

Republic of Mozambique

FY2020 Ex-Post Evaluation of Japanese Grant Aid Project

“The Project for Construction of Bridges on the Road between Ile and Cuamba”

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0. Summary

This project was implemented with the aim of ensuring safe and stable traffic in the northern part of Mozambique, thereby activating human exchanges and logistics in the area, and contributing to socio-economic activities, by constructing bridges in the section between Ile/Nampevo, Zambezia Province, and Cuamba, Niassa Province. At the commencement and the ex-post evaluation, the project was consistent with Mozambique's policies, such as *The Action Plan for the Reduction of Poverty and Road Sector Strategy*, and with the development needs, as represented by handling of agricultural products. Therefore, its relevance is high. The grant limit was increased and the project period was extended as large-scale floods occurred during the project period. Although the project cost was within the revised plan, the project period exceeded the plan. Therefore, its efficiency is fair. Most of the indicators for the expected quantitative and qualitative effects have been achieved without negative impacts. However, certain indicators have not been achieved, as corresponding important assumptions have not been satisfied. Therefore, both its effectiveness and impacts are fair. No major problems are observed in the institutional/organizational, technical, and financial aspects, and the current status of the operation and maintenance system at the time of the ex-post evaluation. Therefore, its sustainability is high.

In light of the above, the project is evaluated to be satisfactory.

1. Project Description



Project Location



Namutimbua Bridge, one of the 13 bridges constructed in the Project

1.1 Background

The Republic of Mozambique (hereinafter referred to as “Mozambique”) established its national rebuilding program in 1992 to reconstruct the basic infrastructures devastated by the conflict. The national road network was reconstructed with the aid of many partner countries and international organizations, placing the development of infrastructures as an important field in *The Action Plan for the Reduction of Absolute Poverty I* (PARPA I: 2001–2005), *The Action Plan for the Reduction of Absolute Poverty II* (PARPA II: 2006–2009), and *The Action Plan for the Reduction of Poverty* (PARP: 2011–2014) at the time of the project planning. However, Mozambique's road density¹ was ranked 12th (38 km/km²) among 14 countries in Southern Africa, and there were more than 300 bridges requiring reconstruction owing to aging and overhead flooding in the rainy seasons. These conditions hindered Mozambique's economic development.

The main industry in the target area of the project is agriculture: the area has a high potential for agriculture, owing to its rich soils and rainfall. However, the access to markets was difficult due to the lack of satisfactory roads and bridges in the target section, affecting the handling of agricultural products. Some routes ensured the tentative access of transportation between the sections by constructing temporary bridges, which have poor sustainability; for example, there were sections that became impassable in the rainy seasons and experienced frequent traffic accidents caused by the narrow approaches to bridges. Thus, there was an urgent need for improvement.

1.2 Project Outline

The project aimed at ensuring safe and stable traffic in the northern part of Mozambique, thereby activating human exchanges and logistics in the area and contributing to socio-economic activities, by constructing bridges in the section between Ile/Nampevo, Zambezia Province, and Cuamba, Niassa Province.

Grant Limit / Actual Grant Amount	3,937 million yen (initial grant limit) 5,173 million yen (revised grant limit) 5,033 million yen (actual) ²
Exchange of Notes Date /Grant Agreement Date	December 10, 2012 (detailed design) E/N and G/A June 14, 2013 (initial) E/N and G/A November 11, 2015 (revision of the project period) ³ G/A

¹ Total road length per unit area of the national land

² The grant limit includes 132 million yen for the Detailed Design. The actual amount is the sum of the actual payment JPY 130,225,000 (Japanese yen) for the Detailed Design, consulting fee JPY 280,231,000 finally agreed (August 18, 2017) and construction fee JPY 4,623,429,000 finally agreed (August 18, 2017) (Source of the actual amount: documents provided by JICA).

³ The deadline of the project period was extended from May 2016 to August 2017 (Source: documents provided by JICA).

	July 20, 2016 (revision of grant limit) ⁴ E/N and G/A
Executing Agency	National Road Administration (ANE)
Project Completion	November 2017
Target Area	Zambezia and Niassa Provinces
Main Contractors	Konoike Construction Co., Ltd. and Daiho Corporation (JV)
Main Consultants	Chodai Co., Ltd. and Eight-Japan Engineering Consultants Inc. (JV)
Procurement Agency	NA
Preparatory Survey	March 2010 – December 2011
Related Projects	<p><u>JICA Technical Cooperation Project:</u> The Project for the Capacity Development of road maintenance in the Republic of Mozambique (August 2011 – August 2014)</p> <p><u>Other donors:</u> Islamic Development Bank (IDB): Improvement of the Section between Nampevo and Gurue (Loan, 2003) IDB: Improvement of the Section between Gurue and Magige (Loan, 2011) Government of Portugal: Improvement of the Section between Magige and Cuamba (Loan, 2011 – 2014)</p>

2. Outline of the Evaluation Study

2.1 External Evaluator

Makoto Tanaka, ICONS Inc.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted according to the following schedule.

Duration of the Study: October 2020 – February 2022

Duration of the Field Study: April 25 – May 8 and August 22 – August 28, 2021

2.3 Constraints during the Evaluation Study

The field study was implemented using only local assistants, as the Japanese Evaluator could not visit the country owing to the worldwide spread of COVID-19. Information on the governance and financial status of the National Road Administration (hereinafter referred to as “ANE”) could not be acquired because no answers to the questionnaire survey were given, and no interview could be implemented with the Ministry of Public Works, Housing, and Water Resources (hereinafter referred to as “MOPHRH”), the supervising ministry of the ANE, that is, the implementing organization of the project.

⁴ The grant limit of the main part was increased from 3,805 million yen to 5,041 million yen (Source: the Ministry of Foreign Affairs of Japan and documents provided by JICA).

3. Results of the Evaluation (Overall Rating: B⁵)

3.1 Relevance (Rating: ③⁶)

3.1.1 Consistency with the Development Plan of Mozambique

At the time of planning, the most important national policy of Mozambique aimed at poverty reduction: *The Action Plan for the Reduction of Poverty* (PARP: 2011–2014) positioned construction of local infrastructures as an important sector, including the Road Sector Strategy (2007–2011, hereinafter referred to as “RSS”) for the road traffic sector. The RSS positioned the target section as an important corridor running through the mid-northern part of the country. This section was designated to be constructed with the highest priority, as it forms a road network combined with the Nacala Corridor, connecting Nacala Port and Malawi and Zambia, and National Route No. 1, the main north-south route of Mozambique. These have contributed to the development of poverty areas with high agricultural potential in the country.

At the time of the ex-post evaluation, the basic development policy of Mozambique was shown in the *2020–2024 Five-Year Plan of the Government* (hereinafter referred to as “PQG 2020–2024”). PQG 2020–2024 aims to provide a “diversified and competitive economy” by providing many opportunities for income and employment for the young, including (1) agricultural production, (2) social and economic infrastructure, (3) fishery and aquaculture, (4) tourism, and (5) mining as important items. Infrastructure is designated as the second of the five important items in the development policy in PQG 2020–2024, and remains one of the most important topics in the development policy of Mozambique, even at the time of the ex-post evaluation.

3.1.2 Consistency with the Development Needs of Mozambique

At the time of planning, agriculture was the main industry in the target area. The area had a high potential for agriculture, owing to plenty of rainfall and rich soil. However, access to markets was difficult due to the lack of roads and bridges in the target section: this substantially affected the handling of agricultural products. The project aimed to construct bridges urgently from the viewpoint of the following human security aspects.

- Many poor people lived in the target area (Zambezia and Niassa Provinces), most of whom were engaged in agriculture. To effectively develop the agriculture sector, the construction of the road network was required.
- The daily life of residents around the target section was affected in terms of commutes, hospital visits, and emergency transport, owing to the lack of appropriate bridges. Thus, the construction of bridges was required to improve their lives.
- Many accidents occurred on the bridges, and the most of them could be avoided by

⁵ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁶ ③: High, ②: Fair, ①: Low

broadening the bridges from one lane to two.

- Certain bridges faced risks of falling, in which case they required replacement.

As described above, the Niassa Corridor connecting Ile/Nampevo and Cuamba plays an important role for domestic, arterial, and industrial roads. However, the traffic has previously been suspended on the bridges in this section, owing to river floods during the rainy seasons. Some of the sections ensured traffic mobility using temporary bridges, but these were not durable. In addition, there were subsections suspended in the rainy seasons and with many traffic accidents owing to the narrowing at bridges. It was urgently necessary to improve these issues. In particular, it was judged that the necessity of the project was high, as ensuring a passable state was necessary to improve issues of disrupted commutation, traffic accidents, the risk of falling bridges, and agricultural development.

At the time of the ex-post evaluation, the section between Ile/Nampevo and Cuamba was an important artery for Niassa Province to send agricultural products and other materials to Zambezia Province and the coastal area. For example, in Cuamba District of Niassa Province, at the end of the target section on the side of Niassa, 72,874 households (84% of the population) were engaged in agriculture, producing 563,505 tons of food crops and 521,766 tons of cash crops, and gaining MZN⁷ 22,000 of income in 2019. In Ile District of Zambezia Province, at the end of the target section on the side of Zambezia, 43,869 people (of the total population of 186,446) were engaged in agriculture, sending 88,368 tons of agricultural products (including 6,392 tons of cash crops) in the period from September 2020 to September 2021 via roads, including the bridges targeted in the project. In Gurue District of Zambezia Province (population: 430,085), 320,993 tons of agricultural products (including 31,471 tons of cash crops) were handled and 43,952 tons (including 26,298 tons of cash crops) were transported to the outside of the district via roads, including the bridges targeted in the project⁸. In 2020, the National Institute of Statistics (INE) released the population and agricultural production statistics for the three districts along the target section (Ile and Gurue Districts of Zambezia Province and Cuamba District of Niassa Province); these are listed in Table 1.

Table 1. Population and Agricultural Production in the Three Provinces along the Section (2020)

Province	Population	Agricultural population	Agricultural production (ton)				Total
			Maize	Rice	Pigeon pea	Soybean	
Ile	318,880	184,950	5,124	1,915	2,750	1	9,790
Gurue	500,531	400,425	24,919	1,621	8,144	9,473	44,157
Cuamba	264,225	166,462	19,421	365	1,692	358	21,836
Total	1,083,636	751,837	49,464	3,901	12,586	9,832	75,783
Nationwide	29,300,000	NA	1,451,686	179,836	168,714	NA	NA

⁷ MZN stands for meticaís (singular: metical), the Mozambican currency: MZN 1 was equivalent to approximately JPY 1.42 as of the end of 2020.

⁸ Source of the above: results of an interview with the Ministry of Agriculture and Rural Development (MADER)

As described above, the target section plays an important role in agriculture in the northern part of Mozambique: accordingly, the project meets the development needs.

3.1.3 Consistency with Japan's ODA Policy

At the time of the planning, Japan's "Country Assistance Policy for the Republic of Mozambique" (March 2013) indicated that it was the most effective approach to promoting the development of the Nacala Corridor, and it was the most effective approach in Japan's development assistance for Mozambique. A variety of projects were implemented, such as the project, "Upgrading of Cuamba-Nampula Road," and "Agricultural Development of the African Tropical Savanna" as part of "Programme of Development and Rehabilitation of the Nacala Corridor." As is clear from the overall program, the target of the project was positioned as an important artery for the transport and traffic sector. The project aimed to contribute to reducing poverty in Mozambique by constructing a triangular road network including the Niassa Corridor, and was also consistent with Japan's assistance policy for Mozambique. The project agreed with the most important sector of assistance, i.e., the "Activation of Local Economy" and the cooperation program of the highest priority, i.e., the "Programme of Development and Rehabilitation of the Nacala Corridor" in the analysis paper of JICA at the time of the planning. It was also positioned in the "Programme of Development of Economic Infrastructure." The project also contributed to the achievement of the "Construction and Amplification of Domestic and Wide-area Economy" goal listed in the Fourth Tokyo International Conference on African Development (TICAD IV, 2008).

From the above, it can be seen that the project has been highly relevant to Mozambique's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The planned outputs of the project were new construction of 13 bridges (length: 15 – 105 m) and culverts⁹ and the replacement, widening, rehabilitation, and reinforcement of existing bridges in the target section as civil works, along with providing detailed design and construction management as consulting services. The planned outputs of the civil works (at the preparatory survey) are listed in Table 2, and the differences between the planned and actual outputs are listed in Table 3.

⁹ A culvert is an underground drain. In the Project, it is expected to use rectangular (box) or tube (pipe) culverts to pass river water and to serve their top as roads.

Table 2. Planned Outputs of Civil Works of the Project (at the Preparatory Survey)

	Bridges	Handling	Width (m)	Length (m)	Approach road (m)
1	Mutabasse	Replacement	9.6	105	335
2	Muliquela	Widening, rehabilitation and reinforcement of the existing bridge	5.2	70	335
3	Matacasse	Replacement	9.6	15	345
4	Lua	Widening, rehabilitation and reinforcement of the existing bridge	5.2	50	530
5	Ualasse	Replacement	9.6	15	205
6	Licungo	Replacement	9.6	35	440
7	Nivaco	Replacement	9.6	30	330
8	Matsitse	Replacement	9.6	15	325
9	Namisagua	Replacement	9.6	15	285
10	Nuhusse	Replacement	9.6	35	415
11	Lurio	New construction	9.6	70	430
12	Muassi	Replacement	9.6	15	265
13	Namutimbua	Replacement	9.6	30	430

Source: documents provided by JICA, etc.

Table 3. Differences of Outputs of Planned Civil Works (at the Preparatory Survey) and Actual Works of the Project

	Bridges	Approach road (m)			Revision other than approach roads	
		Planned	Actual	Difference	At the completion of the Detailed Design	During the Project
1	Mutabasse	335	545.7	+210.7	Abutment height 8.5 → 10 m	Revetment added
2	Muliquela	335	370.2	+35.2	Width 5.2 → 5.35 m Abutment height 8→10 m	Revetment added Railing of the existing bridge restored
3	Matacasse	345	308.0	-37.0		
4	Lua	530	541.9	+11.9	Width 5.2 → 5.35 m	Revetment added
5	Ualasse	205	205.0	±0.0		
6	Licungo	440	398.0	-42.0		
7	Nivaco	330	350.0	+20.0	Pipe culvert deleted	Revetment added
8	Matsitse	325	305.0	-20.0		
9	Namisagua	285	285.0	±0.0		
10	Nuhusse	415	415.0	±0.0	Abutment height 13.5 → 8 m	Revetment added
11	Lurio	430	448.1	+18.1		
12	Muassi	265	311.5	+46.5		
13	Namutimbua	430	464.9	+34.9		
	Total	4,670	4,948.3	+278.3		

Source: documents provided by JICA

All outputs expected by the ANE were achieved. As listed in Tables 2 and 3, there are slight differences between the planned and actual outputs. Some of the designs for the approach roads were changed at the completion of the detailed design, and some changed during the project. The reasons for the changes at the completion of the detailed design were as follows: revisions in the replacement concrete (Mutabasse and Muliquela: changes in the abutment heights), confirmation

of rock outcrops (Nuhusse: change in the abutment height), revisions of the technical standard (Muliquela and Lua: changes in the width), and a lack of need owing to road rehabilitation by the Islamic Development Bank (hereinafter referred to as “IDB”) (Nivaco: pipe culvert deleted).

In January 2015, during the project period, a large-scale flood occurred in central Mozambique, affecting the construction materials, temporary bridges, and abutments under construction. The roads to the target sites were occluded, causing a long period of construction suspension, resulting in the additional costs for rehabilitation from the disaster and construction management during the suspension. Thus, an extension of the project period and increment of the grant limit were agreed to in November 2015 and July 2016, respectively. Accordingly, the alignments of the approach roads were changed, and construction works such as revetment works were added as listed in the right column “During the Project” in Table 3. In addition, an additional grant compensated for the re-restoration (all of them were earthworks for rehabilitation) of the re-affected river-crossings of the bypasses for the dry seasons of three bridges not targeted in the project (in the domain of the ANE), as they were necessary for resuming the construction works of the project.

As a consulting service, detailed design and construction management tasks were performed as planned, along with handling of the flood as described above.

3.2.2 Project Inputs

3.2.2.1 Project Cost

In the original plan, the grant limit on the Japanese side was JPY 3,937 million (including JPY 132 million for the detailed design), whereas the revised limit was JPY 5,173 million (ibid.). The actual disbursement from the Japanese side was JPY 5,033 million¹⁰, 128% of the original plan and 97% of the revised plan.

As a consequence of the above-mentioned flood in January 2015, the contractor notified the ANE that construction should be suspended, because it was impossible to continue the construction works under the situation. After this notification, the ANE, JICA, Japanese consultant, and contractor discussed together and signed the Grant Agreement (G/A) to extend the project period in November 2015, and the Exchange of Notes (E/N) and G/A for increasing the grant limit in July 2016, respectively. The original design of the 13 target bridges and their access roads conformed to the standards of the ANE and the Southern Africa Transport and Communications Commission (SATCC)¹¹, depending on the peak flow rates and planned water levels corresponding to the dimensions of the rivers (source: documents provided by JICA). As the flood disaster in January 2015 exceeded expectations, this is considered as an “external factor”

¹⁰ See "1.2 Project Outline" for the basis of the calculation.

¹¹ The SATCC is one of the sector committees of the South African Development Community (SADC) established in April 1980, to which 9 countries in the Southern Africa (Source: article on the SATCC by the Union of International Association (UIA), <https://uia.org/s/or/en/1100061374>, browsed on June 28, 2021).

as described in the *Ex-post Evaluation Reference*. Therefore, the grant limit and project period in the E/N and G/A as revised owing to the flood are assumed as the planned values for evaluation, and should be compared with the actual values to evaluate the efficiency. Under this consideration, the project cost is 97% of the planned cost, and is within the plan.

The costs burdened by the Mozambican side were approximately JPY 260 million, and all of the general and specific items for the Mozambican side were implemented as planned¹².

3.2.2.2 Project Period

In the original plan, the project period was 3 years and 0 months (36 months) from June 2013 to May 2015¹³. The plan revised after the flood in January 2015 extended the project deadline to August 2017, making the project period 4 years and 3 months (51 months). The actual period was 54 months, from June 2013 to November 2017. According to the ANE Headquarters, the reasons of the extension were not only because the suspension of the constructions of the 13 target bridges and their design changes, but also because the roads used for the construction were unable to be passed through, and the corresponding restoration works took time. The ANE therefore recognized that there were legitimate reasons for the extension. In reference to documents provided by JICA and the results of interviews with the Japanese consultant, the factors causing the extension were as follows.

- As a consequence of the flood in January 2015, the contractor notified the ANE in February 2015 that the construction should be suspended, because it was impossible to continue the construction works under that situation. After this notification, the ANE, JICA, Japanese consultant, and contractor discussed options together.
- The flood affected existing roads and bridges out of the project scope that were nevertheless used for transporting materials for the project. The restoration of these existing out-of-scope roads and bridges was necessary to restart the construction immediately.
- The costs for the above should have been disbursed: they were released by tentatively omitting items planned in the later part of the original scope, because the E/N for increasing the grant limit required additional time.
- After the G/A for extending the period in November 2015, the E/N and G/A were serially updated to increase the grant limit in July 2016, one and a half years after the flood. The tentatively omitted portions of the original scope were linearly revived afterward.
- As mentioned above, the original design for the 13 target bridges and their access roads conformed to the standards of the ANE and SATCC, depending on the peak flow rates and

¹² However, no reference was located to confirm the amount disbursed by the Mozambican side.

¹³ The ex-ante evaluation paper does not state the period from the end of the Detailed Design to the signing on the G/A of the main part. This evaluation study adopts 36 months as the period, counting the planned period of the main part except the Detailed Design, including the start and end of the period as one month each.

planned water levels corresponding to the dimensions of the rivers. The flood disaster in January 2015 exceeded the expectations of these standards.

The actual period was 106% of the planned period even when the period of 51 months in the revised plan was adopted, thereby exceeding the plan. According to the results of an interview with the Japanese consultant, the reasons were as follows.

- The main reason was a change in the alignment of the access roads. They were changed because of ANE requirements in February 2017 during the construction, and corresponded to a strong request from the Mozambican Government in March 2017 to prevent overturning and the pushing-off of badly serviced trailers often happened in the target section. As some of the construction tasks were premised on the alignment before the changes, some critical path works¹⁴ needed to be revised owing to the changes in the alignment, resulting in a 3.3-month extension of the period.
- The work for changing the alignment was planned to start in April 2017, but started in May instead, so as to wait for the end of the rainy season.
- The changes in the alignment required extensions of the approach roads, resulting in an increasing quantity of work on the road structures.
- The changes required removal of the existing road structures in sections already constructed.

From the above, although the project cost was within the plan, the project period exceeded the plan. Therefore, the efficiency of the project is fair.

3.3 Effectiveness and Impacts¹⁵ (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The “Summary of Ex-Ante Evaluation Results” lists the travel time between Nampevo and Cuamba (ordinary car, hour), traffic quantity (ordinary and large vehicles) and annual occlusion period (months) as the quantitative effects. They are classified as into operation and effect indicators, and assumed Operation Indicator (1) Traffic quantity (ordinary and large vehicles), Effect Indicator (1) Travel time between Nampevo and Cuamba (ordinary car), and Effect Indicator (2) Annual occlusion period. The results for the quantitative indicators are listed in Table 4.

¹⁴ A critical path is a work path, or a process that is critical, or the most important for minimizing the period of a whole project. The delay in the work on the critical path results in the delay in the whole project period.

¹⁵ Sub-rating for Effectiveness is considered in combination with Impacts.

Table 4. Achievement of the Quantitative Indicators

	Baseline 2011	Target 2019 (3 years after completion)	Actual ^{*1}			
			2017	2018	2019 (2 years after completion)	2021 (4 years after completion)
Operation Indicator (1) Traffic quantity (vehicles/day) ^{*2}	278	438	429	339	284	NA
Effect Indicator (1) Travel time between Nampevo and Cuamba (ordinary car)	7 h	5 h	NA	NA	NA	6 h 11 min ^{*3}
Effect Indicator (2) Annual occlusion period	Average approximately 1 – 2 months per year ^{*4}	0	0	0	0	0

*1: The target values are assumed to be those in 2019 because the planned completion of the period was in May 2016; they should be the values in 2020, three years after the actual completion in November 2017. However, the indicators in this ex-post evaluation, such as traffic quantity, were thought to be severely affected by the hindrance of the economy caused by the spread of COVID-19 that started in February 2020. Therefore, the values in 2019 are adopted for Operation Indicator (1) and Effect Indicator (2) as the actual values. Regarding Effect Indicator (1), the actual value is assumed to be the one obtained by the method of *3 because no actual values were available from the existing data. At the time of the ex-post evaluation, the data for 2020 have not yet been added.

*2: Regarding the calculation method, see Table 5.

*3: The local assistant measured by driving through a 4WD car in August 2021 (in the dry season).

*4: It was estimated that there was an average of two to four overflows on bridges or culverts per year in the rainy season. Considering the local conditions, restoration and resumption require approximately two weeks. Hence, the target section was thought to be occluded on average for one or two months per year.

Source: documents provided by the ANE, etc.

Operation Indicator (1): Traffic quantity

The ANE provides the number of passing vehicles in the target section. The results are summarized in Table 5.

Table 5. Number of Passing Vehicles in the Target Section

		Average number of daily passing vehicles ^{*1*2}			
		Nampevo – Gurue (110 km)	Gurue – Magige (49 km)	Magige – Cuamba (84 km)	Nampevo – Cuamba (243 km)
Baseline (2011)		–	–	–	278
Target (2019)		–	–	–	438
Actual	2013	517	NA	122	NA
	2014	487	NA	361	NA
	2015	158	32	259	173
	2016	554	131	412	433
	2017	509	126	471	429
	2018	483	173	211	339
	2019	382	129	221	284

*1: The provided data are the number of passing vehicles through each of the five subsections between Nampevo and Gurue, three subsections between Gurue and Magige, and three subsections between Magige and Cuamba, which are calculated by multiplying these by the length of each subsection divided by the total length. Such calculation methods are generally utilized to evaluate traffic quantities. Both the baseline and target values were obtained using the same method.

*2: There are five bridges of Mutabasse, Muliquela, Matabasse, Lua, and Ualasse in the section between Nampevo and Gurue, two of Licungo and Nivaco between Gurue and Magige, and six of Matsitse, Namisagua, Nuhusse, Lurio, Muassi, and Namutimbua between Magige and Cuamba. Lurio Bridge is located just between Zambezia and Niassa Provinces.

Source: prepared by the Evaluator, based on data from the ANE

Table 5 shows that the number of passing vehicles tends to decrease after 2016. The section between Nampevo and Gurue was rehabilitated in 2003, and again between Gurue and Magige in 2011, both by loan from IDB. These sections have at least one lane for one-way travel and are fully paved. The section between Magige and Cuamba was planned to be rehabilitated by the loan from the Government of Portugal, but even at the time of the ex-post evaluation after the planned completion in 2014, the rehabilitation was not completed in that year and is not even now, and it was difficult for large vehicles to pass through this section (impassable in the rainy seasons), as shown in Photo 1. Large vehicles generally bypass this section by utilizing another route in the east. Accordingly, logistics companies want the route expected for the project to be passable (source: results of interviews with the ANE Zambezia and Niassa Delegations, and logistics companies). Increases in the number of passing vehicles through this section seem to be hindered by the fact that many passengers and logistics companies utilize another bypass route.

According to the ANE, which provides the data, the data includes the number of construction vehicles in the project. All 13 target bridges were made with concrete¹⁶; accordingly, several or tens of vehicles ran in the section transporting fresh concrete and other materials during the construction. It is estimated that the number of passing vehicles decreased after the project completion, because there was no car passing through the road to deliver the materials to the

¹⁶ As for the bridges constructed in the Project, Mutabasse, Muliquela, Lua, Licungo, Nuhusse, and Lurio Bridges are post tension T-girder bridges, and Matabasse, Ualasse, Nivaco, Matsitse, Namisagua, Muassi, and Namutimbua Bridges are reinforced concrete (RC) hollow slab bridges (Source: documents provided by JICA).

construction site.

From the above, Operation Indicator (1) has not been achieved.



Photo 1. Example of road condition between Magige and Cuamba

Effect Indicator (1): Travel time between Nampevo and Cuamba (ordinary car)

In the ex-ante evaluation of the project, it was expected that the construction of the 13 target bridges would shorten the travel time between Nampevo, Gurue, and Cuamba from 7 hours (baseline value) in 2011 to 5 hours (target value) in 2019, 3 years after the completion of the project.

In the ex-post evaluation, the local assistant drove through the target section with a 4WD car and recorded the travel time, as listed in Table 6.

Table 6. Travel Time of the Target Section by 4WD Car

	Nampevo – Gurue (110 km)	Gurue – Magige (49 km)	Magige – Cuamba (84 km)	Nampevo – Cuamba (243 km)
Travel time* ¹	2 h 0 min	31 min	3 h 40 min	6 h 11 min
Schedule speed* ²	55 km/h	95 km/h	23 km/h	39 km/h

*1: The local assistant drove from Cuamba to Magige, from Magige to Gurue, and from Gurue to Nampevo in the daytime in August 2021, during the dry season. The listed times are the differences between departure and arrival times.

*2: The schedule speed is the travel distance divided by the total travel time.

Source: record of actual driving by the local assistant

As shown in Table 6, it took 6 hours and 11 minutes to travel through the target section with a 4WD car in the dry season. It was estimated that it would take 8 or 9 hours to travel through the section in the rainy season, because the travel time between Magige and Cuamba would become much longer. From the above, the project has not achieved the Effect Indicator (1).

Four important assumptions were assumed for the achievement of the Project Purpose: “Mozambique's political situation and public security do not worsen”; “No natural disaster occurs that cause significant changes in the design conditions”; “Mozambique's national development plan and policy on roads and bridges are not changed”; and “Road rehabilitation projects in the target section by IDB and the Government of Portugal are implemented and completed as planned.” According to the ANE, two of the four important assumptions were satisfied: “Mozambique's political situation and public security do not worsen” and “Mozambique's national development plan and policy on roads and bridges are not changed.” The assumption that “No natural disaster occurs that cause significant changes in the design conditions” was satisfied because the traffic quantity (as an effect indicator) depended on the revised plan, although the flood in January 2015 was a natural disaster causing changes in the design conditions. In contrast, “Road rehabilitation projects in the target section by IDB and the Government of Portugal are implemented and completed as planned” has not been satisfied, because the road rehabilitation between Magige and Cuamba, a portion being performed by the Government of Portugal, has not been completed yet (thereby affecting the unachieved indicator of the traffic quantity).

Effect Indicator (2): Annual occlusion period

In 2011, before the project, it was estimated that there were an average of two to four overflows on bridges or culverts per year in the rainy seasons between Nampevo, Gurue, and Cuamba, the target section. Considering the local conditions, restoration and resumption require approximately two weeks. Hence, the target section was thought to be occluded on average for 1 or 2 months per year (baseline value). It was expected that the section would become passable throughout the year with no occlusion, because the plan considered sufficient freeboard under the target bridges, that is, the annual occlusion period was expected to be zero (target value) in 2019, 3 years after the completion.

According to the ANE Zambezia and Niassa Delegations, no traffic occlusion has occurred since the completion of the project. From the above, it is judged that Effect Indicator (2) has been achieved.

3.3.1.2 Qualitative Effects (Other Effects)

The Summary of Ex-Ante Evaluation Results lists the following qualitative effects: (1) “the risks of overhead flooding and falling are resolved, which contributes to ensuring safe and stable transport for pedestrians and drivers”; (2) “access of inhabitants to markets and public services, etc., is improved by ensuring stable transport”; and (3) “improvement of road condition is expected to contribute economic development in the area by enabling stable and efficient transport of people and materials.” These statements seem redundant, and it is difficult to judge the achievements objectively, as the short-term outcomes (related to the effectiveness) and mid- and

long-term outcomes (related to the impacts) can be easily confused. Therefore, only (1) (of (1), (2) and (3) above) is considered as a short-term outcome to be used to evaluate and judge the effectiveness, and (2) and (3) are assumed as qualitative indicators of the impacts.

According to the ANE Zambezia and Niassa Delegations, no traffic occlusion caused by natural disasters has occurred since the completion of the project. Inhabitants living in the vicinities of the Lurio, Muassi, and Namutimbua bridges¹⁷ said that they feared that the old bridges used before the project would collapse, but such concerns have been resolved.

There were large-scale rainfalls on February 10 and March 25, 2017, just before the completion of the project. Roads to the target bridges were occluded and transport of materials became impossible owing to these rainfall events, but the bridges were not affected at all (source: documents provided by JICA). As drawn from this rainfall event, it is evident that the possibility of overhead flooding has significantly decreased. For reference, the estimated rainfall in 2021 in the three provinces along the target section (Ile and Gurue Districts of Zambezia Province, and Cuamba District of Niassa Province) are shown in Table 7. The table shows that the maximum monthly rainfall is approximately 200 mm in January. The target bridges are thought not to be affected severely by these estimated rainfall events, as they were not affected by the above-mentioned heavy rainfalls, in which there were almost monthly quantities of rain in one day each.

Table 7. Estimated Rainfalls in 2021 in the Three Districts along the Target Section

Month		1	2	3	4	5	6	7	8	9	10	11	12
Rainfall (mm)	Ile	196	172	105	29	4	3	5	3	2	27	58	158
	Gurue	196	172	105	29	4	3	5	3	2	27	58	158
	Cuamba	196	163	113	25	6	1	1	0	1	16	62	163
Rainy Days	Ile	23	23	21	13	5	5	6	3	3	8	13	21
	Gurue	23	23	21	13	5	5	6	3	3	8	13	21
	Cuamba	29	26	25	15	6	2	3	1	2	7	14	27
Sunny Days	Ile	8	5	10	17	26	25	25	28	27	23	17	10
	Gurue	8	5	10	17	26	25	25	28	27	23	17	10
	Cuamba	2	2	6	15	25	28	28	30	28	24	16	4

Source: Estimation by Meteoblue, a private meteorology company

From the above, it is judged that the qualitative effect (1) of the effectiveness has been achieved.

¹⁷ In this ex-post evaluation, each 10 households were selected and interviewed in Zambezia and Niassa Provinces.

3.3.2 Impacts

3.3.2.1 Intended Impacts

At the planning of the project, the following were listed as quantitative effects: a decrease in transport costs, and an economic effect on the agricultural sector. The following were listed as qualitative effects: the strengthening of the road networks, an improvement of basic living conditions, a decrease in traffic accidents, the resolution of disaster risks, and benefits to poor people.

(1) Quantitative effects

The Preparatory Survey (2nd) Report assumed the following for the quantitative effects (decrease in transport costs and economic effect on the agricultural sector):

- Gross national income (GNI) in the agricultural sector in the target area: USD 146 million (calculated from GNI per capita USD 440, and contribution rate to the agricultural sector of 43%)
- Economic effect for 20 years after the project period: USD 389 million (calculated from estimated annual increase rate 5% in Economic and Social Plan 2011 (PES 2011))

However, no information was obtained on the GNI of the target region in the agricultural sector or on its economic effects. In addition, evidence for the calculation of these indicators is not available. Transporters along the target section (each one in Ile, Magige, and Cuamba) state that they do not feel the project lowers their transport costs because, in most cases, they utilize another route in the east to avoid the section between Magige and Cuamba, as it is in a bad condition, when they move between Ile and Cuamba. In contrast, the ANE Zambezia and Niassa Delegations think that the completion of the project made access to Niassa Province and Cuamba from outside easier, and that it activated distribution of agricultural products produced in the province.

(2) Qualitative effects

In this ex-post evaluation, two indicators of the effectiveness described in the Summary of Ex-Ante Evaluation Results are summarized into indicators of the impacts. In particular, the effectiveness indicators “access of inhabitants to markets and public services, etc., is improved by ensuring stable transport” and “improvement of road conditions is expected to contribute to economic development in the area by enabling stable and efficient transport of people and material” are summarized into the impact indicators of “strengthening of road network” and “activation of economic and social activities”, respectively. There are other indicators of the impacts: “improvement of basic living conditions,” “decrease in traffic accidents” “resolution of disaster risks,” and “benefits to poor people.” Those indicators are discussed further below.

The completion of the project made access to Niassa Province and Cuamba from outside easier, and activated distribution of agricultural products produced in the province. However, the large-scale transport of agricultural products remains an issue to be addressed, because it is difficult for large-scale vehicles to pass through the section from Cuamba to Gurue, where unpaved subsections remain (source: results of interviews with the ANE Zambezia and Niassa Delegations).

The achievements regarding the six indicators are described as follows. Some have been achieved, and others have been partly achieved¹⁸.

- Strengthening of road network: The improvement of road network by the project was pointed out by the following interviewees: the ANE Headquarters and Zambezia and Niassa Delegations, a transporter in Cuamba and one in Gurue, an agricultural product exporter in Cuamba, and inhabitants of Cuamba and Gurue (source: result of each interview). However, large vehicles utilize another route that is longer than the target section between Gurue and Cuamba where unpaved subsections remain; this is because the latter becomes unpassable for large vehicles in the rainy season (source: results of interviews with two transporters in Cuamba). From the above, it is judged that this indicator has been partly achieved.
- Improvement of basic living conditions: Inhabitants near Lurio, Muassi, and Namutimbua Bridges in Niassa Province reported that the project contributed to the improvement of access from their residents to the market and the activation of socio-economic activities, but the bad conditions of the road between Gurue and Cuamba hindered the increases in their income (source: results of interviews with inhabitants in Niassa Province). In contrast, inhabitants in Gurue pointed out similar positive effects, but they did not report any hindering factors, which depended on the bad road conditions between Gurue and Cuamba (source: results of interviews with inhabitants in Gurue). From the above, it is judged that this indicator has been partly achieved.
- Decrease in traffic accidents: The project removed a sharp curve previously existing in the approach road of Ualasse Bridge, providing better driving safety (source: results of an interview with transporters in Gurue). Ualasse and Mutabasse Bridges were difficult to see from their approach roads; this had caused many head-on collisions by cars, as drivers could not recognize that there had been only one lane on each bridge. The project removed this cause of similar accidents by making these two bridges two-laned. From the above, it is judged that this indicator has been achieved.
- Resolution of disaster risks: There were large-scale rainfalls on the 10th of February and the 25th of March 2017, just before the completion of the project, but the bridges were not

¹⁸ The ANE, as the managing body of road infrastructures, recognizes that the expected impacts have not yet been achieved, as the section of road between Magige and Cuamba is still to be completed. Indeed, the ANE continues making efforts to seek funds to complete the construction works of the referred road section.

affected at all (source: documents provided by JICA). It is thought that there will be less possibility of the road network being cut at bridges by heavy rainfall relative to the period before the project, provided that the bridges are appropriately maintained hereafter. From the above, it is judged that this indicator has been achieved.

- Benefits to poor people, and the activation of economic and social activities: The project improved the transport of maize, soybean, and other beans, thereby benefiting the poorer local farmers. The agricultural economy in Niassa Province is expected to improve substantially if the road conditions between Gurue and Cuamba are improved (source: result of an interview with an agricultural product exporter in Cuamba). Although the effect of the project has not been maximized owing to the bad conditions in some access roads, the construction of the bridges has substantially enhanced local economic activities (source: result of interviews with transporters in Gurue). The project made previously unpassable bridges passable for large vehicles, enabling the development of agricultural product markets and increases in exports (source: result of an interview with an agricultural product exporter in Gurue). From the above, it is judged that these two indicators have been partly achieved.

3.3.2.2 Other Positive and Negative Impacts

In addition to the quantitative and qualitative effects described in Section 3.3.2.1, the evaluation study also examined (1) impacts on the natural environment, (2) resettlement and land acquisitions, and (3) other impacts.

(1) Impacts on the Natural Environment

According to “*JICA guidelines for environmental and social considerations*” (established in April 2010), it was judged that adverse impacts from the project on the environment were minimal, considering the characteristics of the sector, project, and project site; the project is not categorized in large-scale projects in the sector of bridges, and was classified as a Category B project.

In addition, an environmental impact assessment of the project was approved in June 2012 by the Ministry for the Coordination of Environmental Affairs (MICOA) of Mozambique. The Summary of Ex-Ante Evaluation Results predicted that the target area would not be in sensitive areas such as national parks and their surroundings, and that the adverse impacts on the natural environment would be minimal. All projects by the ANE are preceded by environmental studies. The ANE studied the impacts on the environment in the designated way, and implemented the environmental countermeasures requested there (source: results of interviews with the ANE Headquarters and Zambezia Delegation). The ANE Headquarters indicated that all environmental measures have been taken in such a way that there have been no environmental problems. None of the interviewed inhabitants insisted on any concerns regarding the environment.

From the above, it is expected that the project will have no negative impacts on the natural

environment.

(2) Resettlement and Land Acquisition

The ex-ante evaluation indicated that the project required a very small-scale acquisition of lands that were previously farmlands, and that the land acquisition should be executed following the domestic procedure. At the time of planning, it was expected that the land acquisition necessary for the project would cause resettlement¹⁹ and require compensation for the farmlands along the target section. Therefore, the ANE commenced the designated procedure of land acquisition and resettlement, but there were no cases of acquisition of houses and farmlands (source: results of interviews with the ANE Headquarters and Zambezia and Niassa Delegations). Consequently, the ANE did not compensate or provide disbursements for any land acquisition in fact (source: answers to the questionnaire to the ANE Headquarters). The ANE Headquarters explained that this was because there were no inhabitants near the 13 target bridges.

From the above, it is expected that the project has caused no cases of land acquisition and resettlement.

(3) Other Impacts

There were no gender-related issues reported in the related references and the interviews with the ANE, transporters, and inhabitants. It is judged that there were no positive or negative impacts related to gender.

The indicators and whether they have been achieved are summarized in Table 8.

Table 8. Achievement of the Indicators for the Effectiveness and Impacts

Indicators	Type of indicator	Achievement	Remarks
Traffic quantity (ordinary and large vehicles)	Quantitative effect of the effectiveness, operation indicator	not achieved	The portion by the Government of Portugal has not been achieved in the important assumption "Road rehabilitation projects in the target section by IDB and the Government of Portugal are implemented and completed as planned."
Travel time between Nampevo and Cuamba (ordinary vehicles)	Quantitative effect of the effectiveness, effect indicator	not achieved	Same as the above
Annual occlusion period	Quantitative effect of the effectiveness, effect indicator	achieved	
Risk of overhead	Qualitative effect of	achieved	

¹⁹ There was a possibility of resettlement for three households in the vicinity of Lua Bridge (Source: Preparatory Survey Report).

flooding and bridge collapse	the effectiveness		
Decrease in transport costs	Quantitative effect of the impacts	unknown	Positive effect
Economic effect on the agricultural sector	Quantitative effect of the impacts	unknown	Although the indicator is not available, positive effect is reported.
Strengthening of road network	Qualitative effect of the impacts	partially achieved	This indicator includes “Access of inhabitants to markets and public services, etc., is improved by ensuring stable transport.”, which was an indicator for qualitative effect of the Project Purpose.
Improvement of basic living conditions	Qualitative effect of the impacts	partially achieved	
Decrease in traffic accidents	Qualitative effect of the impacts	achieved	
Resolution of disaster risks	Qualitative effect of the impacts	achieved	
Benefits to poor people	Qualitative effect of the impacts	partially achieved	
Activation of economic and social activities	Qualitative effect of the impacts	partially achieved	This indicator includes “Improvement of road condition is expected to contribute economic development in the area by enabling stable and efficient transport of people and materials.”, which was an indicator for qualitative effect of the Project Purpose.

From the above, it can be considered that the project has achieved its objectives to some extent. Therefore, the effectiveness and impacts of the project are fair. The reason some of the indicators for the quantitative effects of the effectiveness have not been achieved depends mainly on unsatisfied yet important assumptions.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional/Organizational Aspects of Operation and Maintenance

The target section consists of national roads, the maintenance of which is implemented by the ANE Zambezia and Niassa Delegations. Of these, 29 staff members (25 technical and 4 administrative members) belong to the former, and 23 (17 technical and 6 administrative members) belong to the latter. These numbers did not change from the completion of the project until the ex-post evaluation. When any disorder occurs, the local community reports it, and the ANE engineers confirm the situation. The actual road maintenance works are contracted out to companies selected through designated procedures under the supervision of members. The current number of staff is sufficient (source: answers to the questionnaire from the ANE Headquarters, results of interviews with ANE Zambezia and Niassa Delegations, documents provided by JICA,

etc.).

From the above, no major problems have been observed in the institutional/organizational aspects.

3.4.2 Technical Aspect of Operation and Maintenance

The staff members at the ANE Zambezia and Niassa Delegations were in charge of construction management during the project period, and could confirm the situation of the target. They have sufficient knowledge on structures, including the bridges targeted in the project, and were expected to correspond to problems rapidly. The target section was maintained using the road inspection and maintenance system introduced in Zambezia and Niassa Provinces, which was introduced in Maputo and Gaza Provinces through the JICA technical cooperation project “The Project for the Capacity Development of road maintenance in the Republic of Mozambique” implemented from August 2011 to August 2014 prior to the project. In addition, the technology to use this system was transferred through internal training in the ANE, and consequently, the system was effectively used in Zambezia and Niassa Provinces.

The actual maintenance works are contracted out to companies based on inspection results. There are companies with sufficient technical skills to implement such maintenance works. Therefore, no problems exist in operation and maintenance. The ANE has prepared a manual of daily management, inspection, maintenance, and correspondences to abnormalities, etc., following its internal regulations. A training system for the staff of each delegation has also been established after the completion of “The Project for the Capacity Development of road maintenance in the Republic of Mozambique.” Thus, no problems are seen to exist regarding technical transfer (source of the above: results from an interview with the ANE Headquarters, etc.).

From the above, no major problems have been observed in the technical aspect.

3.4.3 Financial Aspect of Operation and Maintenance

The main maintenance works on the bridges themselves and their access roads as constructed in the project comprise inspection, cleaning, and repair. The ANE bears the costs for maintenance, using subsidies from the Road Fund (hereinafter referred to as “FE”) established by the MOPHRH for financing national roads. The ANE and FE posted the amounts listed in Table 9 as the budgets for daily maintenance of the section, including the 13 target bridges. According to the ANE, the FE will allocate sufficient budget for future maintenance (source: answers to the questionnaire to the ANE). However, no data were obtained on the costs of each bridge or the actual disbursements.

Table 9. Budget for Daily Maintenance of the Target Section

Year	Budget for maintenance (MZN)	Budget for maintenance (USD)*	Remarks
2012	5,473,410.00	185,539	
2013	11,302,210.00	380,290	project period
2014	13,916,888.85	440,966	project period
2015	9,217,919.58	211,130	project period
2016	10,216,418.45	136,492	project period
2017	10,963,954.12	182,672	project period
2018	9,264,786.77	152,156	
2019	9,231,253.23	145,580	

*Converted by the exchange rate for business implementation contracts and business consignment contracts with JICA in December of each year

Source: Answers to the questionnaires to the ANE and FE

The ANE revenues and disbursements from 2017 to 2019 are listed in Table 10. According to this, the revenue and expenditure are almost balanced.

Table 10. ANE Revenue and Expenditure from 2017 to 2019

Year	Revenue (top: MZN, bottom: USD*)	Expenditure (top: MZN, bottom: USD*)	Expenditure / Revenue
2017	836,616,001.60 13,938,954	836,616,001.60 13,938,954	100.00 %
2018	1,588,762,199.96 26,092,334	1,588,762,199.95 26,092,334	100.00 %
2019	923,125,978.49 14,558,040	948,746,890.69 14,962,102	102.78 %

*Converted from Meticais to USD by the exchange rate for business implementation contracts and business consignment contracts with JICA in December of each year

Source: Answers to the questionnaire to the ANE

However, the ANE has not formulated a large-scale repair plan for the 13 target bridges (source: answer to the questionnaire to the ANE). Thus, the ANE must find evidence for posting the budget for the costs of the future large-scale maintenance for each bridge.

From all of the above, no major problems have been observed in the financial aspect.

3.4.4 Status of Operation and Maintenance

Before the project, the target bridges did not ensure stable traffic, because they were temporary bridges with one lane and weight restrictions. The project made them permanent and upgraded the pavements on them and ensured stable traffic, thereby activating markets beside the arterial roads (source: documents provided by JICA). The inhabitants in Gurue and Niassa Provinces who were interviewed answered similarly.

The target section will be maintained in the same scheme as for other national roads, that is, contractors selected by the ANE will implement maintenance works, and the ANE will supervise their work (source: answer to the questionnaire to the ANE). The target section is slotted in the

ANE's maintenance program for all roads in the domain of the ANE, and the 13 target bridges will be maintained along that program (source: result of an interview with the ANE Headquarters). The ANE Zambezia Delegation has formed annual maintenance plans in which the 13 target bridges are slotted (source: result of an interview with the ANE Zambezia Delegation).

In addition, the ANE holds regular meetings with related local authorities so that the local inhabitants respect and preserve road facilities (source: answers to the questionnaire to the ANE).

From the above, the status of the operation and maintenance is good.

From the above, no major problems have been observed in the institutional/organizational, technical, financial aspects and current status of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented with the aim of ensuring safe and stable traffic in the northern part of Mozambique, thereby activating human exchanges and logistics in the area, and contributing to socio-economic activities, by constructing bridges in the section between Ile/Nampevo, Zambezia Province, and Cuamba, Niassa Province. At the commencement and the ex-post evaluation, the project was consistent with Mozambique's policies, such as *The Action Plan for the Reduction of Poverty* and *Road Sector Strategy*, and with the development needs, as represented by handling of agricultural products. Therefore, its relevance is high. The grant limit was increased and the project period was extended as large-scale floods occurred during the project period. Although the project cost was within the revised plan, the project period exceeded the plan. Therefore, its efficiency is fair. Most of the indicators for the expected quantitative and qualitative effects have been achieved without negative impacts. However, certain indicators have not been achieved, as corresponding important assumptions have not been satisfied. Therefore, both its effectiveness and impacts are fair. No major problems are observed in the institutional/organizational, technical, and financial aspects, and the current status of the operation and maintenance system at the time of the ex-post evaluation. Therefore, its sustainability is high.

In light of the above, the project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agencies

(1) Clarification of maintenance plans (to the ANE)

The target section is slotted in the ANE's maintenance program for all roads in the ANE domain. Bridges are part of roads, but as structures, bridges are different from the main bodies of roads, both structures need specific maintenance plans. After a passage of a certain rainy season or

occurrence of an exceptional event, to be sure, the ANE proceeds with a detailed inspection, to identify and quantify the damages on the structure and to propose the subsequent repair works, including estimated costs. To maximize the effects of such efforts, staff should deploy the general road inventory, integrate the maintenance plans for each structure, and clarify the plans for specific structures when forming the maintenance program for all roads in the domain of the ANE. This will help consider what percentage of the limited total budget can be diverted to certain structures, e.g., those for which unexpected maintenance costs exceeding expectations (from the costs for other structures) in the maintenance program should be borne for some reasons. In addition, this will also clarify which structures need regular large-scale maintenance when forming a long-term maintenance program.

(2) Delivery of meteorological data to the ANE (To the MOPHRH)

The risks of overhead flooding and the falling of bridges can be evaluated from the estimated water levels and flow rates of the rivers under these bridges. This behavior of rivers can be estimated from meteorological data. As a large-scale flood occurred in January 2015 during the project period, recent heavy intensive rainfalls and severe disasters are not exceptional in the target area. Therefore, it seems important that estimations of the behaviors of rivers from meteorological data at the time of their designs should be continuously revised for the future maintenance of bridges. For this purpose, it is recommended to build an organizational structure for assisting the ANE in establishing maintenance programs and large-scale repair plans of specific structures by providing meteorological data to the ANE. Specifically, the MOPHRH should refer to meteorological data to estimate the occurrence of meteorological phenomena that may affect road structures, in alliance with the National Directorate of Water Resources Management (DNGRH) inside the Ministry, and the National Institute of Meteorology (INAM), etc., and then provide such data to the ANE. The MOPHRH, from a technical perspective, should also assist the ANE in utilizing meteorological data for predicting future rainfalls, and in revising the data necessary for future management of the 13 target bridges²⁰.

4.2.2 Recommendations to JICA

Confirmation of progress of related projects by other donors for the realization of project effects, etc.

The purpose of the Project was to secure safe and stable transportation in the area between Ile and Nampevo, while the direct output was the development of 13 bridges in the same section. Of the section, the roles were divided between IDB for road development between Ile / Nampevo and Magige, the Portuguese government for road development between Magige and Cuamba, and

²⁰ For example, an upward revision of the design high-water level a river may cause changes in the abutment height or access road alignment to ensure the clearance below the girder of the bridge over the river in case of large-scale upgrade.

JICA for the development of bridges in the same section. However, according to interviews with related parties, the roads between Magige and Cuamba have not been constructed as planned, and even if the bridges are constructed in the Project, the connecting roads are unpaved. Large vehicles use other detour routes because the section is difficult to pass, and it is strongly suggested that this is the cause of the failure to achieve some of the operation and effect indicators of the Project and it hindered the project effects. The plan was scheduled to be completed in 2014 (before the flood in January 2015, which had a major impact on the Project), and road construction for the section was completed in the first half of the project period according to the initial plan of the Project. It is desirable to confirm the prospect of completion with the implementing agency regarding the status of road construction between Magige and Cuamba so that the originally planned Project effect will be fully realized.

4.3 Lessons Learned

Response to unexpected matters

In January 2015, during the project period, heavy rainfall occurred in the target area, causing large-scale flooding. In response to this situation, the concerned entities first confirmed the damage status not only of the target bridges but also of the surrounding roads necessary for the construction of bridges and bridges other than the target, and identified the factors making it impossible to continue the construction. Next, the management considered what should be done to resume the construction, then calculating the personnel, equipment, and funds required for it, and temporarily cutting part of the scope of the original plan. At the same time, steps were taken to extend the construction period and change the grant limit, and measures were taken to restore the temporarily-cut scope with the signature of the revised G/A and E/N. Notably, when a natural disaster made it impossible to continue construction, it was calmly decided what to do, rather than just waiting. As it was necessary to complete the restoration work before the next rainy season with almost no time to spare, the Japanese consultant and contractor gathered information on the damage situation, confirmed the necessary items for the restoration work, and promptly reduced the cost. In close cooperation with this, JICA promptly approved the related design changes.

Although the completion was 18 months behind schedule and the project cost increased by JPY 1,096 million, all of the originally planned outputs were achieved. In addition, the heavy rainfall occurring just before the completion of the extended construction period did not cause great damage to the target bridges which were about to be completed, i.e., there was no need to re-extend the project period.

It is thought that the case reasons for such favorable results are (1) calmly identifying the influence on the Project when an unexpected situation occurred, (2) listing, based on the survey results what should be done and what can be done to restart the Project under the constraints of existing human resources, goods, and money, (3) boldly rearranging the initial plan to devote

existing resources as necessary, and (4) the related entities cooperating closely through (1) to (3) and playing their respective roles based on mutual trust.

Developing countries are not only vulnerable to natural disasters but also other factors such as harsh natural environments, inadequate meteorological data, and inadequate records of past natural phenomena; they are also often restricted in responding to the influences of natural disasters. The above measures in the Project will set a good precedent for responding to unexpected situations potentially occurring in similar projects in the future.