province (Phase 2) (hereinafter referred to as "the Project") to Mozambique. The Team held a series of discussions with the officials of the Government of Mozambique and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Maputo, 11th March, 2019

Mr. Satoshi Umenaga
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Mr. César Macuácua
Director General
Administração Nacional de Estradas
Republic of Mozambique

ATTACHMENT

1. Objective of the Project

The objective of the Project is to secure smooth and safe connectivity at the whole of N380 by reconstructing four bridge, which are shown in Annex 1, hereby contributing to promotion of local economy.

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 (Phase 2)".

3. Project site

Both sides confirmed that the sites of the Project are located on N380 in Cabo Delgado Province, which is shown in Annex 1.

4. Responsible authority for the Project

Both sides confirmed the authorities responsible for the Project are as follows:

4-1. The Administração Nacional de Estradas (hereinafter referred to as "ANE") will be the executing agency for the Project (hereinafter referred to as "the Executing Agency"). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant authorities properly and on time. The organization charts are shown in Annex 2.

4-2. The line ministry of the Executing Agency is the Ministério das Obras Públicas, Habitação e Recursos Hídricos. The Ministério das Obras Públicas, Habitação e Recursos Hídricos shall be responsible for supervising the Executing Agency on behalf of the Government of Mozambique.

5. Items requested by the Government of Mozambique

5-1. As a result of discussions, both sides confirmed that the items requested by the Government of Mozambique are as follows:

- Design and supervision
- Reconstruction of four Bridges (Muagamula, Muera I, Muera II, Mungoe) with approach roads

5-2. JICA will assess the feasibility of the above requested items through the survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan.

6. Procedures and Basic Principles of Japanese Grant

6-1. The Mozambique side agreed that the procedures and basic principles and basic principles of Japanese Grant as described in Annex 3 shall be applied to the Project.

As for the monitoring of the implementation of the Project, JICA requires Mozambique side to submit the Project Monitoring Report, the form of which is attached as Annex 4.

6-2. The Mozambique side agreed to take the necessary measures, as described in Annex 5, for smooth implementation of the Project. The contents of the Annex 5 will be elaborated and refined during the Preparatory Survey and be agreed in the mission dispatched for explanation of the Draft Preparatory Survey Report.

The contents of Annex 5 will be updated as the Preparatory Survey progresses, and eventually, will be used as an attachment to the Grant Agreement.

7. Schedule of the Survey

7-1. The Team will proceed with further survey in Mozambique until 26th March 2019.

7-2. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to Mozambique in order to explain its contents around end of August 2019.

7-3. If the contents of the draft Preparatory Survey Report is accepted and the undertakings for the Project are fully agreed by the Mozambique side, JICA will finalize the Preparatory Survey Report and send it to Mozambique around November 2019.

7-4. The above schedule is tentative and subject to change.

8. Environmental and Social Considerations

8-1. The Mozambique side confirmed to give due environmental and social considerations before and during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010).

https://www.jica.go.jp/english/our_work/social_environmental/guideline/pdf/gui

deline100326.pdf

8-2. The Project is categorized as "B" from the following considerations:
The project is not considered to be a large-scale road, is not located in a sensitive area, and has none of the sensitive characteristics under the JICA Guidelines for Environmental and Social Considerations (April, 2010), it is not likely to have a significant adverse impact on the environment. The guidelines can be downloaded at the following URL.
The Mozambique side confirmed to conduct the necessary procedures concerning the environmental assessment (including stakeholder meetings, Initial Environmental Examination (IEE) and information disclosure, etc.) and make IEE report of the Project. The IEE approval shall be received from the responsible authorities and submitted to JICA by end of June 2019. In addition, acquisition of environmental licence shall be done by end of July 2019.

9. Safety Measures
To avoid accidents on sites 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_spa.pdf
The Team recommended to the Mozambique side to explain to the residents about the Project (necessity and significance, construction period, sites, impact etc.), so that consensus support can be obtained from them for the smooth implementation of the Project.

10. Other Relevant Issues
10-1. The Team explained a method of the preparatory survey based on an inception report submitted by the Team. The Mozambique side understood the contents and accepted the method.
10-2. The Mozambique side shall, at its own expense, provide the Team with the following items:
1) Necessary data, information and coordination with relevant agencies for the preparatory survey,

2) Answers to the questionnaire submitted by the Team,
3) Assignment of Counterpart personnel,
4) Security information in a timely manner,
5) Permissions of conducting field activities, such as topographic survey, geotechnical investigations, environmental and social considerations, a traffic volume survey, etc., by local consulting firsms entrusted by the Team and issuing identification cards for members of the said firms, and
6) Sourcing traffic safety through the field survey in cooperation with relevant authoritities (e.g. traffic police, etc.)

10-3. Misconduct

The team explained and the Mozambique side understood the preventive measures about fraudulent practices which would be stipulated in JICA's Grant Agreement.

10-4. 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.

10-5. Proper Maintenance of Catipusse Bridge

Catipusse Baily Bridge will be used as the access road to the construction sites in the project. The Mozambique side shall conduct proper maintenance of the Catipusse Bridge.

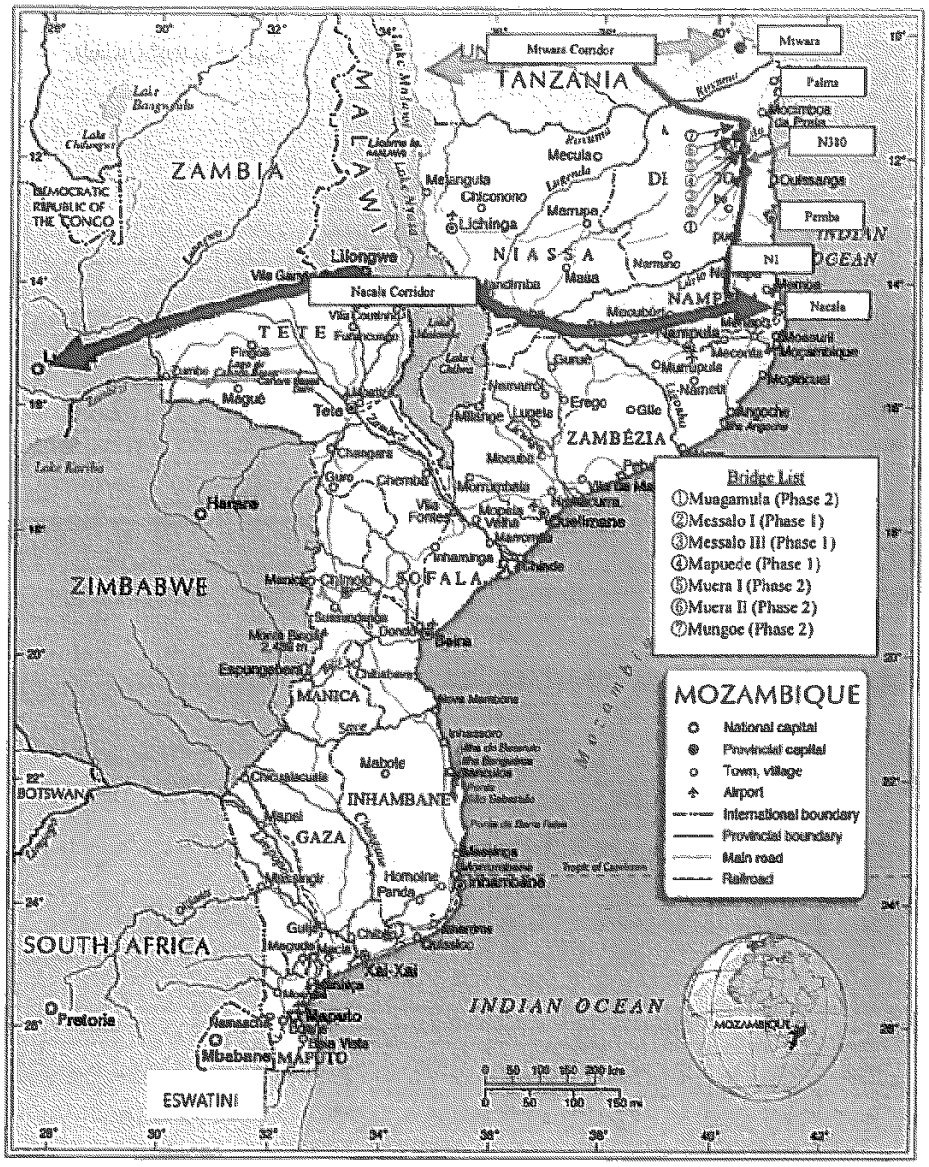
10-6. Maintenance of the Bridges

The Team explained the importance of maintenane of the bridges constructed by the Project considering the proper asset management impacts greatly on life-span of the facilities and its maintenance cost. The Mozambique side shall secure enough staff and budget necessary for approporiate maintenance of the bridges.

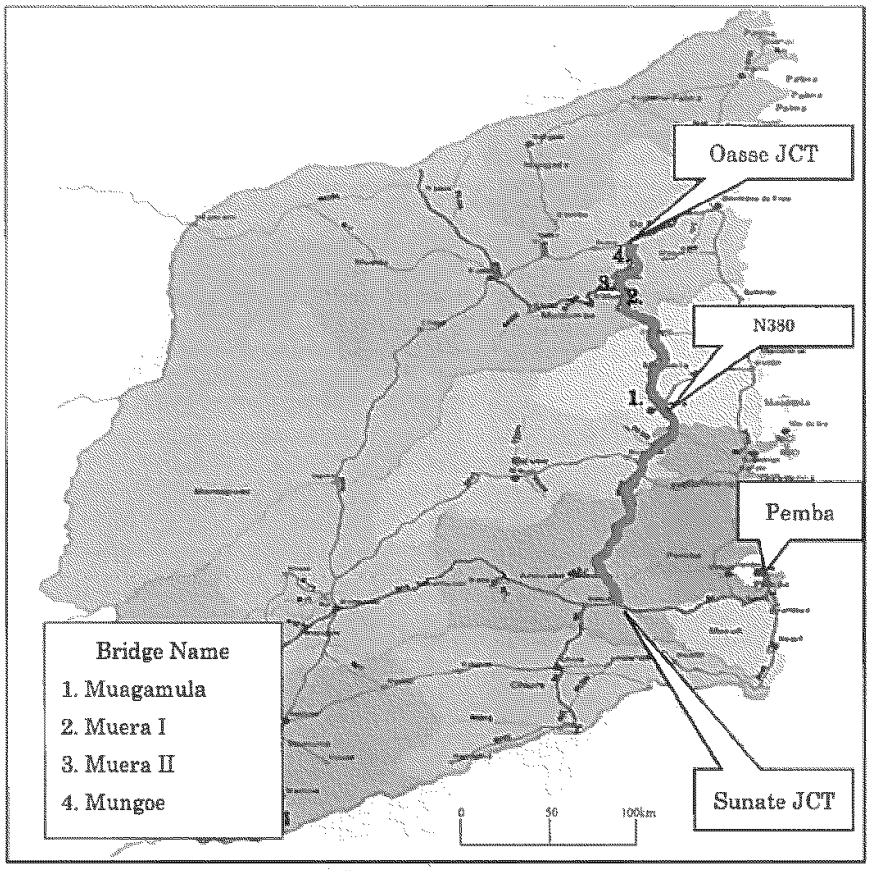
【Annex 1】 Project Site
【Annex 2】 Organization Chart
【Annex 3】 Japanese Grant (including Attachment 1, 2)
【Annex 4】 Project Monitoring Report (template)
【Annex 5】 Major Undertakings to be taken by the Government of Mozambique

Annex1

Project Site



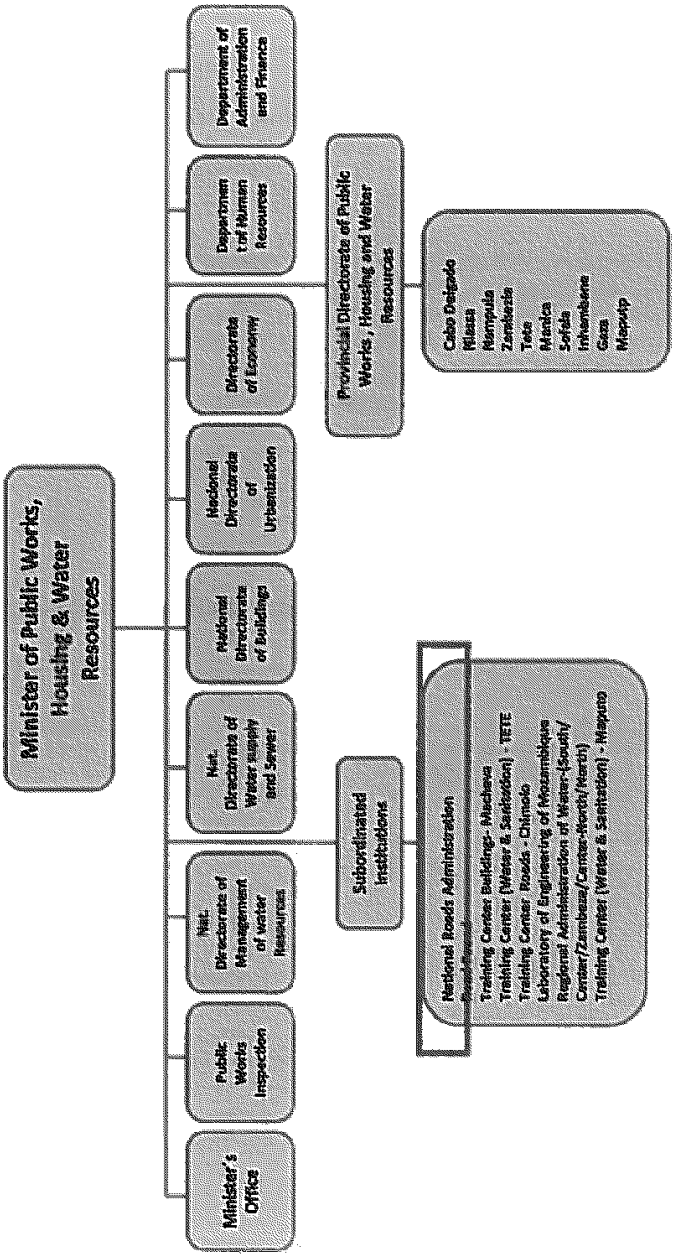
Location Map (Cabo Delgado Province)



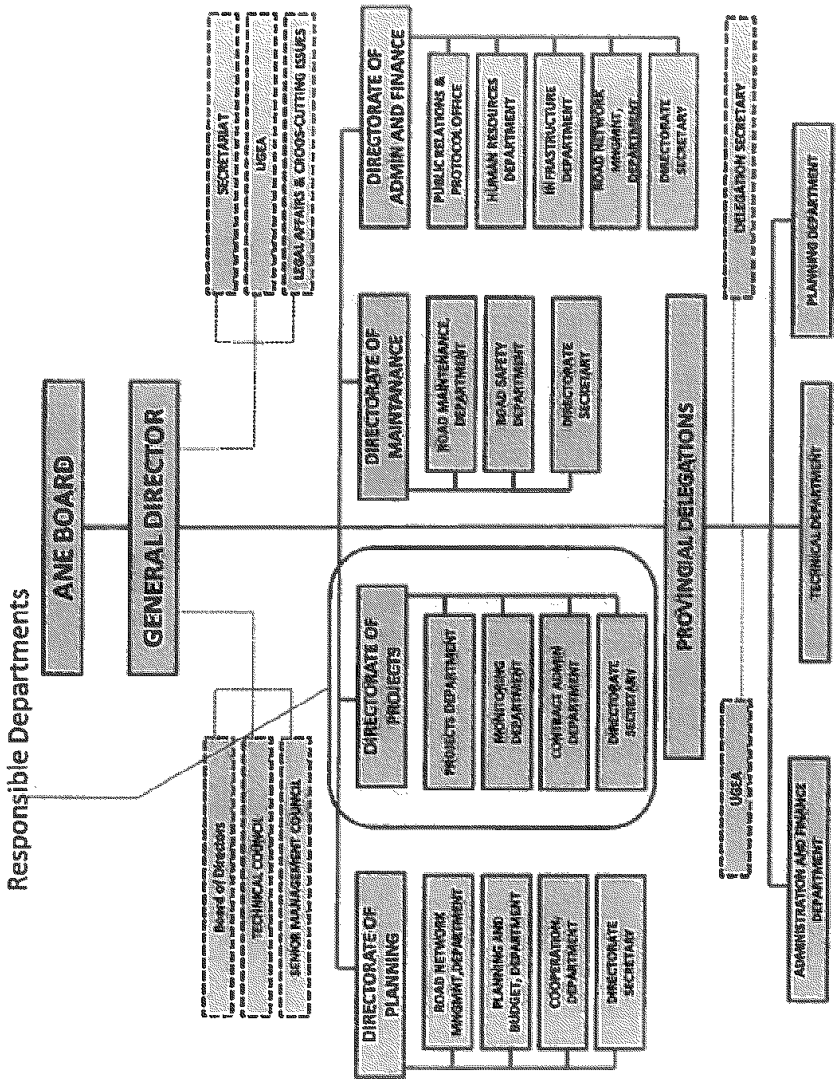
Annex 2

Organization Charts

1. Ministério das Obras Públicas, Habitação e Recursos Hídricos



2. Administração Nacional de Estradas (National Roads Administration)



Annex 3

JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as "the Recipient") to purchase the products and/or 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. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as "Project Grants").

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See "PROCEDURES OF JAPANESE GRANT" for details):

(1) Preparation
- The Preparatory Survey (hereinafter referred to as "the Survey") conducted by JICA

(2) Appraisal
-Appraisal by the government of Japan (hereinafter referred to as "GOJ") and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes
-The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as "the G/A")
-Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as "the B/A")
-Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant

Construction works/procurement
-Implementation of the project (hereinafter referred to as "the Project") on the basis of the G/A

(4) Ex-post Monitoring and Evaluation
-Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the 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 necessary for the implementation of the Project.

- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant 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.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take 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 executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (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 feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

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 to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to

cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) 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 to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to 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 to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) 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 Recipient (or executing agency), 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 from the Contractor, before start of construction.

b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.

2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

Attachment I

PROCEDURES OF JAPANESE GRANT

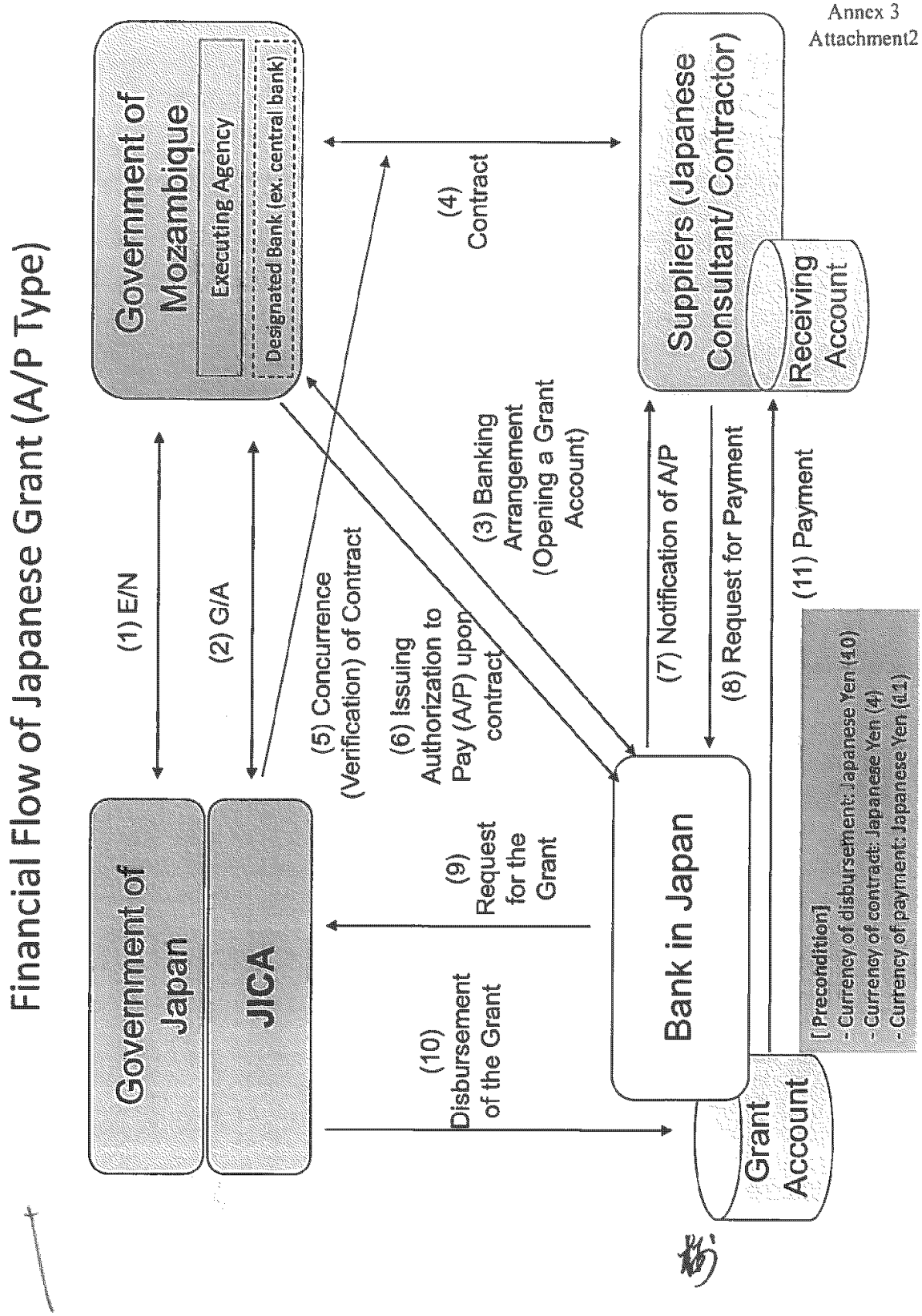
Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2)Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3)Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detailed Design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
	(14) Completion certificate		x			x	x	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

Notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.

2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

Annex 3
Attachment2



Annex 4
G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX
20XX, Month

Organizational Information

Signer of the G/A (Recipient)	Person in Charge	(Designation)
	Contacts	Address: Phone/FAX: Email:
Executing Agency	Person in Charge	(Designation)
	Contacts	Address: Phone/FAX: Email:
Line Ministry	Person in Charge	(Designation)
	Contacts	Address: Phone/FAX: Email:

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

1

G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

1: Project Description

1-1 Project Objective

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original *(proposed in the outline design)*	Actual
1.		

2-2 Scope of the work

Components	Original* *(proposed in the outline design)*	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	*(at the time of signing the Grant Agreement)*	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			

G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 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 *(at the time of outline design)* name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):
Actual *(PMR)*

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original *(at the time of outline design)*
Actual *(PMR)*

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original *(at the time of outline design)*

G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

Actual *(PMR)*

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks *(at the time of outline design)*

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

5

G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

	Contingency Plan (if applicable):
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

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 of 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.

G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant

Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
- Contractor's Main Staff List

4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
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) (PMR (final)only)
8. Pictures (by JPEG style by CD-R) (PMR (final)only)
9. Equipment List (PMR (final)only)
10. Drawing (PMR (final)only)
11. Report on RD (After project)

7

Attachment 6

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)

-
-
-

Attachment 7

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 5

Major Undertakings to be taken by the Government of Mozambique

1. Specific obligations of the Government of Mozambique which will not be funded with the Grant

(1) Before the Bidding

No.	Items	Deadline	In charge	Cost (US$)	Ref.
1	To approve IEE (Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation of countermeasures obligated in the IEE.	before signing of the G/A	ANE		
2	To open Bank Account (Banking Arrangement (B/A))	within 1 month after signing of the G/A	MEF		
3	To issue the Authorization to Pay (A/P) to a bank in Japan (the Agent Bank) for the payment to the Consultant	within 1 month after signing of the contract with the consultant	MEF		
4	To secure and clear the following lands 1) right of way for the Project 2) temporary construction yard and stock yard near the Project area 3) borrow pit and disposal site near the Project area	before notice of the bidding document(s)	ANE		
5	To submit Project Monitoring Report (with the result of Detailed Design (D/D)	before preparation of bidding document(s)	ANE		
6	To investigate and remove landmine	by end of August 2019	ANE		

Note : ANE- Administração Nacional de Estradas

MITESS- Ministério do Trabalho, Emprego e Segurança Social

MEF- Ministry of Economy and Finance

Annex 5

(2) During the Project Implementation

No.	Items	Deadline	In charge	Cost (US$)	Ref.
1	To issue A/P(s) to the Agent Bank in Japan for the payment(s) to the Supplier(s)	within 1 month after signing of the contract(s)	MEF		
2	To bear the following commissions to the Agent Bank in Japan for the banking services based upon the B/A	during the Project			
	1) Advising commission of A/P	within 1 month after signing of the contract(s)	MEF		
	2) Payment commission for A/P	every payment	MEF		
3	To ensure prompt unloading and customs clearance at the ports of disembarkation in recipient country and to assist the Supplier with internal transportation therein	during the Project	MEF/ANE		
4	To accord Japanese nationals and/or physical persons of third countries (main contractors, subcontractors, supplies and consultants) 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 country of the Recipient and stay therein for the performance of their work. The Recipient implements this project in accordance with Regulation of the Mechanisms and Procedures of Employment of foreign Workers stipulated in article 12 "Investment Projects" on the decree No. 37/2016, August 31, 2016. Working status for the Project shall be preceded as a contract for the investment Project approved by the Recipient Government stipulated in Article 12 on the degree No. 37/2016, August 31, 2016. The possible number of Japanese nationals and/or physical persons of third countries are 30 persons while the number of persons of Recipient country is 70. If the above number of Japanese nationals and/or physical persons of third countries exceed than the Project shall apply for Working Permit Authorization Regime stipulated in article 16, 17, 18 and 19 on the degree No. 37/2016, August 31, 2016.	during the Project	MITESS /ANE		

Annex 5

No.	Items	Deadline	In charge	Cost (US$)	Ref.
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted	during the Project	MEF/ANE/Road Fund		
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	ANE		
7	1) To submit Project Monitoring Report	every month	ANE		
	2) To submit Project Monitoring Report (Final)	within one month after signing of Certificate of Completion of the Work under the contract(s)	ANE		
8	To submit a report concerning completion of the Project	within six months after completion of the Project	ANE		
9	To provide facilities for the temporary road on the river of project sites				
	1) Bailey bridge The existing Bailey bridges at the project sites (Muagamula, Muera 1, Muera 2, Mungoe)	before start of the construction	ANE		
10	To secure the following lands - temporary construction yard and stock yard near the Project area - borrow pit and disposal site near the Project area	during the construction	ANE		
11	To take necessary measure for safety construction - traffic control - public notifications Securing safety for personnel involved in the Project	during the construction	ANE		
12	To implement Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP)	during the construction	ANE		
13	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	ANE		

Annex 5

(3) After the Project

No.	Items	Deadline	In charge	Cost	Ref.
1	To implement EMP and EMoP	for a period based on EMP and EMoP	ANE		
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semi-annually - 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		
3	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 of structure 3) Routine check/Periodic inspection	After completion of the construction	ANE		

2. Other obligations of the Government of Mozambique funded with the Grant

No.	Items	Deadline	Amount (Million Japanese Yen)
1	To reconstruct bridges (Muagamula, Muera 1, Muera 2, Mungoe)		
2	To implement detailed design, bidding support and construction supervision (Consulting Service)		
3	Contingencies		
	Total		XXX

5. Technical Notes

5.1 1st Site Survey

TECHNICAL NOTES

ON THE PREPARATORY SURVEY FOR THE PROJECT FOR CONSTRUCTION OF BRIDGES ON N380 IN CABO DELGADO PROVINCE (PHASE 2) 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 middle of March and confirmed the main items of the Project for Construction of Bridges on N380 in Cabo Delgado Province (Phase 2) in the Republic of Mozambique (hereinafter referred to as "the Project) on the 12th of March 2019 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 10, Other Relevant Issue of the Minutes of Discussions of the 11th March 2019.

1. Bridge Width

The width of bridges is 9.9 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 standard as below.

1) ANEs design standards, SATCC

2) Design specification of highway bridges issued by Japan Road Association (JRA)

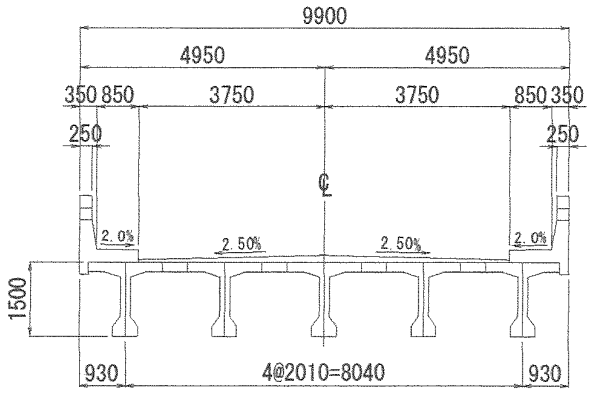


Figure 1. Bridge Width

Table 1. Bridge List

No.	Bridge Name	Length of Existing Bridge(m)	Planning of Bridge Length(m)	Span	Location of the New Bridge
1	Muagamula	33.5	35		Existing concrete bridge
2	Muera 1	44.5	50	2@25m	Existing bridge
3	Muera 2	20.0	25		Existing bridge
4	Mungoe	15.5	25		Existing bridge

If any special condition change is recognized necessary, some items may be revised accordingly with beforehand notice from the Team to ANE.

Mr. Jun Morishita
The Chief Consultant
Preparatory Survey Team
CHODAI Co., Ltd.

Mr. César Macuácua
Director General
National Roads Administration
Republic of Mozambique

5.2 2nd Site Survey

TECHNICAL NOTES

ON THE PREPARATORY SURVEY FOR THE PROJECT FOR CONSTRUCTION OF BRIDGES ON N380 IN CABO DELGADO PROVINCE (PHASE 2) 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 middle of November and confirmed the main items of the Project for Construction of Bridges on N380 in Cabo Delgado Province (Phase 2) in the Republic of Mozambique (hereinafter referred to as "the Project) on the 19th of November 2019 as shown in the following.

1. Design conditions and standard

The Team shall design the new bridges and approach roads based on the ANE's design standard, and supplement with Japanese design standards and relevant standard as below and shown in Table 1.

1) ANE's design standards
2) Southern Africa Transport and Communications Commission (SATCC)
3) Design specification of highway bridges issued by Japan Road Association (JRA) and others

The countermeasures of flood were designed to prevent the overflow and main girder damage on the bridge by flowing down the design discharge volume at the opening by the bridge as the ANE's design standards. Since the approach road connects the design road surface height of the new bridge and the existing road, overflow may occur in the existing road section. Therefore, the Team kindly request those roads maintenance management by ANE.

2. Bridge and road width

The width of bridges is 9.9 m with two traffic lanes including the sidewalks on both sides as shown in Figure 1. The width of roads is 10.6 m with two traffic lanes including the shoulders as shown in Figure 2.

3. Specifications of bridge and road

The lengths, span length and type of structures of each bridges were determined considering the flood flow of each river, site condition and the construction cost. The specifications of bridge and road are shown in Table 2.

4. Detour road during construction period

Detour road during construction period will be required due to the new bridges will be replaced on the same location of existing bridges. The detour road in river sections is planned as embankment structure with corrugated pipes for water flow or Bailey bridge. The bailey bridges are supposed to be provided by ANE, while those will be erected and removed by the contractor. The construction and maintenance of the detour road is carried out by the contractor, and the following matters require the assistance of ANE.

1) Notifying the police about road restrictions such as speed limit
2) Notification to citizens about the road restrictions during construction period
3) Responding to citizens in the event of a traffic accident or disaster

The plan of detour roads are shown in Figure 3, 4 and 5.

5. Timeline for the project implementation

The Team explained to the Mozambique side that the expected timeline for the project implementation is as attached in Table 3. However timing of cabinet approval is not yet fixed and dependent on security situation of project site.

6. Undertakings of the Project

Both sides confirmed the undertakings of the Project as described in Table 4, 5 and 6. With regard to exemption of customs duties, internal taxes and other fiscal levies as stipulated in No.3, No.5 and No.6 of Table 5, both sides confirmed that such customs duties, internal taxes and other fiscal levies, which shall be clarified in the bid documents by ANE during the implementation stage of the Project. 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. 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. Both sides also confirmed that the Table 4, 5 and 6 consider to use as an attachment of G/A. Both sides confirmed that ANE shall take necessary measures to ensure and maintain the security of the Project site and the persons related to the implementation of the Project, in cooperation with relevant authorities during the Project period. Such security measures shall reasonably reflect needs of the Consultant/the Contractor engaging in the Project, as shown in Table 5. Both sides agreed that in case the additional security cost would be necessary for the implementation of the Project, such cost shall be borne by the Recipient without using the Grant.

7. Environmental and Social Considerations

7-1 Environmental Checklist

The environmental and social considerations including major impacts and mitigation measures for the Project are summarized in the Environmental Checklist attached as Table 7. 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.

7-2 Environmental Issues

7-2-1 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 (SEA) is necessary. Both sides confirmed that Mozambique side has obtained the environmental license on July 2019.

7-2-2 Environmental Management Plan and Environmental Monitoring Plan

Both sides confirmed Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) of the Project is as Figure 6, Figure 7 and Table 8, 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.

7-3 Environmental and Social Monitoring

7-3-1 Environmental Monitoring

Both sides agreed that the Mozambique side will submit results of environmental monitoring to JICA with PMR by using the monitoring form attached as Annex 1. The timing of submission of the monitoring form is described in Table 8.

8. Indicators of the Project Evaluation

Both sides agreed that key indicators for expected outcomes are as Table 9. The Mozambique side will be responsible for the achievement of agreed key indicators and shall monitor the progress based on those indicators.

Table 1. Bridge Road Design Conditions and Applied Standards

Item	Design Conditions	Applied Standards
Design discharge, return period	Return period based on hydrological analysis	- ANE's design standard
Pavement design	Design period	- ANE's design standard
Vertical clearance under bridge girders	According to the planed flow quantity	- River Management Facility Structure Ordinance (Japan River Association)
Live load	SATCC (NA, NB-36, NC) B live load	- SATCC - Specification for highway bridges (Japan Road Association)
Seismic load	Seismic coefficient = 0.1	- SATCC
Thermal load	+49° C～0°C	- SATCC

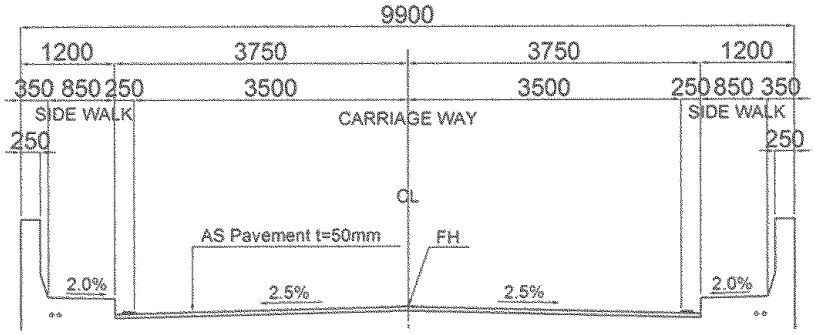


Figure 1. Bridge Width

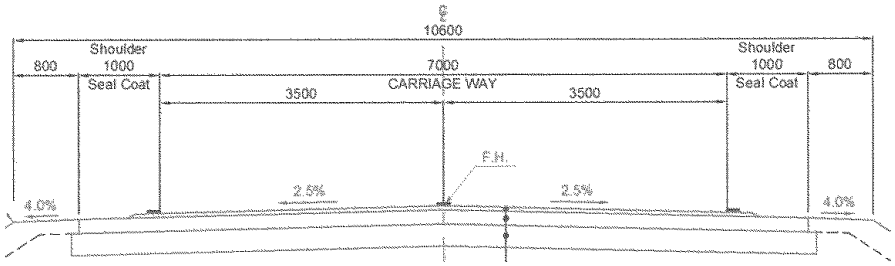


Figure 2. Road Width

Table 2. Specifications of bridges and roads

Item	Muagamula Bridge	Muera I Bridge	Muera II Bridge	Mungoe Bridge
Bridge location on N380	Macomia +12.8km	Macomia +85.7km	Macomia +85.9km	Macomia +99.2km
Bridge type	Concrete bridge			
Bridge length	35.0 m	50.0 m	25.0 m	

Span arrangement	1 span	2 span (25m+25m)	1 span	
Length of Bridge and Road	790 m	400 m	370 m	480 m
Superstructure type	Post-tension T girder			
Substructure type	2 inversed T type abutments	2 inversed T type abutments and a wall type pier	2 inversed T type abutments	
Foundation type	Cast-in-place concrete piles (CIP)			

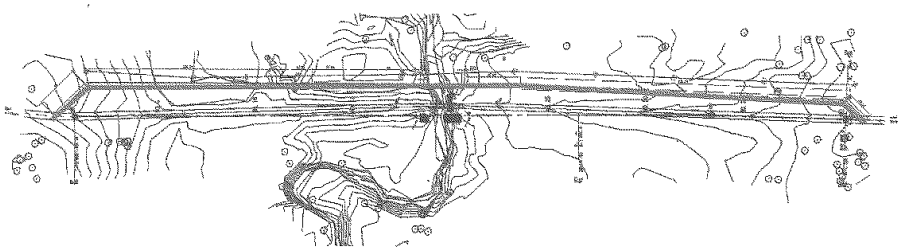


Figure 3. Plan of Detour Road of Muagamula Bridge

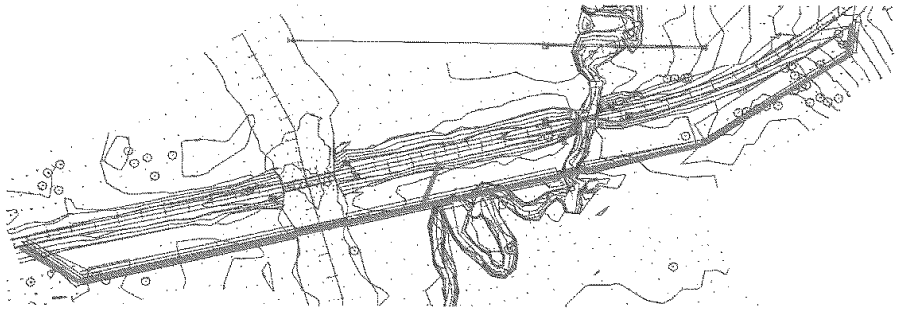


Figure 4. Plan of Detour Road of Muera I and Muera II Bridge

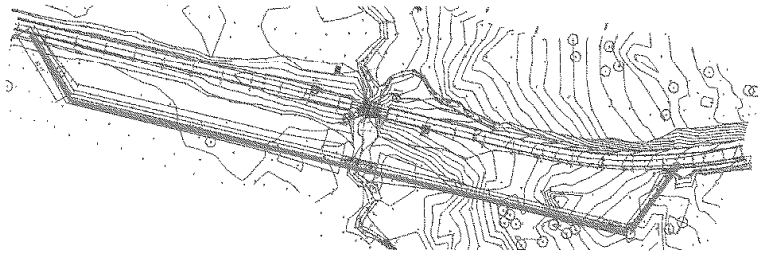


Figure 5. Plan of Detour Road of Mungoe Bridge

Table 3. Timeline for the Project Implementation

Project Implementation Schedule (tentative)

Item	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	....	34	35
Contract																			
Cabinet meeting	▽																		
Exchange of notes		▼																	
Grant agreement		▼																	
Consultant agreement				▼															
Detail design/ tender																			
Site survey			■	■				■											
Detail design			□	□	□	□	□	□											
Publication of tender									▽										
Distribution of document										▽									
Opening tender/ evaluation												▽							
Contract of construction												▽							
Contract verification													▽						
Commencement order														▽					
Construction (22 month)															■	■	■	■	■

Table 4. Major Undertakings to be taken by the Government of Mozambique (Before the Bidding)

No.	Items	Deadline	In charge	Cost (MZM)
1	To approve IEE (Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation of countermeasures obligated in the IEE.	End of July 2019	MITADER	2,000,000
2	To open Bank Account (Banking Arrangement (B/A))	within 1 month after signing of the G/A	MEF	2,217,000
3	To issue the Authorization to Pay (A/P) to a bank in Japan (the Agent Bank) for the payment to the Consultant	within 1 month after signing of the contract with the consultant	MEF	
4	To secure and clear the following lands 1) right of way for the Project 2) temporary construction yard and stock yard near the Project area 3) borrow pit and disposal site near the Project area	before notice of the bidding document(s)	ANE	
5	To submit Project Monitoring Report (with the result of Detailed Design (D/D)	before preparation of bidding document(s)	ANE	
6	To investigate and remove landmine	Consult with JICA after it is decided to start the Project.	ANE	1,300,000

Note : ANE- Administração Nacional de Estradas
MITADER- Ministério da Terra, Ambiente e Desenvolvimento Rural
MITESS- Ministério do Trabalho, Emprego e Segurança Social
MEF- Ministry of Economy and Finance

Table 5. Major Undertakings to be taken by the Government of Mozambique (During the Project Implementation)

No.	Items	Deadline	In charge	Cost (MZM)
1	To issue A/P(s) to the Agent Bank in Japan for the payment(s) to the Supplier(s)	within 1 month after signing of the contract(s)	MEF	
2	To bear the following commissions to the Agent Bank in Japan for the banking services based upon the B/A	during the Project		
	1) Advising commission of A/P	within 1 month after signing of the contract(s)	MEF	3,000
	2) Payment commission for A/P	every payment	MEF	970,000
3	To ensure prompt unloading and customs clearance at the ports of disembarkation in recipient country and to assist the Supplier with internal transportation therein	during the Project	MEF/ ANE	
4	To accord Japanese nationals and/or physical persons of third countries (main contractors, subcontractors, supplies and consultants) 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 country of the Recipient and stay therein for the performance of their work. The Recipient implements this project in accordance with Regulation of the Mechanisms and Procedures of Employment of foreign Workers stipulated in article 12 "Investment Projects" on the decree No. 37/2016, August 31, 2016. Working status for the Project shall be preceded as a contract for the investment Project approved by the Recipient Government stipulated in Article 12 on the degree No. 37/2016, August 31, 2016. The possible number of Japanese nationals and/or physical persons of third countries are 30 persons while the number of persons of Recipient country is 70. If the above number of Japanese nationals and/or physical persons of third countries exceed than the Project shall apply for Working Permit Authorization Regime stipulated in article 16, 17, 18 and 19 on the degree No. 37/2016, August 31, 2016.	during the Project	MITESS /ANE	

No.	Items	Deadline	In charge	Cost (MZM)
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted	during the Project	ANE/Road Fund	6,360,000
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	ANE	
7	1) To submit Project Monitoring Report	every month	ANE	
	2) To submit Project Monitoring Report (Final)	within one month after signing of Certificate of Completion of the Work under the contract(s)	ANE	
8	To submit a report concerning completion of the Project	within six months after completion of the Project	ANE	
9	To provide facilities for the temporary road on the river of project sites			
	1) Bailey bridge The existing Bailey bridges at the project sites (Muagamula, Muera 1, Muera 2, Mungoe)	before start of the construction	ANE	
10	To secure the following lands - temporary construction yard and stock yard near the Project area - borrow pit and disposal site near the Project area	during the construction	ANE	
11	To take necessary measure for safety construction - traffic control - public notifications Securing safety for personnel involved in the Project	during the construction	ANE	
12	To implement Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP)	during the construction	ANE	
13	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	ANE	

Table 6. After the Project of Major Undertakings to be taken by the Government of Mozambique

No.	Items	Deadline	In charge	Cost (MZM)
1	To implement EMP and EMoP	for a period based on EMP and EMoP	ANE	-
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semi-annually - 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	-
3	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 of structure 3) Routine check/Periodic inspection	After completion of the construction	ANE	4,624,000 / year

Table 7. Environmental Check List

Environmental Check List: The Project for Construction of Bridges on N380, Mozambique

Category	Environmetal 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) Y (b) Y (c) Y (d) Y	(a) SEA (Simplified Environmental Assessment) reports have been prepared in line with official process. (b) SEA reports have been approved by an official authority (Provincial Directorate of Lands, Environment and Rural, DEPTADER) in Cabo Delgado Province) in June, 2019 (c) SEA reports have been approved without conditions (d) Nothing in particular, and all the required environmental permits have been obtained
	(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) Stakeholder meetings for information disclosure have been held at each bridge site by National Road Administration (ANE). Local stakeholders principally understand the project outnline and its impact. (b) The comments from stakeholders have been recoreded in SEA reports and reflected to the project.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Several alternatives including "the case without project" have been examined with the traffic capacity and functions, construction cost, and social and environmental impact in the selection of the typical cross-section design and alignment of the new road section.
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) Where industrial areas already exist near the route, is there a possibility that the project will make air pollution worse?	(a) Y (b) N	(a) Vehicles traffic and construction vehicles may affect ambient air quality during both construction phase. For the cases where the air pollution exceeds standards, mitigation measures are considered. (b) There is no industrial areas already exist near the route.
	(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 surface runoff from roads will contaminate water sources, such as groundwater? (c) Do effluents from various facilities, such as parking areas/service areas comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas not to comply with the country's ambient water quality standards?	(a) Y (b) N (c) N	(a) Turbid water will generate in the construction works. The turbid water will contaminate rivers and streams around the target road section temporarily. (b) Impact on water resources of runoff from road surface is unlikely to occur. (c) Development of parking or service areas which generate waste water in operation phase are not included in the project.
	(3) Wastes	(a) Are wastes generated from the project facilities, such as parking areas/service areas, properly treated and disposed of in accordance with the country's regulations?	(a) N	(a) Development of parking or service areas are not included in the project.
	(4) Noise and Vibration	a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a) N	(a) Increasing of noise and vibration due to traffic at the bridge sites may unlikey occur.
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 are no protected areas in the project site. However, Quirimbus National Park is located nearby project sites.
	(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 roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (nonnative invasive) species and pests? Are adequate measures for preventing such impacts considered? (f) In cases the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	(a) N (b) N (c) N (d) Y (e) N (f) N	(a) There are no ecological valuable habitats in the site. (b) The habitats of endangered species have not been identified in and around the site. (c) Significant ecological impact is unlikely to occur. (d) There is possibility of migration of wildlife crossing the bridge sites. (e) Because of improvement project of existing bridges, increase in destruction of forest and poaching is unlikely to occur. (f) Nothing in particular.
	(3) Hydrology	a) Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	(a) N	(a) Nothing in particular.
	(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)(b) Filling works are included in the construction. However, there are no soft ground to occur slope failures or landslides in and around the site. (c) Adequate filling works prevent accidental and sufficient soil runoff.

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) Are the compensations going to be paid prior to the resettlement? (e) Are 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 (c) N (d) N (e) N (f) N (g) N (h) N (i) N (j) N	(a)-(j) No resettlement is expected by the project.
	(2) Living and Livelihood	(a) Where 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 roads will impede the movement of inhabitants? (f) Is there any possibility that structures associated with roads (such as bridges) will cause a sun shading and radio interference?	(a) N (b) N (c) Y (d) Y (e) N (f) N	(a) Nothing in particular. (b) Nothing in particular. (c) Infectious diseases might be brought due to immigration of workers associated with the project. (d) There are possibilities of increasing of traffic accident. (e) Nothing in particular. (f) Nothing in particular.
	(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) Nothing in particular.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) Nothing in particular.
	(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 to be respected?	(a) N (b) N	(a) Nothing in particular. (b) Nothing in particular.
	(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 being 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) Working conditions during the construction phase shall be comply with both domestic legal framework and international standards. (b) Working conditions during the construction phase shall be comply with both domestic legal framework and international standards. (c) Working conditions during the construction phase shall be comply with both domestic legal framework and international standards. (d) Working conditions during the construction phase shall be comply with both domestic legal framework and international standards.
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 adequate mitigation measures and monitoring plans to reduce impacts of pollution during the construction are prepared. (b) The construction activities to cause serious impact on ecosystem are not included in the project. However, if observed, necessary measures are prepared based on protected areas' regulations. (c) If observed any serious impats on social environment, necessary measures are prepared.
	(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) The monitoring plans mentioned in the SEA reports including monitoring sheet will be implemented during the construction and operation phase. (b)(c)(d) The monitoring plan referring to the items, methods, frequencies framework and report system is proposed in the SEA reports and monitoring sheets.
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 istribution facilities).	(a) N (b) N	(a) Nothing in particular. (b) Nothing in particular.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) Impacts to transboundary or global environmental issues are unlikely to occur.

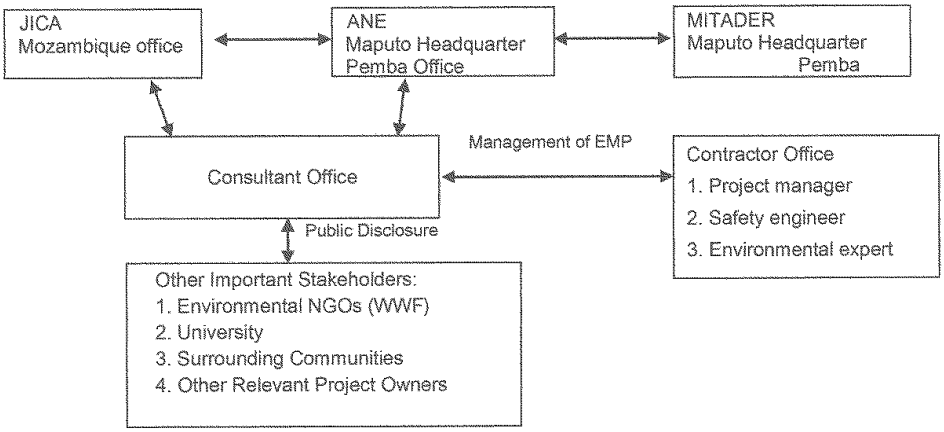


Figure 6. Organization system of Environmental Management Plan (EMP) (during works)

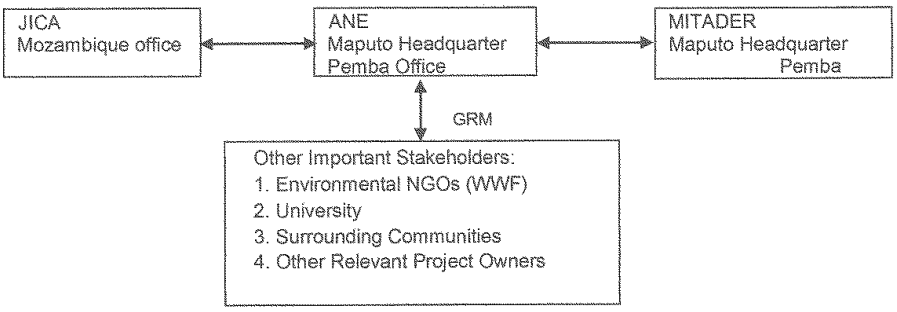


Figure 7. Organization system of Environmental Management Plan (EMP) (in service)

Table 8. Environmental Managment Plan (EMP)

Item	Monitoring	Location	Frequency	Responsible organization
During works				
Air pollution	SO_2, No_2, CO and Total Suspended Particles (TSP) by appropriate equipment and visual monitoring	Around the bridge sites	Monthly	Contractor
Water pollution	pH, turbidity, and erosion by appropriate equipment and/or visual monitoring	Upstream and downstream from the bridge	Monthly	Contractor
Waste	Record reviewing and visual monitoring for disposal method and water pollution	Around the bridge sites	Daily	Contractor
Soil pollution	Patrol (leaking oil from construction equipment or storage yard to ground)	Around the bridge sites	Daily or time of any changes	Contractor
Noise	Measure noise by equipment	Around the bridge sites	Daily or demand bases	Contractor
Protected Area	Confirm impact areas in the field, especially any change of construction	Around the bridge site	As needed	Contractor

	areas	(Muagamula Bridge only)		
Ecosystems	Monitoring if there is wild animal form Quirimbas National park. If roadkill on the bridge is observed, the incident shall be reported to relevant authorities, such as ANE, DEPTADER, etc. Any changes of flora including cutting tree is observed.	Around the bridge sites	Daily or as needed	Contractor
HIV/AIDS and other infections	Confirm the record of education program for labors and situation of infections.	Around the bridge sites	Every quarter or as needed	Contractor
Working Environment	Confirm the record of working environment and education and management on safety.	Around the bridge sites	Every day or month	Contractor
Accidents	Confirm the record of road safety and construction safety.	Around the bridge sites	At the beginning of construction and following every month	Contractor
In service				
Ecosystem	Monitor roadkill cases of large wild animals and regulate traffic or give education, if necessary.	Around the bridge sites	Time of accident or demand base	ANE
Accidents	Confirm and monitor the situation of traffic accident, and regulate traffic or give education, if necessary.	Around the bridge sites	Time of accident or demand base	ANE

Table 9. Quantitative Outputs of the Project Evaluation

Index	Initial Value (2019)	Target Value (3 years after completion)
Traffic volume (12 hours)	391	-
Travel time for heavy vehicles(Macomia-Oasse)	300 minutes	-
Passenger volume (paasenger/year) (12hour, 6:00-18:00)	496,000	-
freight flows (ton/year)	273,000	-

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Director General
National Roads Administration
Republic of Mozambique

ANNEX 1. Monitoring Form

Monitoring Form (A): Construction Phase

The latest results of the below monitoring items shall be submitted to JICA as part of Progress Report throughout the construction phase.

Name of the Project: The Project for Construction of Bridges on N380, Mozambique

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	

2. Pollution

(1) Water Quality

Item*	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standards	Referred International Standards	Frequency
pH	-			6.5-8.5	6-9	At least every 1 months
COD	mg/L				125	At least every 1 months
Oil	Checking oil spillage from construction areas					At any time
If concern about contamination by visual monitoring, the following items will be implemented.						
TDS	mg/L			<500	-	At least every 1 months
OD	mg/L				4-5 (20°C)	At least every 1 months
BOD	mg/L				25	At least every 1 months
Phos.	mg/L				0.1	At least every 1 months
SS	mg/L				45	At least every 1 months
Coli.	MPN				Less than1100	At least every 1 months

* OD: Oxygen Demand, Coli.: TDS: Total Dissolved Solids, Total Coliforms, COD: Chemical Oxygen Demand, BOD: Biological Oxygen Demand, Phos.: Total Phosphorus, SS: Suspended Solid or Turbidity, Coli.: Coliform

(2) Air Quality

If there is concern about contamination by visual monitoring, the following items will be implemented.

Item*	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standards (No.67)	Referred International Standards (WHO)	Frequency
SO_2	$\mu g/m^3$			100 (24 hours)	125 (24 hours)	(1) Measurement: Monthly during the construction period or as needed, especially at the construction site of Muagamula Bridge where the baseline showed higher value than standards
NO_2	$\mu g/m^3$			190 (1 hour)	200 (1 hour)	
CO	$\mu g/m^3$			10,000 (8 hour in ave.)	-	
TSP	$\mu g/m^3$			150 (24hrs)	-	(1) Visual observation: Daily during the construction period (2) Measurement: Monthly during the construction period or as needed

* TSP: Total Suspended Particles

(3) Waste

Item	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standards	Referred International Standards	Frequency
Disposal Methods	Visual Observation					(1) Daily during the construction period
Water Pollution	Visual Observation / Measurement of major water quality elements, if any					(1) Daily during the construction period

(4) Soil Pollution

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Oil leaking	Visual Observation		Daily, or time of any changes

(5) Noise

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
LAeq: Noise Level per 1 hour	Noise Measurement Equipment		Daily, or on demand base

3. Natural Environment

(1) Protected Area *This item is required only for the Muagamula Bridge Construction

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Protected Area (Construction border)	Visual Observation		Daily, or time of any changes

(2) Ecosystem

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Tree Cutting	Visual Observation		Daily, or time of any changes
Fauna and Flora, including road-kill	Visual Observation		Daily, or time of any changes

4. Social Environment and others

(1) HIV/AIDS

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Educational Activities	Number of events		Every quarter during construction period
Workers health condition	Observation and interview		If needed

(2) Working Environment

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Safety facilities and equipment	Visual Observation		Every day, especially during erection works
Safety management seminar	Visual Observation		Every month, especially during erection works

(3) Accidents

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Safety plan	Record of education at schools		At the beginning of construction and followed up
Medical facility	Visual Observation		At the beginning of construction and followed up
Signboards	Visual Observation		At the beginning of construction and followed up

(4) Remarks on other impacts
If unexpected impacts on social environment are expected beyond the original environmental management plan, such as temporal land use on private land for detours, contractor and/or consultant must report the situation immediately to ANE before relevant activities.

Monitoring Form (B): Operation Phase

The latest results of the below monitoring items shall be submitted to JICA on biannual or annual frequency for at least 5 years. If there is observed impacts beyond expectation, additional mitigation measures and/or extension of monitoring period shall be discussed.

Name of the Project: The Project for Construction of Bridges on N380, Mozambique

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	

2. Pollution

Nothing in particular and demand-base, if needed.

3. Natural Environment

(1) Ecosystem

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Road-kill of wild animals	Visual Observation		At the beginning of operation, and once in a couple of years in following phases

4. Social Environment and others

(1) Accidents

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Safety plan	Record of education at schools		At the beginning of operation, and once in a couple of years in following phases
Medical facility	Visual Observation		At the beginning of operation, and once

			in a couple of years in following phases
Signboards	Visual Observation		At the beginning of operation, and once in a couple of years in following phases
Traffic accidents	Visual Observation		At the beginning of operation, and once in a couple of years in following phases

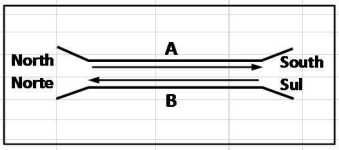
6. Other Relevant Data

6.1 Traffic Volume Survey

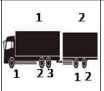
（1）Muagamula Bridge (Weekday, Southbound)

Bridge Name Muagamula

Location Map



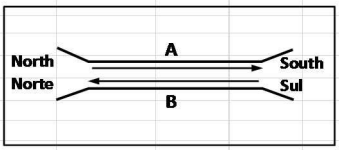
DATE : 01/03/2019
Surveyor : Maehude
Direction : A

		6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	Total
Person [Pessoa]		4	10		1	5	2					2		24
Bicycle [Bicicleta]		1	1									1		3
Motorcycle [Motocicleta]		2	2	1	1		2		1	1	1	5		16
Passanger Car [Carro]				2	3	2	2				1	1		11
Pickup Truck [Picape]		4	2	9	10	4	8		7	3	2	3		52
Micro Bus & Van [Micro onibus & furgão]		2	3	1	1	2	2			1	2	2		16
Bus [Onibus]		5	3	2							1			11
Truck [Caminhão]			3	5	2	2			3					15
2-Axial Truck [Caminhão de carga]					3									3
3-Axial Truck [Caminhão de carga com 3-eixo]		2	2				1		1					6
4-Axial Truck [Caminhão de carga com 4-eixo]														0
Semi-Trailor [Semi-trailer (um trailer)]		1	1		1									3
Semi-Trailor (3-Axial) [Semi-trailer (trailer3-exio Caminhão&trailer)]					1			1			2			4
Full-Trailer (Dubble trailer) [Trailer completo (Dois trailer)]														0
Tracktor [Trator]														0
Total		21	27	20	23	15	17	1	12	5	9	14	0	164

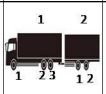
（2）Muagamula Bridge (Weekday, Northbound)

Bridge Name Muagamula

Location Map



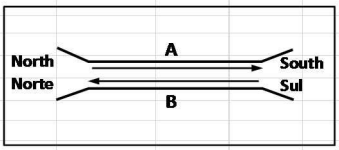
DATE : 01/03/2019
Surveyor : Maehude
Direction : B

		6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	Total
Person [Pessoa]			3	3	3	7			2		3			21
Bicycle [Bicicleta]		1	1	1			1				1			5
Motorcycle [Motociclela]		1		1			2			3	2	6		15
Passanger Car [Carro]			1	1	1	2	1		2		1	3		12
Pickup Truck [Picape]		16	4	3	6	4	4		1	5	11	3		57
Micro Bus & Van [Micro onibus & furgão]				3	5	1			2	1	1	2		15
Bus [Onibus]			1	1	1		2							5
Truck [Caminhão]		1	3		1	5			3	2				15
2-Axial Truck [Caminhão de carga]		1			2				1			1		5
3-Axial Truck [Caminhão de carga com 3-eixo]		1	1	1	1							3		7
4-Axial Truck [Caminhão de carga com 4-eixo]														0
Semi-Trailor [Semi-trailer (um trailer)]														0
Semi-Trailor (3-Axial) [Semi-trailer (trailer3-exio Caminhã o&trailer)]					1									1
Full-Trailer (Dubble trailer) [Trailer completo (Dois trailer)]														0
Tracktor [Trator]														0
Total		21	14	14	21	19	10	0	11	11	19	18	0	158

（3）Muagamula Bridge (Holiday, Southbound)

Bridge Name Muagamula

Location Map



DATE : 02/03/2019
Surveyor : Maehude
Direction : A

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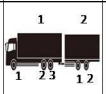
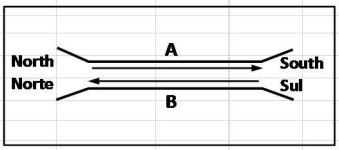
Person [Pessoa]		12	9	7	1	2	3			1				35
Bicycle [Bicicleta]				1					1	1	1			4
Motorcycle [Motociclela]			2	2	2	1			1	3	3			14
Passanger Car [Carro]		1		1	2				2					6
Pickup Truck [Picape]		2	4	5	1	10	12	1	1	1	4			41
Micro Bus & Van [Micro onibus & furgão]		3	4	3		1				1	1			13
Bus [Onibus]		1	4	1		1	1				2			10
Truck [Caminhão]			1	2	1	3			1	1	1			10
2-Axial Truck [Caminhão de carga]				1			6				1			8
3-Axial Truck [Caminhão de carga com 3-eixo]				1						1	1			3
4-Axial Truck [Caminhão de carga com 4-eixo]														0
Semi-Trailor [Semi-trailer (um trailer)]					1									1
Semi-Trailor (3-Axial) [Semi-trailer (trailer3-exio Caminhã o&trailer)]										1				1
Full-Trailer (Dubble trailer) [Trailer completo (Dois trailer)]														0
Tracktor [Trator]														0
Total		19	24	24	8	18	22	1	6	10	14	0	0	146

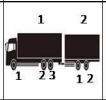
（4）Muagamula Bridge (Holiday,Northbound)

Bridge Name Muagamula

Location Map



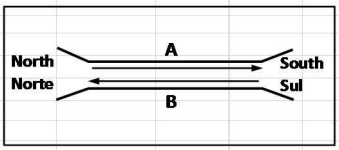
DATE : 02/03/2019
Surveyor : Maehude
Direction : B

		6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	Total
Person [Pessoa]		10	3		4	5	5		5	5				37
Bicycle [Bicicleta]		1	1			1								3
Motorcycle [Motociclela]			2	2	4	2	1			5				16
Passanger Car [Carro]			1	1			1			2	2			7
Pickup Truck [Picape]		5	5	1	6	6	3		1	1	1			29
Micro Bus & Van [Micro onibus & furgão]			2	4	3				1	1	1			12
Bus [Onibus]				2	1	2	1							6
Truck [Caminhão]					3		4				3			10
2-Axial Truck [Caminhão de carga]							2							2
3-Axial Truck [Caminhão de carga com 3-eixo]			1				1				1			3
4-Axial Truck [Caminhão de carga com 4-eixo]														0
Semi-Trailor [Semi-trailer (um trailer)]														0
Semi-Trailor (3-Axial) [Semi-trailer (trailer3-exio Caminhã o&trailer)]				1	3	3				1				8
Full-Trailer (Dubble trailer) [Trailer completo (Dois trailer)]														0
Tracktor [Trator]														0
Total		16	15	11	24	19	18	0	7	15	8	0	0	133

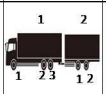
（５）Muera II Bridge (Weekday, Southbound)

Bridge Name Mwela

Location Map



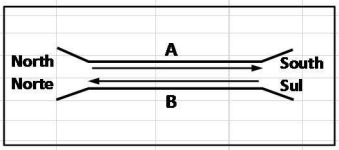
DATE : 01/03/2019
Surveyor : Ahida
Direction : A

		6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	Total
Person [Pessoa]		12	4		2	5	9		2	1	7	4		46
Bicycle [Bicicleta]		2	1			1	1				4	2		11
Motorcycle [Motociclela]		3	1			1	2		2		2	1		12
Passanger Car [Carro]		3	3	1		2	3	2	2		1		1	18
Pickup Truck [Picape]		10	2	2	2	1	4	6	3		3	2	6	41
Micro Bus & Van [Micro onibus & furgão]		3	1		1	4	3				1	1	1	15
Bus [Onibus]				1	1		2	1						5
Truck [Caminhão]		5	2	1		1	4		1		3			17
2-Axial Truck [Caminhão de carga]		1	1			2	1				1			6
3-Axial Truck [Caminhão de carga com 3-eixo]		1	3			2			1					7
4-Axial Truck [Caminhão de carga com 4-eixo]														0
Semi-Trailor [Semi-trailer (um trailer)]			1											1
Semi-Trailor (3-Axial) [Semi-trailer (trailer3-exio Caminhã o&trailer)]		1	2											3
Full-Trailer (Dubble trailer) [Trailer completo (Dois trailer)]														0
Tracktor [Trator]														0
Total		41	21	5	6	19	29	9	11	1	22	10	8	182

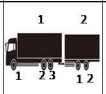
（6）Muera II Bridge (Weekday, Northbound)

Bridge Name Mwela

Location Map



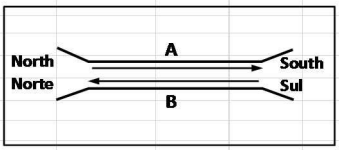
DATE : 01/03/2019
Surveyor : Ahida
Direction : B

		6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	Total
Person [Pessoa]		8	4	3	3	2	2	4	4		3			33
Bicycle [Bicicleta]		3	1								3	1		8
Motorcycle [Motociclela]		2	1	1	3	1	2	1		1		3		15
Passanger Car [Carro]		1	2		1	1	2			1	1	1		10
Pickup Truck [Picape]		5	4	7	2	5	6	3	2	4		2	2	42
Micro Bus & Van [Micro onibus & furgão]		3			2				2	3				10
Bus [Onibus]		5						1		1				7
Truck [Caminhão]		5	2	1	1			1	1	1	3			15
2-Axial Truck [Caminhão de carga]		1		1	1		2	1						6
3-Axial Truck [Caminhão de carga com 3-eixo]		3			1		1			1	1		2	9
4-Axial Truck [Caminhão de carga com 4-eixo]														0
Semi-Trailor [Semi-trailer (um trailer)]														0
Semi-Trailor (3-Axial) [Semi-trailer (trailer3-exio Caminhã o&trailer)]		5					1			2			1	9
Full-Trailer (Dubble trailer) [Trailer completo (Dois trailer)]														0
Tracktor [Trator]														0
Total		41	14	13	14	9	16	11	9	14	11	7	5	164

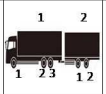
（７）Muera II Bridge (Holiday, Southbound)

Bridge Name Mwela

Location Map



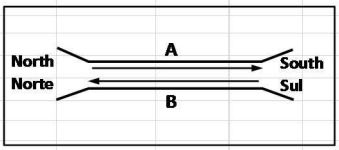
DATE : 02/03/2019
Surveyor : Ahida
Direction : A

		6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	Total
Person [Pessoa]		11	6		4	7	5	3	2	2	5			45
Bicycle [Bicicleta]		2								1	1			4
Motorcycle [Motociclela]		1		1	1	1		1	3					8
Passanger Car [Carro]		2		2	1		2		2		3			12
Pickup Truck [Picape]		1	3	2		4	5	2	7		3			27
Micro Bus & Van [Micro onibus & furgão]				2		5			2		1			10
Bus [Onibus]		1				1	1	1						4
Truck [Caminhão]		3	2			1	1		3	1	1			12
2-Axial Truck [Caminhão de carga]		1	1											2
3-Axial Truck [Caminhão de carga com 3-eixo]		3	1			2			1		3			10
4-Axial Truck [Caminhão de carga com 4-eixo]														0
Semi-Trailor [Semi-trailer (um trailer)]														0
Semi-Trailor (3-Axial) [Semi-trailer (trailer3-exio Caminhã o&trailer)]		5			1	2	5		1		1			15
Full-Trailer (Dubble trailer) [Trailer completo (Dois trailer)]														0
Tracktor [Trator]														0
Total		30	13	7	7	23	19	7	21	4	18	0	0	149

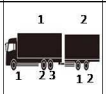
（8）Muera II Bridge (Holiday, Northbound)

Bridge Name Mwela

Location Map



DATE : 02/03/2019
Surveyor : Ahida
Direction : B

		6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	Total
Person [Pessoa]		8	3	4	1	1		3	4	3	6			33
Bicycle [Bicicleta]		2					2		1					5
Motorcycle [Motociclela]		2	1	3			3		2	1	1			13
Passanger Car [Carro]		3	4	3	1	1	1	2		1	1			17
Pickup Truck [Picape]		4	3	2	9	7	2	3	2		3			35
Micro Bus & Van [Micro onibus & furgão]		4	2				2			1	2			11
Bus [Onibus]		6								1				7
Truck [Caminhão]		3		1	1	2	2		1					10
2-Axial Truck [Caminhão de carga]		1	2		1		1				2			7
3-Axial Truck [Caminhão de carga com 3-eixo]		2				6		1	1					10
4-Axial Truck [Caminhão de carga com 4-eixo]														0
Semi-Trailor [Semi-trailer (um trailer)]														0
Semi-Trailor (3-Axial) [Semi-trailer (trailer3-exio Caminhã o&trailer)]		2	1								2			5
Full-Trailer (Dubble trailer) [Trailer completo (Dois trailer)]														0
Tracktor [Trator]														0
Total		37	16	13	13	17	13	9	11	7	17	0	0	153

6. 2 Geological Survey

No.	Bridge Name	South	East
1	Muagamura (Bdg 2)	12° 8'13"S	40° 7'14 "E
2	Muera I (Bdg 6)	11°38'10"S	40° 0'56"E
3	Muera II (Bdg 7)	11°38'08"S	40° 01'3"E

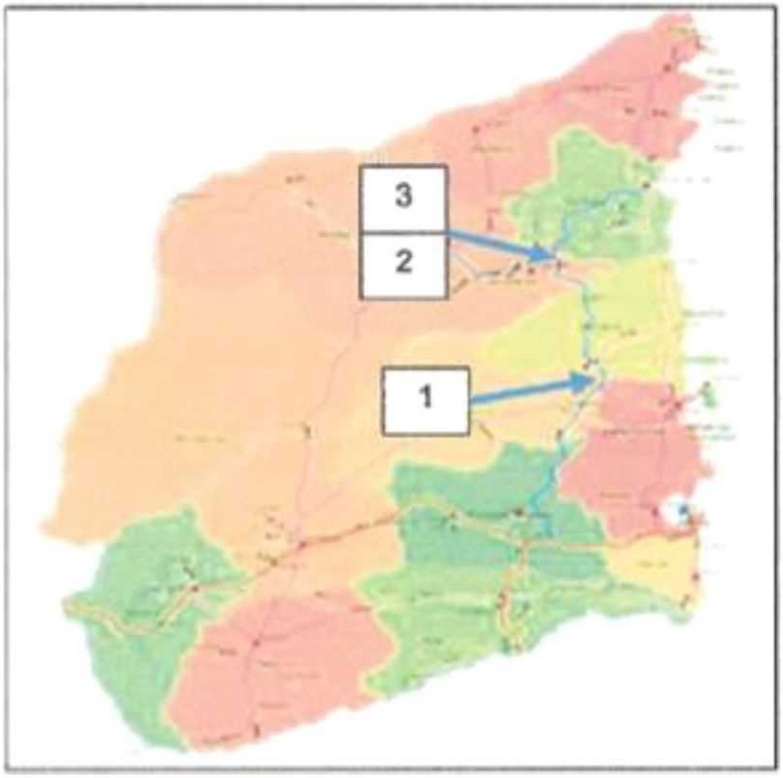
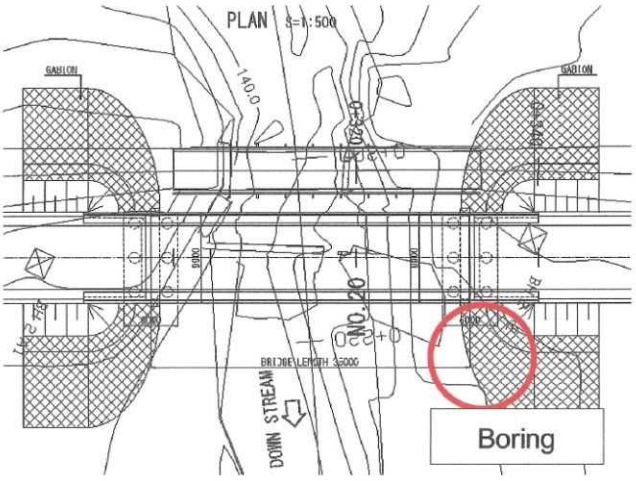


Figure 1 Project Location Map

Annex B. Proposed Boring Location: Muagamura Bridge

1) Boring: one location at Abutment 2, downstream

2) Boring length: about 30m

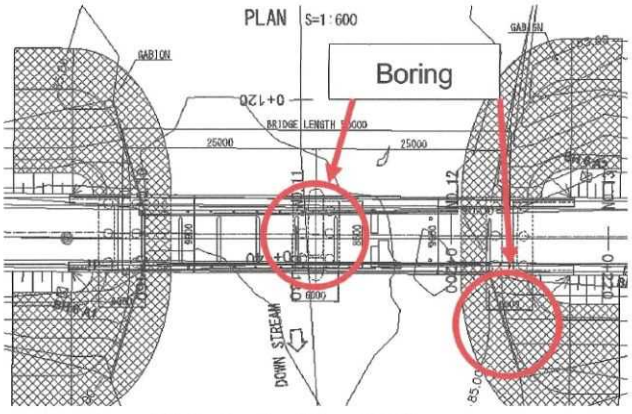


a)

Annex C. Proposed Boring Locmation: Muera I Bridge

1) Boring: two locations at Pier and Abutment 2, downstream

2) Boring length: about 50m

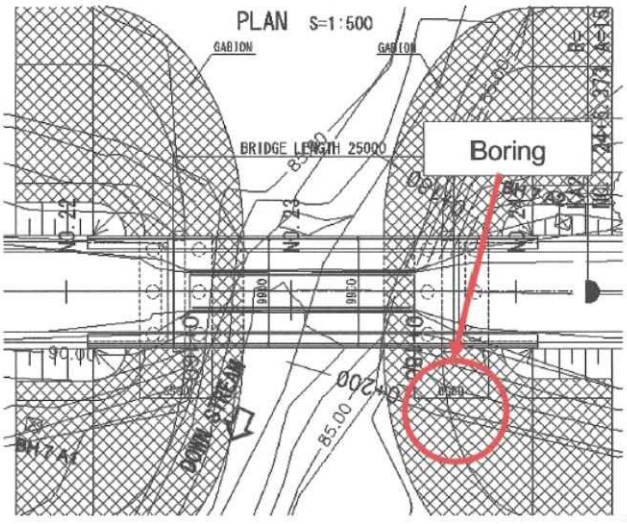


b)

Annex D. Proposed Boring Location: Muera II Bridge

1) Boring: one location at Abutment 2, downstream

2) Boring length: about 20m



c)

Figure 7 Borehole Location, a) Muagamula (B2) b) Muera 1 (B6) c) Muera 2 (B7)

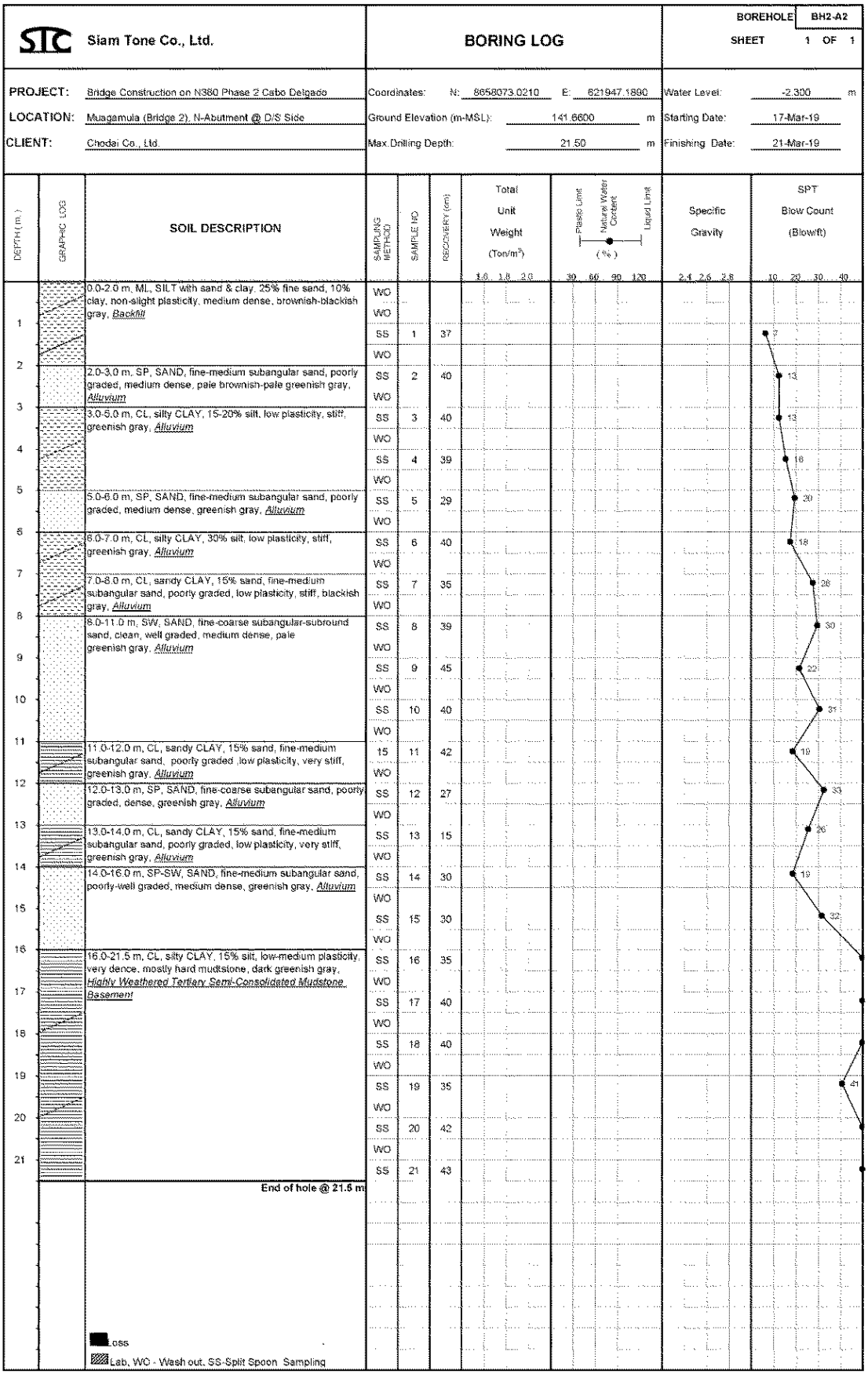


Figure 8.1 BH2-A2/1 at N-Abutment D/S Side of Muagamula Bridge (B2)

Siam Tone Co., Ltd.	BORING LOG	BOREHOLE BH6-A2/1 SHEET 1 OF 3
PROJECT: Bridge Construction on N380 Phase 2 Cabo Delgado	Coordinates: N: 8713470.5270 E: 610714.6950	Water Level: -4.700 m
LOCATION: Muera 1 (Bridge 6), N-Abutment @ D/S Side	Ground Elevation (m-MSL): 89.1650 m	Starting Date: 29-Mar-19
CLIENT: Chodai Co., Ltd.	Max.Drilling Depth: 57.50 m	Finishing Date: 18-Apr-19

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, ML, clayey SILT with sand, 25% clay, 10% fine subangular sand, non plasticity, loose, yellowish brown, *Backfill*	WO						
			WO						
1			SS	1	35				7
			WO						
2			SS	2	35				5
			WO						
3			SS	3	35				8
			WO						
4		4.0-5.0 m, CL, silty CLAY, 30% silt, low-medium plasticity, medium stiff, reddish brown, *Backfill*	SS	4	40				8
			WO						
5		5.0-13.0 m, CL, silty CLAY, 10-15% silt, medium-high plasticity, stiff, greenish gray mostly with dark greenish-blackish gray on top 3 m, *Alluvium*	SS	5	40				10
			WO						
6			SS	6	45				9
			WO						
7			SS	7	38				14
			WO						
8			SS	8	45				9
			WO						
9			SS	9	43				12
			WO						
10			SS	10	45				13
			WO						
11			15	11	40				10
			WO						
12			SS	12	45				13
			WO						
13		13.0-15.0 m, SP, SAND, fine subangular sand, loose-medium dense, greenish gray, *Alluvium*	SS	13	30				9
			WO						
14			SS	14	28				16
			WO						
15		15.0-16.0 m, SP, SAND, fine subangular sand,very dense, greenish gray, *Alluvium*	SS	15	16				50/26
			WO						
16		16.0-17.0 m, CL, silty CLAY, 10% silt, medium plasticity, very soft, blackish gray, *Alluvium*	SS	16	45				2
			WO						
17		17.0-18.0 m, CL, sandy CLAY, 30% fine-medium subangular sand, low-medium plasticity, stiff, blackish gray, *Alluvium*	SS	17	45				10
			WO						
18		18.0-19.0 m, SP, SAND, fine-medium subangular sand, medium dense, greenish gray, *Alluvium*	SS	18	37				30
			WO						
19		19.0-20.0 m, CL, silty CLAY, 20% silt, medium-high plasticity, stiff, greenish gray, *Alluvium*	SS	19	45				10
			WO						
20		20.0-21.0 m, SP, SAND, fine-medium subangular sand, medium dense, greenish gray, *Alluvium*	SS	20	45				21
			WO						
21		21.0-23.0 m, SP, SAND, fine-medium subangular sand, very dense, greenish gray, *Alluvium*	SS	21	20				50/17
			WO						
22			SS	22	30				50/23
			WO						
23		18.0-19.0 m, SP, SAND, fine-medium subangular sand, medium dense, greenish gray, *Alluvium*	SS	23	25				16
			WO						
24		24.0-26.0 m, CL, silty CLAY, 10-20% silt, medium-high plasticity, stiff, blackish gray, *Alluvium*	SS	24	40				12
			WO						
25			SS	25	35				13
			WO						

Figure 8.2.1 BH6-A2/1 at N-Abutment D/S Side of Muera I Bridge (B6)

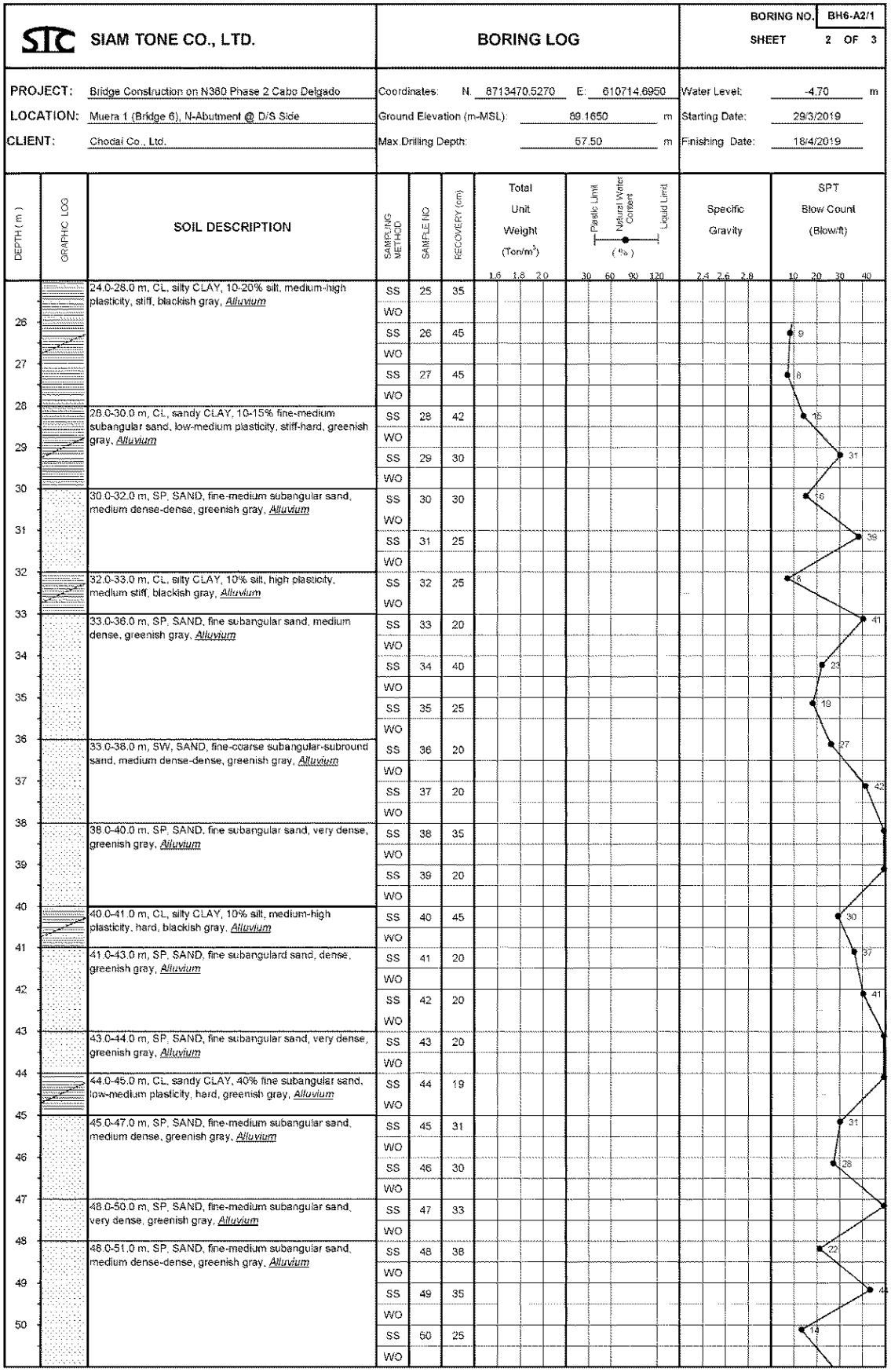


Figure 8.2.2 BH6-A2/1 at N-Abutment D/S Side of Muera I Bridge (B6)

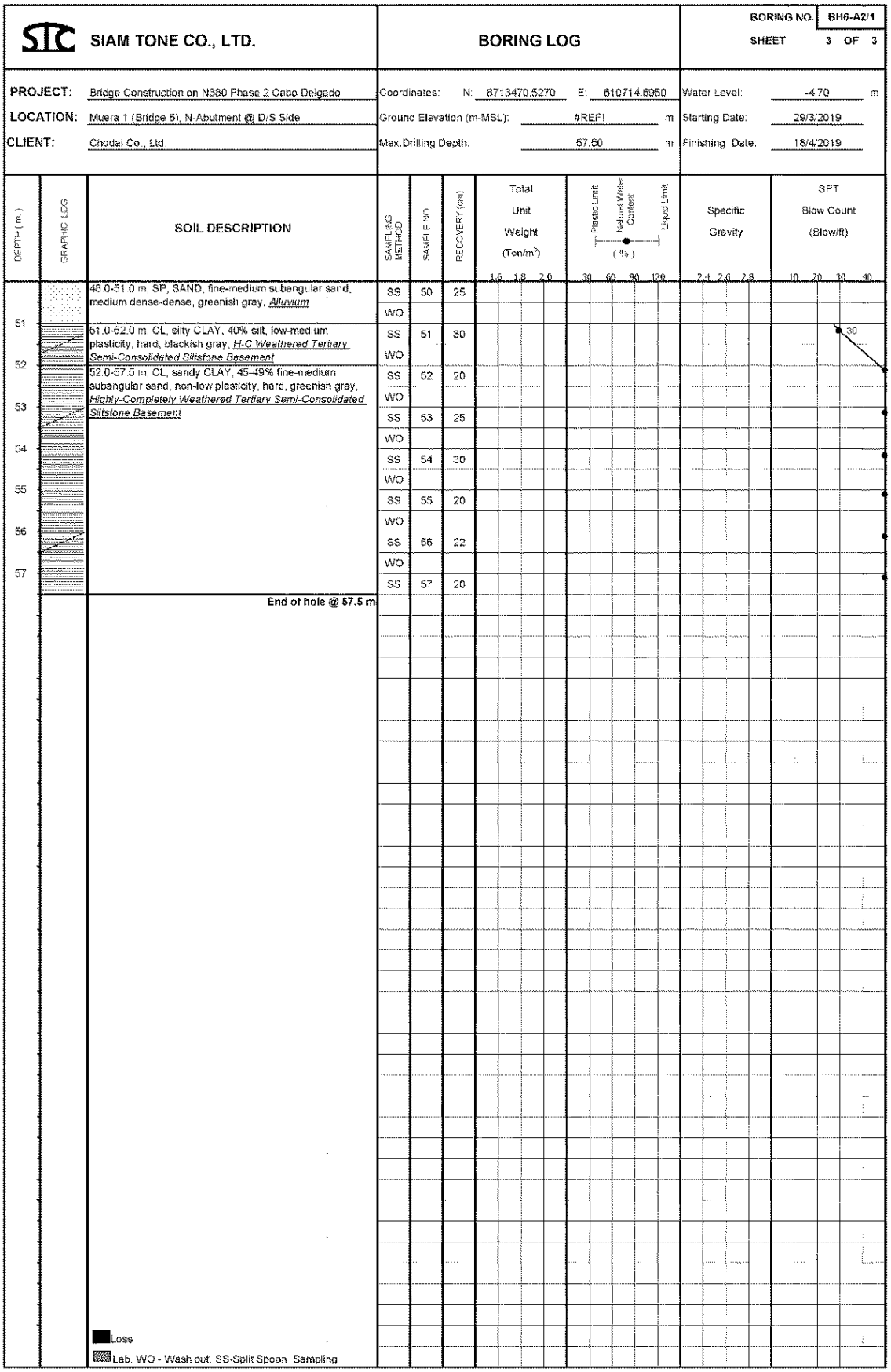


Figure 8.2.3 BH6-A2/1 at N-Abutment D/S Side of Muera I Bridge (B6)

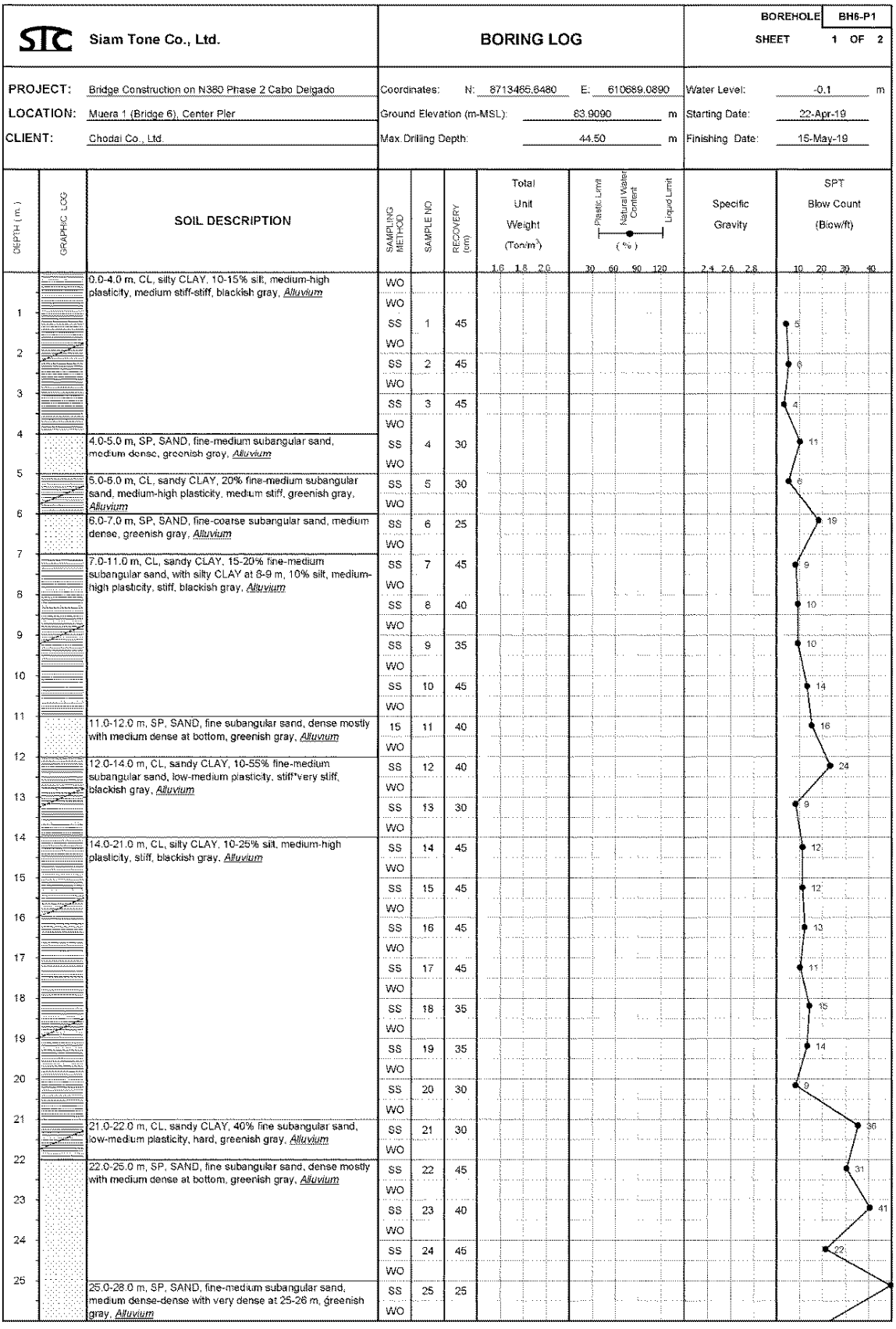


Figure 8.3.1 BH6-P1 at Central Pier of Muera I Bridge (B6)

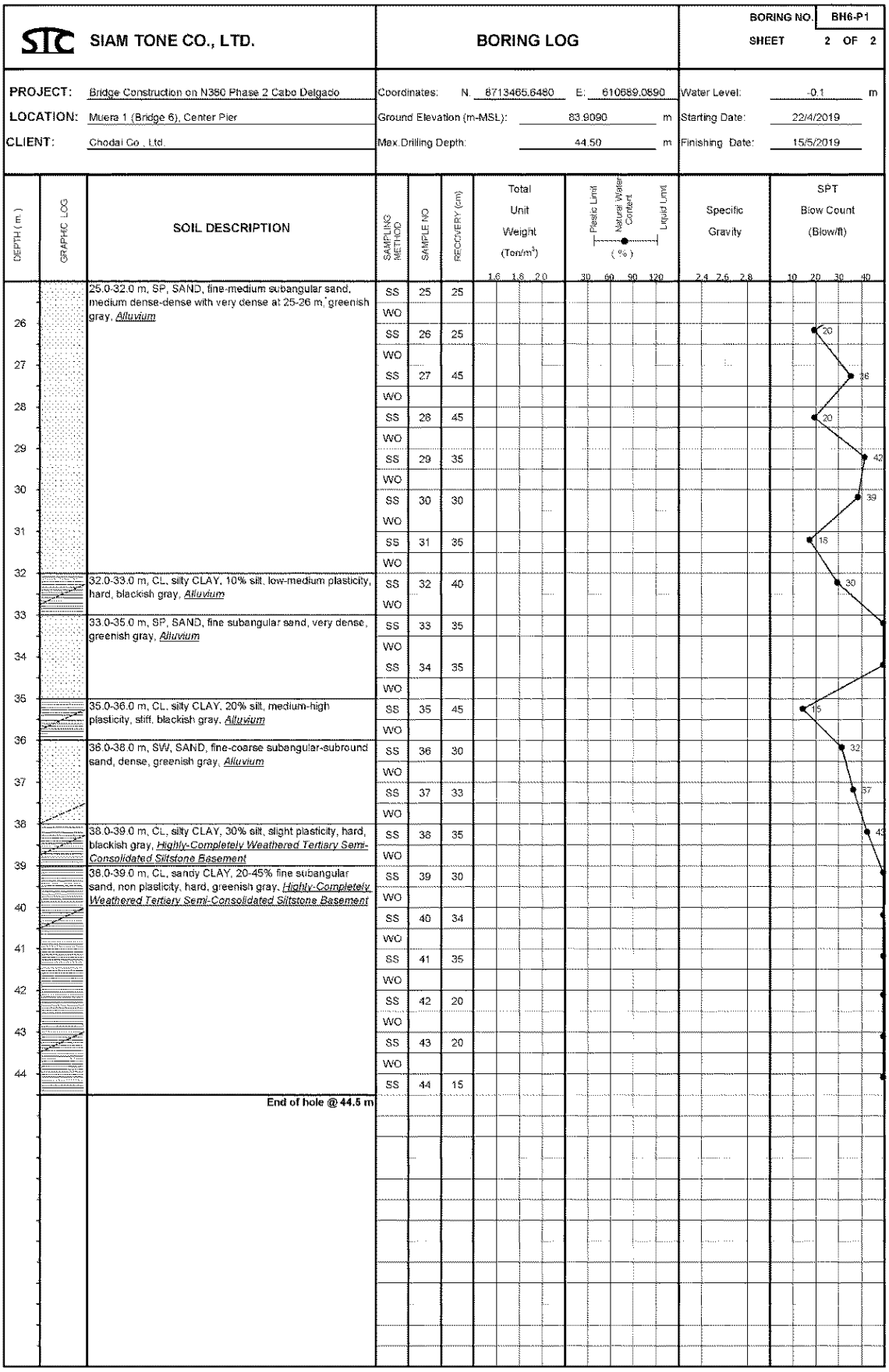


Figure 8.3.2 BH6-P1 at Central Pier of Muera I Bridge (B6)

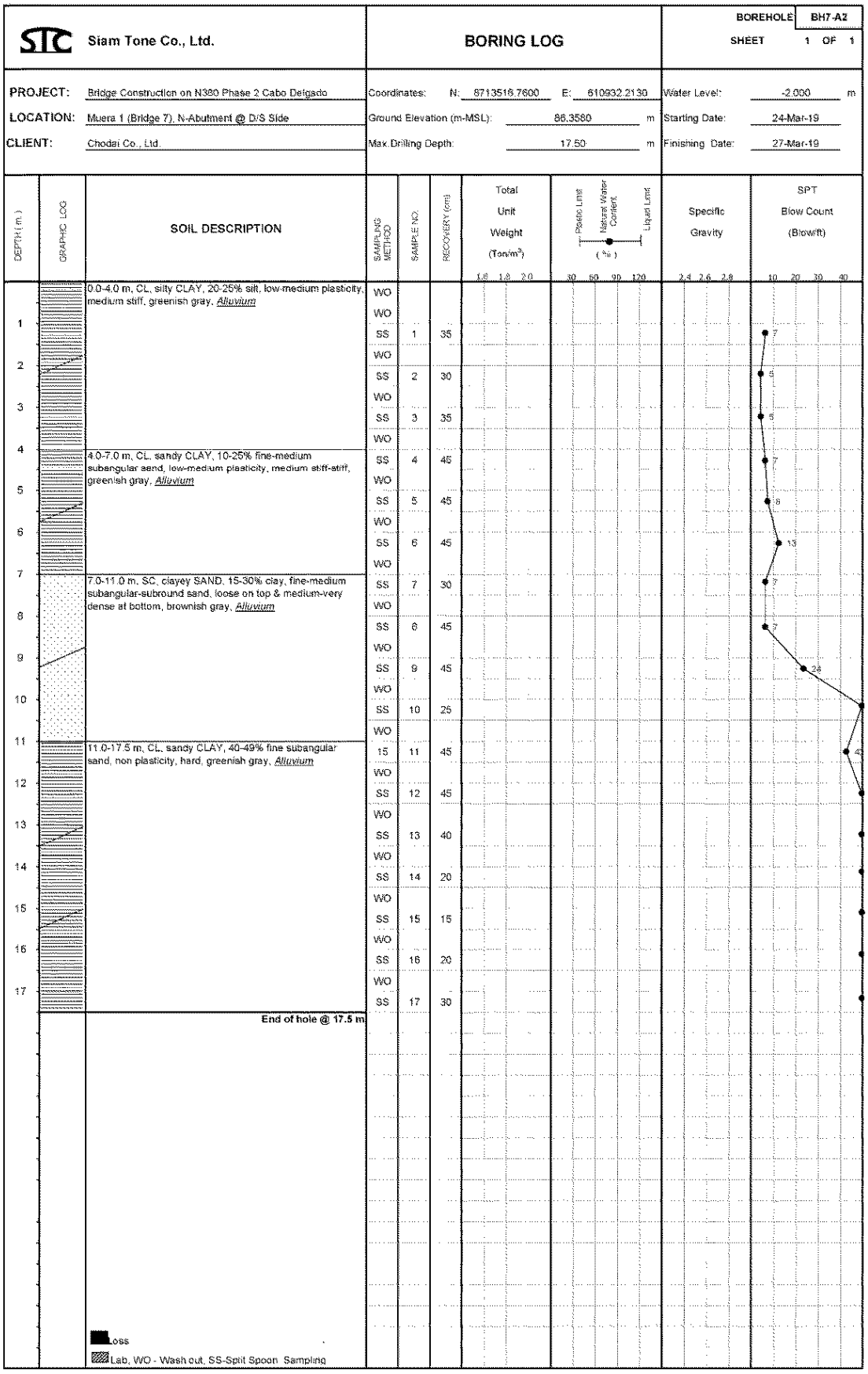


Figure 8.4 BH7-A2/1 at N-Abutment D/S Side of Muera II Bridge (B7)

6.3 Environmental Monitoring Form and Check List

(1) Monitoring Form

Monitoring Form (A): Construction Phase

The latest results of the below monitoring items shall be submitted to JICA as part of Progress Report throughout the construction phase.

Name of the Project: The Project for Construction of Bridges on N380, Mozambique

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	

2. Pollution

(1) Water Quality

Item*	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standards	Referred International Standards	Frequency
pH	-			6.5-8.5	6-9	At least every 1 months
COD	mg/L				125	At least every 1 months
Oil	Checking oil spillage from construction areas					At any time
If concern about contamination by visual monitoring, the following items will be implemented.						
TDS	mg/L			<500	-	At least every 1 months
OD	mg/L				4-5 (20℃)	At least every 1 months
BOD	mg/L				25	At least every 1 months
Phos.	mg/L				0.1	At least every 1 months
SS	mg/L				45	At least every 1 months
Coli.	MPN				Less than1100	At least every 1 months

* OD: Oxygen Demand, Coli.: TDS: Total Dissolved Solids, Total Coliforms, COD: Chemical Oxygen Demand, BOD: Biological Oxygen Demand, Phos.: Total Phosphorus, SS: Suspended Solid or Turbidity, Coli.: Coliform

(2) Air Quality

If there is concern about contamination by visual monitoring, the following items will be implemented.

Item*	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standards (No.67)	Referred International Standards (WHO)	Frequency
SO_2	μg/m³			100 (24 hours)	125 (24 hours)	(1) Measurement: Monthly during the construction period or as needed, especially at the construction site of Muagamula Bridge where the baseline showed higher value than standards
NO_2	μg/m³			190 (1 hour)	200 (1 hour)	
CO	μg/m³			10,000 (8 hour in ave.)	-	
TSP	μg/m³			150 (24hrs)	-	(1) Visual observation: Daily during the construction period (2) Measurement: Monthly during the construction period or as needed

* TSP: Total Suspended Particles

(3) Waste

Item	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standards	Referred International Standards	Frequency
Disposal Methods	Visual Observation					(1) Daily during the construction period
Water Pollution	Visual Observation / Measurement of major water quality elements, if any					(1) Daily during the construction period

(4) Soil Pollution

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Oil leaking	Visual Observation		Daily, or time of any changes

(5) Noise

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
LAeq: Noise Level per 1 hour	Noise Measurement Equipment		Daily, or on demand base

3. Natural Environment

(1) Protected Area *This item is required only for the Muagamula Bridge Construction

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Protected Area (Construction border)	Visual Observation		Daily, or time of any changes

(2) Ecosystem

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Tree Cutting	Visual Observation		Daily, or time of any changes
Fauna and Flora, including road-kill	Visual Observation		Daily, or time of any changes

4. Social Environment and others

(1) HIV/AIDS

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Educational Activities	Number of events		Every quarter during construction period
Workers health condition	Observation and interview		If needed

(2) Working Environment

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Safety facilities and equipment	Visual Observation		Every day, especially during erection works
Safety management seminar	Visual Observation		Every month, especially during erection works

(3) Accidents

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Safety plan	Record of education at schools		At the beginning of construction and followed up
Medical facility	Visual Observation		At the beginning of construction and followed up
Signboards	Visual Observation		At the beginning of construction and followed up

(4) Remarks on other impacts

If unexpected impacts on social environment are expected beyond the original environmental management plan, such as temporal land use on private land for detours, contractor and/or consultant must report the situation immediately to ANE before relevant activities.

Monitoring Form (B): Operation Phase

The latest results of the below monitoring items shall be submitted to JICA on biannual or annual frequency for at least 5 years. If there is observed impacts beyond expectation, additional mitigation measures and/or extension of monitoring period shall be discussed.

Name of the Project: The Project for Construction of Bridges on N380, Mozambique

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	

2. Pollution

Nothing in particular and demand-base, if needed.

3. Natural Environment

(1) Ecosystem

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Road-kill of wild animals	Visual Observation		At the beginning of operation, and once in a couple of years in following phases

4. Social Environment and others

(1) Accidents

Monitoring Item	Method	Monitoring Results and Measures to be Taken	Frequency
Safety plan	Record of education at schools		At the beginning of operation, and once in a couple of years in following phases
Medical facility	Visual Observation		At the beginning of operation, and once in a couple of years in following phases
Signboards	Visual Observation		At the beginning of operation, and once in a couple of years in following phases
Traffic accidents	Visual Observation		At the beginning of operation, and once in a couple of years in following phases

(2) Check List

Environmental Check List: The Project for Construction of Bridges on N380, Mozambique

Category	Environmetal 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) Y (b) Y (c) Y (d) Y	(a) SEA (Simplified Environmental Assessment) reports have been prepared in line with official process. (b) SEA reports have been approved by an official authority (Provincial Directorate of Lands, Environment and Rural, DEPTADER) in Cabo Delgado Province) in June, 2019 (c) SEA reports have been approved without conditions (d) Nothing in particular, and all the required environmental permits have been obtained
	(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) Stakeholder meetings for information disclosure have been held at each bridge site by National Road Administration (ANE). Local stakeholders principally understand the project outnline and its impact. (b) The comments from stakeholders have been recoreded in SEA reports and reflected to the project.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Several alternatives including "the case without project" have been examined with the traffic capacity and functions, construction cost, and social and environmental impact in the selection of the typical cross-section design and alignment of the new road section.
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) Where industrial areas already exist near the route, is there a possibility that the project will make air pollution worse?	(a) Y (b) N	(a) Vehicles traffic and construction vehicles may affect ambient air quality during both constrcution phase. For the cases where the air pollution exceeds standards, mitigation maeasures are considered. (b) There is no industrial areas already exist near the route.
	(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 surface runoff from roads will contaminate water sources, such as groundwater? (c) Do effluents from various facilities, such as parking areas/service areas comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas not to comply with the country's ambient water quality standards?	(a) Y (b) N (c) N	(a) Turbid water will generate in the construction works. The turbid water will contaminate rivers and streams around the target road section temporarily. (b) Impact on water resources of runoff from road surface is unlikely to occur. (c) Development of parking or service areas which generate waste water in operation phase are not included in the project.
	(3) Wastes	(a) Are wastes generated from the project facilities, such as parking areas/service areas, properly treated and disposed of in accordance with the country's regulations?	(a) N	(a) Development of parking or service areas are not included in the project.
	(4) Noise and Vibration	a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a) N	(a) Increasing of noise and vibration due to traffic at the bridge sites may unlikey occur.
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 are no protected areas in the project site. However, Quirimbus National Park is located nearby project sites.
	(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 roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (nonnative invasive) species and pests? Are adequate measures for preventing such impacts considered? (f) In cases the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	(a) N (b) N (c) N (d) Y (e) N (f) N	(a) There are no ecological valuable habitats in the site. (b) The habitats of endangered species have not been identified in and around the site. (c) Significant ecological impact is unlikely to occur. (d) There is possibility of migration of wildlife crossing the bridge sites. (e) Because of improvement project of existing bridges, increase in destruction of forest and poaching is unlikely to occur. (f) Nothing in particular.
	(3) Hydrology	a) Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	(a) N	(a) Nothing in particular.
	(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)(b) Filling works are included in the construction. However, there are no soft ground to occur slope failures or landslides in and around the site. (c) Adequate filling works prevent accidental and sufficient soil runoff.

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) Are the compensations going to be paid prior to the resettlement? (e) Are 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 (c) N (d) N (e) N (f) N (g) N (h) N (i) N (j) N	(a)-(j) No resettlement is expected by the project.
	(2) Living and Livelihood	(a) Where 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 roads will impede the movement of inhabitants? (f) Is there any possibility that structures associated with roads (such as bridges) will cause a sun shading and radio interference?	(a) N (b) N (c) Y (d) Y (e) N (f) N	(a) Nothing in particular. (b) Nothing in particular. (c) Infectious diseases might be brought due to immigration of workers associated with the project. (d) There are possibilities of increasing of traffic accident. (e) Nothing in particular. (f) Nothing in particular.
	(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) Nothing in particular.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) Nothing in particular.
	(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 to be respected?	(a) N (b) N	(a) Nothing in particular. (b) Nothing in particular.
	(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 being taken to ensure that security guards involved in the project not to viorate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) Working conditions during the construction phase shall be comply with both domestic legal framework and international standards. (b) Working conditions during the construction phase shall be comply with both domestic legal framework and international standards. (c) Working conditions during the construction phase shall be comply with both domestic legal framework and international standards. (d) Working conditions during the construction phase shall be comply with both domestic legal framework and international standards.
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 adequate mitigation measures and monitoring plans to reduce impacts of pollution during the construction are prepared. (b) The construction activities to cause serious impact on ecosystem are not included in the project. However, if observed, necessary measures are prepared baesd on protected areas' regulations. (c) If observed any serious impats on social environment, necessary measures are prepared.
	(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) The monitoring plans mentioned in the SEA reports including monitoring sheet will be implemented during the construction and operation phase. (b)(c)(d) The monitoring plan referring to the items, methods, frequencies framework and report system is proposed in the SEA reports and monitoring sheets.
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 istribution facilities).	(a) N (b) N	(a) Nothing in particular. (b) Nothing in particular.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) Impacts to transboundary or global environmental issues are unlikely to occur.