

The Independent State of Papua New Guinea

Ex-Post Evaluation of Japanese Grant Aid Project

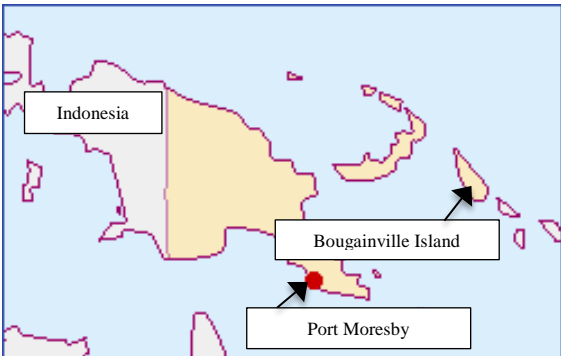
“The Project for Construction of Bridges on Bougainville Coastal Trunk Road”

External Evaluator: Keiichi Takaki, International Development Center of Japan

0. Summary

The objective of this project is to provide safe and stable transportation between Kokopau and Arawa by constructing fifteen bridges on Bougainville Coastal Trunk Road, thereby contributing to the stability of people’s lives and socio-economic reconstruction. The relevance of this project was high since it is consistent with the development policies, sector policies and development needs of the recipient country and Japan’s ODA policy. The efficiency of the project is high since the project was implemented within the schedule and budget. The effectiveness and impact of the project is also high. Although one bridge could not be used for a certain period of time, all the other bridges have been open throughout. The transportation time is reduced, the traffic volume has increased and transportation convenience is greatly improved. Operation and maintenance have been implemented appropriately, and the financial status is good. There are some organizational issues since only one official is engaged in the maintenance and there is also a minor technical problem. Therefore, sustainability of the project effects is fair. In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description



Project Location



Rawa 1 Bridge

1.1 Background

Bougainville Island experienced armed conflict at the time of the independence movement that started in 1988, and the main infrastructure including Bougainville Coastal Trunk Road was damaged. This trunk road stretches for approximately 190 km from Kokopau across from Buka to Arawa, the former capital. Not only is it the most important route for people and goods (agricultural products such as cocoa and kopra and daily necessities) but also for emergency vehicles such as ambulances. However, at 15 locations along the route, the bridges and causeway bridges¹ were damaged or there was no bridge, and people and vehicles had no choice but to cross the river shallows. Such conditions

¹ A bridge that connects the two sides of a river by shaping concrete into the form of a bank with holes in the sides for river water to pass through

impeded the flow of traffic. Against this background, this project constructed 15 bridges between Kokopau and Arawa in order to ensure safe and stable transportation.

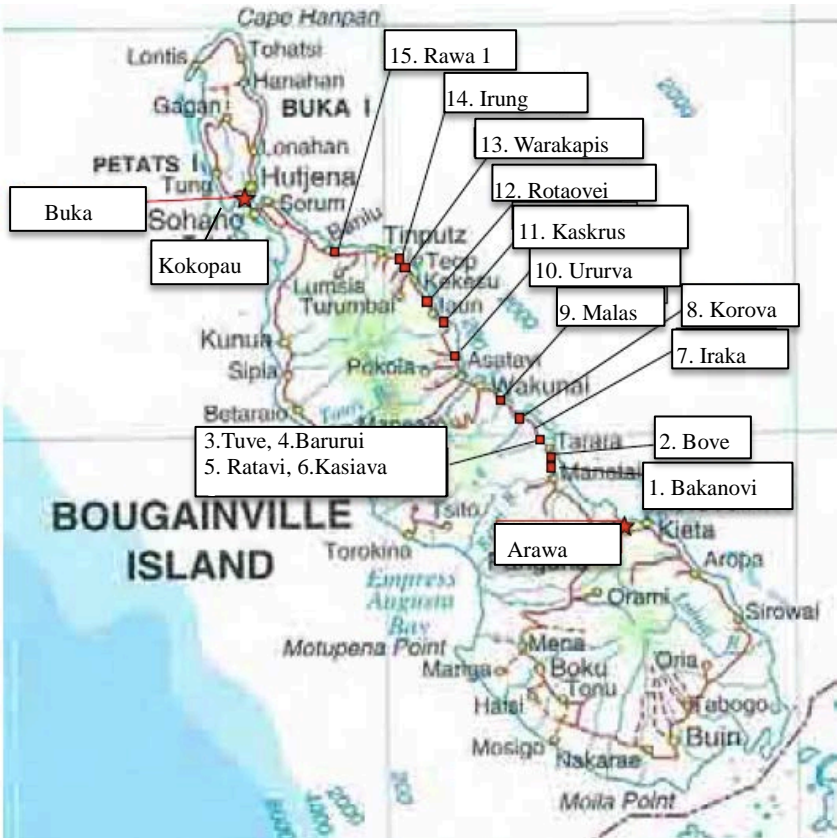


Figure 1 Locations of the Bridges

1.2 Project Outline

The objective of this project is to provide safe and stable transportation between Kokopau and Arawa (approximately 190 km) by constructing fifteen bridges on Bougainville Coastal Trunk Road, thereby contributing to the stability of people’s lives and socio-economic reconstruction.

| | |
|---|---|
| Grant Limit / Actual Grant Amount | D/D ² : 50 million yen /50 million yen Main: 3,154 million yen /3,058 million yen |
| Date of Exchange of Notes (/Date of Grant Agreement) | June 2009 / June 2009 |
| Implementing Agency | Department of Works (DOW) Autonomous Bougainville Government (ABG) |
| Project Completion Date | March 2012 |

² Detailed Design

| | |
|--------------------|--|
| Main Contractor(s) | Kitano Construction Corp. |
| Main Consultant(s) | Chodai Co., Ltd./Eight-Japan Engineering Consultants Inc. (JV) |
| Basic Design | October 2008 |
| Detailed Design | September 2009 |
| Related Projects | None |

2. Outline of the Evaluation Study

2.1 External Evaluator

Keiichi Takaki, International Development Center of Japan

2.2 Duration of Evaluation Study

Duration of the Study: August 2014 – June 2015

Duration of the Field Study: October 26 – November 8, 2014 and January 11 – January 17, 2015

3. Results of the Evaluation (Overall Rating: A³)

3.1 Relevance (Rating: ③⁴)

3.1.1 Relevance to the Development Plan of Papua New Guinea

As stated below, this project is consistent with the development policies of Papua New Guinea and Autonomous Bougainville Government at the time of both planning and ex-post evaluation.

The Medium Term Development Plan 2005-2010, the current development plan at the time of project planning, aimed at strategic budget allocation for 7 expenditure priorities including reconstruction and maintenance of the transportation infrastructure as the first items. The Medium Term Development Plan 2011-2015, the current development plan at the time of the ex-post evaluation, had improvement of the roads as the essential main sector for socio-economic development and aimed at establishing a nationwide road network.

The National Transport Development Plan (NTDP) 2001-2010 was formulated as the highest plan in the transportation sector at the time of planning for the provision of safe and reliable transportation services in the nation. In 2006, it was revised to allocate a budget for repair and maintenance of the existing infrastructure as the priority and this was announced as the NTDP 2006-2010. This plan covers 15 priority trunk roads including Bougainville Coastal Trunk Road. NTDP 2006-2010 allocated a budget for improving 15 national highways in response to people's needs. At the time of the ex-post evaluation, the National Transport Strategy 2014-2018 was the successor to NTDP 2006-2010 and it

³ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁴ ③: High, ② Fair, ① Low

had 16 national highways as priority roads including Bougainville Coastal Trunk Road.

At the time of planning, the Autonomous Bougainville Government formulated the Strategic Action Plan 2006-2010 including improvement of the transportation network for improved access to services as a strategic policy. This plan included the improvement of Bougainville Coast Trunk Road and bridges as an important project. At the time of the ex-post evaluation, the Autonomous Bougainville Government's priority for development 2011-2015 was the current development plan, and it had four pillars: "Peace and Security," "Economic Development," "Human Development," and "Good Governance." The first item "Peace and Security" emphasized the importance of basic infrastructure including roads as a means of contact between communities and individuals and assistance in maintaining strong community and family ties as this would contribute to preventing conflicts and crime.

3.1.2 Relevance to the Development Needs of Papua New Guinea

As stated below, this project is consistent with the development needs of Papua New Guinea at the time of both planning and ex-post evaluation.

At the time of planning, the main infrastructure including Bougainville Coastal Trunk Road was damaged because of the armed conflict at the time of the separatist movement that started in 1988. There were 15 locations on the trunk road where the bridge or causeway bridge was damaged or there was no bridge, and people and vehicles had to cross the shallows, and they could not cross the river when the water level was high⁵. At the time of planning, concrete examples of inconvenience were as described below and the development needs were high.

- When the level of the river rose, children often did not go to school. It was difficult to keep in touch with relatives and friends who lived in other villages⁶.
- At the time of emergency transport by ambulance, sometimes the ambulance could not cross the river because of the high water level, and patients sometimes passed away⁷.
- When police vehicles had to go to the scene of a crime or accident, their arrival was often delayed because of the high water level of the river⁸.
- When cocoa exporters transported cocoa beans to the port, they often could not cross the river because of the high water level until the next day. Cocoa beans often got wet because of rain and their quality was degraded⁹.

⁵ Basic Design Study Report

⁶ Based on interviews with local people

⁷ Based on interviews at Arawa Health Center

⁸ Based on interviews at Arawa Police Station

⁹ Based on an interview with a cocoa bean exporter

Although at the time of the ex-post evaluation, there was no future projection of the traffic volume between Kokopau and Arawa where the bridges in this project are located, the island population has increased by 2.7%¹⁰, and thus the number of people who use the bridges and roads is expected to increase at a similar rate. In addition, reliable and efficient transportation of goods is essential¹¹ for the economic growth of the island. Thus, the need for the bridges is expected to continue.

3.1.3 Relevance to Japan's ODA Policy

As described below, this project is consistent with Japan's ODA policy.

Japan's ODA Charter considers sustainable development as a major issue, and it mentions the intention to assist the socio-economic infrastructure for the purpose of promoting trade, investment and movement of people in developing countries and supporting sustainable development.

At the time of the Fourth Pacific Islands Leaders Meeting in May 2006, the Government of Japan announced five main areas of assistance for Papua New Guinea: 1. Economic Growth, 2. Sustainable Development, 3. Good Governance, 4. Security, and 5. People-to-People Communication and Exchange. In July 2006, the ODA task force and the Government of Papua New Guinea held a policy dialogue and agreed to implement economic cooperation for the subsequent 5 years primarily in three areas: 1. improvement of basic education by distance education, 2. improvement of the socio-economic infrastructure in the area of transportation including bridges and ports, and 3. promotion of farming and fishing villages such as small-scale self-sufficient agriculture¹².

This project is highly relevant to the country's development plan and development needs as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

The outputs were as planned (refer to Table 1). The names of bridges no. 3, no. 4, and no. 5 were changed from Pukarobi 1, Pukarobi 2 and Creepers in the plan to Tuve, Barurui and Ratavi respectively, since the names at the time of planning were the river names under colonial rule. During the project implementation, these names were changed so they were consistent with the traditional local names of the rivers¹³.

¹⁰ National Census 2011, National Statistical Office of Papua New Guinea

¹¹ Based on interviews at the Autonomous Bougainville Government (ABG)

¹² ODA Data by Country, 2008

¹³ Based on interviews at ABG

Table 1 Planned and Actual Outputs

| Planned | | | | | | Actual | | | | | |
|---------|------------|-----------------|------------|-----------|------------|--------|-----------|-----------------|------------|-----------|------------|
| No | Name | Structural Type | Length (m) | Width (m) | Foundation | No | Name | Structural Type | Length (m) | Width (m) | Foundation |
| 1 | Bakanovi | Bridge | 75 | 5 | Pile | 1 | Bakanovi | Bridge | 75 | 5 | Pile |
| 2 | Bove | Bridge | 20 | 5 | Pile | 2 | Bove | Bridge | 20 | 5 | Pile |
| 3 | Pukarobi 1 | Bridge | 25 | 5 | Pile | 3 | Tuve | Bridge | 25 | 5 | Pile |
| 4 | Pukarobi 2 | Bridge | 50 | 5 | Pile | 4 | Barurui | Bridge | 50 | 5 | Pile |
| 5 | Creepers | Bridge | 20 | 5 | Pile | 5 | Ratavi | Bridge | 20 | 5 | Pile |
| 6 | Ratavi | Bridge | 50 | 5 | Pile | 6 | Kasiava | Bridge | 50 | 5 | Pile |
| 7 | Iraka | Bridge | 75 | 5 | Pile | 7 | Iraka | Bridge | 75 | 5 | Pile |
| 8 | Korova | Bridge | 20 | 5 | Pile | 8 | Korova | Bridge | 20 | 5 | Pile |
| 9 | Malas | Bridge | 20 | 5 | Pile | 9 | Malas | Bridge | 20 | 5 | Pile |
| 10 | Ururva | Bridge | 20 | 5 | Pile | 10 | Ururva | Bridge | 20 | 5 | Pile |
| 11 | Kaskrus | Bridge | 25 | 5 | Spread | 11 | Kaskrus | Bridge | 25 | 5 | Spread |
| 12 | Rotaovei | Bridge | 40 | 5 | Spread | 12 | Rotaovei | Bridge | 40 | 5 | Spread |
| 13 | Warakapis | Bridge | 25 | 5 | Spread | 13 | Warakapis | Bridge | 25 | 5 | Spread |
| 14 | Irung | Bridge | 40 | 5 | Spread | 14 | Irung | Bridge | 40 | 5 | Spread |
| 15 | Rawa 1 | Bridge | 40 | 5 | Spread | 15 | Rawa 1 | Bridge | 40 | 5 | Spread |

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual expenditure borne by the Japanese side was 3,058 million yen and the planned expenditure was 3,203 million yen. The actual expenditure was less than the planned expenditure by 96 million yen. The planned expenditure to be borne by the Papua New Guinea side was 5 million yen, but the actual expenditure is not known (refer to Table 4). Therefore, the evaluation was based on the expenditure by the Japanese side. The project budget was lower than planned (95% to the plan).

Table 2 Planned and Actual Project Budget

(Unit: million yen)

| Item | | Planned | Actual |
|-----------------------|---|---------|---------|
| Japanese side | D/D | 50 | 50 |
| | Main | 3,154 | 3,058 |
| Papua New Guinea side | Removal of existing bridges | 5 | Unknown |
| | Maintenance of existing structures | | |
| | Expenditure for opening B/A ¹⁴ , A/P ¹⁵ | | |

¹⁴ Banking Arrangement

¹⁵ Authorization to Pay

3.2.2.2 Project Period

The planned schedule was from June 25, 2009, the date of the Exchange of Notes, to June 2012 (37 months). The actual implementation period was from June 25, 2009 to March 20, 2012 (33 months). The actual period was shorter than planned by 4 months (89% to the plan).

The reasons why the project implementation period was shorter were that 1. the rainfall amount in the first year of the implementation was less than expected, 2. the bridges were located on the 190 km trunk road, subject to slightly different rainfall patterns which were recorded in the first year, and used for planning the efficient construction activities. In addition, ABG held monthly meetings to raise local people's awareness, and went on radio to explain about the project. Because of these, local people had better understanding of the project and were cooperative, which lead to less security problems than expected¹⁶.

Both the project cost and project period were within the plan. Therefore, the efficiency of the project is high.

3.3 Effectiveness¹⁷ (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

As described below, the objectives included in the operation and effect indicators set at the time of planning are mostly achieved.

(1) Waiting days due to flooding

After project completion, a part of the Rotaovei Bridge (Bridge No. 12) and its approach road were washed away by increased river water on April 24, 2014, and the bridge was closed for 22 days until repairs were completed on May 15, 2014. All the other bridges have been open throughout, and the waiting days due to flooding were zero (refer to Table 3)¹⁸.

For this project to have full effect, Bougainville Coastal Trunk Road has to be open throughout. This road has been maintained as necessary and has never been closed. Although the trunk road has 7 causeway bridges that are submerged by high water for 2-3 hours a few days a year, it is not a major problem for the transportation of local people¹⁹. From the above, the objectives of the project at the time of planning were mostly achieved.

(2) Travel time between Kokopau and Arawa

The bridges constructed in this project have reduced the travel time between Kokopau and Arawa

¹⁶ Based on interviews at ABG

¹⁷ Sub-rating for Effectiveness is determined with consideration for Impact.

¹⁸ From interviews at ABG

¹⁹ From interviews at ABG

from 5 or 6 hours to 3 hours, and the objective at the time of planning was achieved (Refer to Table 3)²⁰.

(3) Diversified Transportation Means

Table 5 shows that there were no motorcycles or bicycles and there are more small buses and middle-sized trucks than at the time of planning in 2008 as shown in Table 4. Cocoa exporters said that before the project, middle-sized and large trucks could not cross some of the rivers and they mostly used small trucks. Since project completion, they use more middle-sized trucks, and this is consistent with the traffic survey at the time of the ex-post evaluation. From the above, the objective at the time of planning was achieved.

(4) Increased Traffic Volume

In accordance with the traffic survey at the time of planning in 2008 (Table 4), the number of vehicles from Arawa to Buka was 72, and in the opposite direction the number was 86. In accordance with the traffic survey at the time of the ex-post evaluation (Table 5), the number of vehicles from Arawa to Buka was 123, and in the opposite direction, the number was 106. The traffic volume at the time of the ex-post evaluation had increased by 1.7 times and 1.2 times respectively. Thus, the objective was achieved.

Table 3 Target and Actual Effect Indicators

| Effect indicator | Baseline | Target | Actual | | |
|--|----------------|----------------------------------|-----------------|-------------------------|--------------------------|
| | 2008 | 2012 | 2012 | 2013 | 2014 |
| | Baseline year | Completion year | Completion year | 1 year after completion | 2 years after completion |
| 1. Waiting days due to flooding | 30 days | 0 days | 0 days | 0 days | 22 days ²¹ |
| 2. Travel time between Kokopau and Arawa | 5-6 hours | 5-5.5 hours | 3 hours | 3 hours | 3 hours ²² |
| 3. Diversified transportation means | No description | Diversified transportation means | Diversified* | | |
| 4. Increased traffic volume | No description | Increased traffic volume | Increased* | | |

*These are based on interviews, not on quantitative data

²⁰ Same as above

²¹ 22 days of waiting is at Rotaovei Bridge and the situation there are described in the section on the current status of operation and maintenance.

²² Travel time from Kokopau to Arawa at the time of the ex-post evaluation was confirmed by the evaluator.

Table 4 Traffic Survey Results (Plan)
 Survey Date and Time: March 20, 2008
 6:00-18:00
 Survey Location: Rawa 1

| Vehicle Type | Arawa → Buka | Buka → Arawa |
|-----------------------------|-----------------|-----------------|
| 4WD | 24 | 24 |
| Small truck | 48 | 62 |
| Total number of vehicles | 72 | 86 |
| Total number of passengers | 1,017 | 1,400 |
| Total number of pedestrians | 23 | 27 |

Source: Basic Design Study Report

Table 5 Traffic Survey Results (Ex-post evaluation)
 Survey Date and Time: November 3, 2014
 6:00-18:00
 Survey Location: Rawa 1

| Vehicle Type | Arawa → Buka | Buka → Arawa |
|-----------------------------|-----------------|-----------------|
| 4WD | 110 | 91 |
| Ambulance | 1 | 2 |
| Police Vehicle | 2 | 1 |
| Small bus | 2 | 2 |
| Small truck | 9 | 10 |
| Medium sized truck | 0 | 2 |
| Total number of vehicles | 123 | 106 |
| Total number of passengers | 1,486 | 1,054 |
| Students | 9 | 10 |
| Adults | 7 | 10 |
| Total number of pedestrians | 16 | 20 |

Source: Traffic survey by the evaluator

3.3.2 Qualitative Effects

(1) Emergency vehicles can cross the bridges at all times

This project aimed to make it possible for emergency vehicles such as ambulances and police vehicles to cross the bridges at all times. At the time of the ex-post evaluation, Arawa Health Center, the only hospital in Arawa, had one doctor and twenty-five nurses. Before this hospital had a doctor, emergency transportation of patients was required 8-10 times a month. After they got the doctor, emergency transportation of patients was required 3-4 times a month. Before the bridges were constructed, transportation to Buka District Hospital took 4-5 hours. When there was heavy rain and the water level of the rivers rose, they often could not transport patients and patients sometimes passed away while waiting for the water level to subside. Since the bridges were constructed, transportation takes 2 hours, and emergency transportation of patients²³ can be provided at any time.

Arawa Police are responsible for a large area, and they have to dispatch their vehicles to the area around Uruva Bridge, about 90 km away, at least 3 times a month for traffic accidents and homicide cases. Before the bridges were constructed, the journey took two hours. At the time of the ex-post evaluation, it took one hour, greatly helping police investigations²⁴. From the above, the ability of emergency vehicles to cross the bridges has been much improved.

3.4 Impacts

²³ From interviews at Arawa Health Center

²⁴ Based on interviews at Arawa Police Station

3.4.1 Intended Impacts

Table 6 Target and Actual Impact Indicators

| Indicator | Baseline | Target | Actual | | |
|--|--|---|---------------------------|-------------------------|--------------------------|
| | 2008 | 2012 | 2012 | 2013 | 2014 |
| | Baseline Year | Completion year | Completion year | 1 year after completion | 2 years after completion |
| 1. Reduced transportation cost | The transportation fare from Kokopau to Arawa is 100 kina. | Due to diversified transportation means, the number and types of vehicles will increase and transportation costs will be reduced. | Improved | Improved | Improved |
| 2. Stable transportation of goods | No description | Stable transportation of daily necessities | Improved | Improved | Improved |
| 3. Increased agricultural production | Agricultural production in 2006: Cocoa (10.5t), Copra (12.4t) | Improvement expected due to improved transportation means | No judgment since no data | | |
| 4. Solution of river water pollution due to riverbed crossing | River water used for drinking and washing is polluted. | Water pollution solved | Improved | Improved | Improved |
| 5. Stable river environment and stable use of land by local people near rivers | Dilapidated causeways lead to renewed collapse of riverbanks and environmental destruction | By improving the river areas, riverbank collapse will be controlled and the environment will be stabilized. | 0 (solved) | 0 (solved) | 0 (solved) |
| 6. Riverbed crossing solved | Riverbed crossing at 15 locations | Crossing of river by vehicles will be solved. | 0 (solved) | 0 (solved) | 0 (solved) |
| 7. River accidents solved | River accidents occur because of unsafe riverbed crossing by vehicles and pedestrians | River accidents solved | 0 (solved) | 0 (solved) | 0 (solved) |
| 8. Improved access to medical and educational facilities | No description | Access to medical and educational facilities will be improved. | Improved | Improved | Improved |

(1) Reduced transportation fare

Table 7 shows that the transportation fare in each year fell from 150 kina in 2008 to 50 kina in 2012. The reason for the increased fare before the bridges were constructed was that vehicles had to cross the riverbed, which caused the engines and brakes to break down, and the vehicle owners added the repair and maintenance costs to the fare. After the bridge construction, they reduced the fare since they did not need to add the repair and maintenance costs to the fare and there was competition due to the increased number of vehicles²⁵. Thus, the objective at the time of planning was achieved.

Table 7 Transportation between Kokopau - Arawa
(Unit: Kina)

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---------------------|------|------|------|------|------|------|------|
| Transportation fare | 150 | 150 | 100 | 100 | 50 | 50 | 50 |

Source: ABG

In the ex-post evaluation a beneficiary survey was conducted to investigate the improved traffic convenience for local communities in addition to the reduced transportation fee²⁶. Table 8 shows that the survey asked respondents to choose the applicable items, and 70-90% of the respondents agreed that transportation is cheaper, they have more transportation means, it is safer and faster, and transportation is reliable and they can plan transportation better than before. Thus, it can be said that the bridges greatly improved transportation convenience.

²⁵ Based on interviews at ABG

²⁶ For this ex-post evaluation, a beneficiary survey was conducted in the villages near the bridges. The survey was carried out at villages with a relatively large population for efficient information collection. The survey target was households and the respondents were either the household head or his/her spouse. Table 14 shows the total number of households and the number of actual respondents in all the villages. Tables 15 and 16 show the age and sex of the respondents, respectively.

Table 14 Beneficiary Survey Villages

| Name of village | Total number of households | Number of respondent households | Response rate (%) |
|-------------------|----------------------------|---------------------------------|-------------------|
| Bove | 92 | 38 | 41.3 |
| Coastal Veanana | 26 | 16 | 61.5 |
| Puskombu | 48 | 34 | 70.8 |
| Tarara | 66 | 20 | 30.3 |
| Teopasino Village | 43 | 18 | 41.8 |
| Veanana Highway | 54 | 25 | 46.2 |
| Vito | 60 | 54 | 90.0 |
| Total | 389 | 205 | 52.6 |

Source: Beneficiary survey

Table 15 Age of Respondents

| Age category | Number of persons | Percentage (%) |
|--------------|-------------------|----------------|
| Under 20 | 27 | 13.2 |
| 21-30 | 63 | 30.6 |
| 31-40 | 44 | 21.7 |
| 41-50 | 33 | 16.1 |
| 51-60 | 21 | 10.5 |
| Over 61 | 6 | 3 |
| No response | 11 | 5.4 |

Source: Beneficiary survey

Table 16 Sex of Respondents

| Sex | Number of persons | Percentage(%) |
|--------|-------------------|---------------|
| Female | 95 | 46.3 |
| Male | 110 | 53.7 |
| Total | 115 | 100 |

Source: Beneficiary survey

Table 8 Improved Transportation Convenience by the Bridges

| Items | Number of respondents (%) |
|---|---------------------------|
| 1. Transportation is cheaper. | 138 (67.3%) |
| 2. More transportation means are available. | 185 (90.2%) |
| 3. Transportation is safer. | 197 (96.1%) |
| 4. Transportation is faster. | 202 (98.5%) |
| 5. Transportation is reliable and you can plan transportation better than before. | 188 (91.7%) |

Source: Beneficiary survey

(2) Stable transportation of goods

Cocoa bean transporters said that before the bridges were constructed, they often could not cross some rivers to transport their cocoa beans to the storehouses at the port within the same day of shipping, and the cocoa beans got wet in the rain and the quality was compromised. After the bridge construction, transportation within the same day of shipping was possible, and it improved the quality of the cocoa beans²⁷. As the cocoa transporters said that they can always transport their cocoa beans and the transportation of goods is more stable, it can be said that the object has been achieved.

The ex-post evaluation examined the cost of transporting goods. Table 9 shows that the transportation cost of 1 ton of goods was 1,000 kina in 2011 and 2,000 kina since 2012 because the provision of transportation means vis-à-vis demand is not sufficient. The bridge construction has not led to reduced cost of transporting goods²⁸.

Table 9 Transportation Cost for 1 ton of Goods between Kokopau and Arawa

| Year | (Unit: kina) | | | | | | |
|---------------------|--------------|------|------|-------|-------|-------|-------|
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
| Transportation cost | n/a | n/a | n/a | 1,000 | 2,000 | 2,000 | 2,000 |

Source: ABG

(3) Increased production of main agricultural products

Since the Autonomous Region of Bougainville does not have any data on agricultural production, production of agricultural produce cannot be compared before and after the bridge construction. It cannot be known whether the objective was achieved²⁹.

(4) Solution of river pollution

156 respondents (76.1%) in the beneficiary survey said that after the bridge construction they had not crossed the riverbed and this has solved river pollution. Thus, the objective was achieved.

²⁷ Based on an interview with a cocoa bean exporter

²⁸ Based on interviews at ABG

²⁹ Same as above

(5) Stable land use

Before the project implementation, the rivers were not cleaned and the remains of dilapidated causeway bridges were left, and the water level rose at the time of heavy rain. This caused flooding of the neighboring villages and agricultural land. According to villagers near the Iraka Bridge, the remains of dilapidated causeway bridges blocked the river flow and this caused overflowing of the river at the time of heavy rain every year and flooding of their houses and land. At the time of bridge construction, these leftover bridges were removed and there is no flooding any more.

The beneficiary survey found that 119 respondents were engaged in agriculture near the bridges and 64 respondents (53.8%) responded “much improvement,” and 33 respondents (27.7%) responded “improvement.” Land use is improved and the objective is achieved.

(6) Frequency of riverbed crossing by vehicles

Before the bridge construction, 20-30 vehicles per day crossed the riverbeds. Since the bridge construction, the number is zero and the objective was achieved³⁰.

(7) River accidents involving pedestrians and vehicles

According to ABG, the number of river accidents was 3 in 2010 and 5 in 2011. Since the bridge construction, the number is zero and the objective at the time of planning has been achieved. (Refer to Table 10)

Table 10 Total Number of Accidents at Fifteen Bridges

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|-----------------|------|------|------|------|------|------|------|
| Number of cases | 0 | 0 | 3 | 5 | 0 | 0 | 0 |

Source: ABG

(8) Improved access to medical and educational facilities

Local people said that before the bridge construction, some people passed away due to illness and injury since they could not get to hospital in time because of the high water level at the time of heavy rain. The beneficiary survey asked, “How do you think the bridge changed the access to hospital for your household or your community?” 169 (82.4%) responded “much better” and 26 (12.7%) responded “better,” indicating the bridges much improved access to medical facilities.

The beneficiary survey asked, “How do you think the bridge changed the access to school for your household or your community?” 155 (75.6%) responded “much better,” and 33 (16.1%) responded “better,” indicating the bridges much improved access to educational facilities. From the above, the objective to improve access to medical and educational facilities has been achieved.

3.4.2 Other Impacts

(1) Impacts on the Natural Environment

Since the bridge construction polluted the river water in 4 villages where about 600 people used

³⁰ By the interview at ABG

the water for their daily lives, ABG provided 15 water tanks with a capacity of 5,000 liters for each village (60 tanks in total). Since the water tanks were to be used after the bridge construction was completed, ABG did not purchase land for their instalment, and each community provided land. Vibration and noise during construction was minimal and was not a problem. In this regard, there were no problems at the time of the ex-post evaluation³¹.

(2) Land Acquisition and Resettlement

During the bridge construction, farmland had to be used for detours and agricultural products had to be removed. The owners of the removed products were compensated in cash in accordance with the rules of the Government of Papua New Guinea. In this matter, the people concerned were consulted in advance and their agreement was obtained, hence there were no problems. After the bridge construction, the farmland was restored to the original state, and there were no problems at the time of the ex-post evaluation³².

(3) Unintended Positive Impact

Local contractors and local people were involved as sub-contractors and workers under the Japanese contractor for the bridge construction and they received technical training. This made it possible for them to be engaged in maintenance and repair work. When part of the Rotaovei Bridge was washed away, the local contractors and local people repaired it³³.

The beneficiary survey found that 196 respondents (96.6%) knew that the bridges were constructed with the assistance of Japan. It further asked how much it had changed their impression of Japan. Of 196 respondents, 145 (73.9%) responded “much better” and 35 (24.1%) responded “better”, indicating that it had greatly improved their impression of Japan.

This project has largely achieved its objectives. Therefore, the effectiveness and impacts of the project are high.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspects of Operation and Maintenance

The bridges constructed in the project are operated and maintained by ABG which was established in 2000. Only one official from the Technical Service Department of ABG is solely engaged in maintenance of the bridges. The management of the Technical Service Department of ABG is broadly structured, and the official engaged in maintenance of the bridges is given a high degree of

³¹ Based on interviews at ABG
³² Same as above
³³ Same as above

discretion. Thus, appropriate maintenance depends on his judgment and efforts³⁴. Although the bridges are listed in ABG's bridge inventory, the condition of the bridges is not updated in the inventory. Without his presence, no other officials know the condition of the bridges. Therefore, the organization of maintenance operations is not adequate.

Cleaning and weeding at bridges and culverts are undertaken by the communities near each bridge. Local people are organized into twelve groups, and they undertake cleaning once every month for 1-2 days with a 200-kina wage per person per day. Repair and construction of the bridges are undertaken by contractors by open bidding³⁵.

ABG plans to expand its organization by recruiting 2-3 new staff in 2015, and to divide the trunk road between Kokopau and Arawa into three sections, and one official will be in charge of one or two sections. The current official in charge will transfer his responsibilities to the new staff³⁶.

3.5.2 Technical Aspects of Operation and Maintenance

As described later in the section on operation and maintenance, operation and maintenance are adequately carried out, and ABG has an adequate level of technical capability. On the other hand, since only one official is in charge of maintenance, no one is trained and no manuals are prepared, and this is an issue. New recruiting should be carried out, responsibility for maintenance should be transferred, and new personnel should be trained.

At the time of construction of the bridges, no local contractors had an adequate level of technical capability, and they received training from the Japanese contractor as they constructed the bridges. At the time of the ex-post evaluation, the local contractors had acquired the technical capability necessary for repairing the bridges.

3.5.3 Financial Aspect of Operation and Maintenance

Table 11 shows the planned and actual expenditure. Usually, budgets are allocated by the submission of project proposals and the approval of ABG and the central government.

Since the necessary budget is allocated as shown in Table 11 and maintenance works have been appropriately implemented with this budget as shown in Table 12, it can be said that the financial status is no problem.

³⁴ Based on interviews at ABG
³⁵ Same as above
³⁶ Same as above

Table 11 Budget for Maintaining the Bridges Constructed in the Project
(budget and actual expenditure)

(Unit: Kina)

| | | 2012 | 2013 | 2014 |
|-------------|--|-----------|-----------|-----------|
| Budget | Item | 3,000,000 | 3,000,000 | 1,926,000 |
| Expenditure | Overhead costs (personnel, operation and maintenance of vehicles) | 544,950 | 311,865 | 546,565 |
| | Maintenance of facilities (repair and cleaning of bridges and others) | 1,152,727 | 380,012 | 359,762 |
| | Construction (river training) | 36,993 | 42,977 | 709,473 |
| | Total | 1,734,670 | 734,853 | 1,615,800 |
| | Difference | 1,265,330 | 2,265,147 | 310,200 |

Source: ABG

3.5.4 Current Status of Operation and Maintenance

The project planning foresaw the operation and maintenance works as listed in Table 12. These works have been appropriately carried out, and the bridges constructed in the project are used for the most part without any problems.

On the other hand, the Rawa 1 Bridge has a problem with the gabion baskets that protect the banks. Young villagers with behavioral problems steal the wires from the gabion baskets for fishing. To prevent this, ABG plans to cover them with concrete³⁷.

³⁷ Based on interviews at ABG

Table 12 Planned and Actual Maintenance Works for the Facilities

| Work Item | Location | Content of Work | Frequency | | | |
|-----------------------------|-----------------------|---|-----------------------------------|--------|------|------|
| | | | Planned | Actual | | |
| | | | | 2012 | 2013 | 2014 |
| Road and bridge maintenance | Whole facility | Update ABG's bridge inventory | Continuously | 1 | 0 | 0 |
| | | Maintenance work based on the RAMS or BMS DOW system | Continuously | 0 | 0 | 0 |
| Bridge maintenance | Expansion joints | Cleaning of expansion joints, and if damage is detected, take photos and record the date | Twice per annum | 10 | 12 | 12 |
| | Drains | Cleaning of drainage pipes, and if damage is detected, take photos and record the date | | 10 | 12 | 12 |
| | Bearings | Cleaning around the bearings. Confirm the movement and deterioration of elastomeric bearings. | | 10 | 12 | 12 |
| | Handrails Guard Rails | Confirm the degree of deterioration and if damage is detected, take photos and record the date | | 10 | 12 | 12 |
| | Steel Girders | Confirm the paint condition and rust. If problems are detected, take photos and record the date | | 10 | 12 | 12 |
| | Abutment, Pier | Confirm local scouring and subsidence of the structure | After flooding | 10 | 12 | 12 |
| Approach road | Pavement | Repair potholes | Twice per annum | 10 | 12 | 12 |
| | Shoulder | Weed and level the shoulder | | 10 | 12 | 12 |
| | Slope | Repair slope erosion | | 10 | 12 | 12 |
| | Drain | Removal of deposits | | 10 | 12 | 12 |
| Bank protection | Concrete blocks | Confirm movement due to erosion. Repair protection if problems are detected | Twice per annum and after a flood | 10 | 12 | 12 |
| Periodical bridge repair | Steel members | Prepare budget and repair | Every 30 years | 0 | 0 | 0 |

Source: Basic Design Study Report (The actual frequency of maintenance work is based on responses from ABG)

The Rotaovei Bridge was closed from April 24 to May 15, 2014 since the approach road connecting the Trunk Road and the bridge was washed away, and part of the bridge collapsed. The approach road was washed away since the increased river water directly flowed onto it, and the soil was washed away. Part of the bridge was built on the soil and once the soil was gone, this part of the bridge collapsed. The approach road did not have the structural strength to withstand the direct flow of a large volume of water, and ABG should have trained the river so that increased water would not

directly flow onto the approach road³⁸. The bridge and the approach road were repaired by local contractors who were subcontracted when the bridge was constructed. The Rotaovei Bridge has been open since May 16 without any problems. To prevent the same problem at the Rotaovei Bridge from happening again, ABG had completed river training at the time of the ex-post evaluation³⁹.

Some minor problems have been observed in terms of the institutional and technical aspects of operation and maintenance. Therefore, the sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project is to provide safe and stable transportation between Kokopau and Arawa by constructing fifteen bridges on Bougainville Coastal Trunk Road, thereby contributing to the stability of people's lives and socio-economic reconstruction. The relevance of this project was high since it is consistent with the development policies, sector policies and development needs of the recipient country and Japan's ODA policy. The efficiency of the project is high since the project was implemented within the schedule and budget. The effectiveness and impact of the project is also high. Although one bridge could not be used for a certain period of time, all the other bridges have been open throughout. The transportation time is reduced, the traffic volume has increased and transportation convenience is greatly improved. Operation and maintenance have been implemented appropriately, and the financial status is good. There are some organizational issues since only one official is engaged in the maintenance and there is also a minor technical problem. Therefore, sustainability of the project effects is fair. In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

Although the bridges constructed in the project have been appropriately operated and maintained by ABG, only one official is engaged in operation and maintenance with great discretion. Thus, appropriate operation and maintenance depends on his judgment and efforts, and the organization of ABG regarding management and support is not adequate. Since no other officials were engaged in operation and maintenance at the time of the ex-post evaluation, ABG has no system for training junior officials for the future. From the above, in order to ensure sustainability, ABG should construct a system for managing and supporting the official engaged in maintenance and operation, and for training staff by recruiting new staff.

³⁸ The evaluation did not take points off because of river development not included in the plan. This is because only the Rotaovei Bridge was closed for 22 days thanks to the early response by ABG, and ABG has already completed the measurements for river development to prevent the same thing from happening again. Thus, it did not cause any major problems in realizing the effectiveness and ensuring the sustainability of the project.

³⁹ Based on interviews at ABG

4.2.2 Recommendations to JICA

Although the bridges constructed in the project had no problems with regard to maintenance at the time of the ex-post evaluation, in order to ensure sustainability, JICA should urge ABG's technical service department to strengthen its organization and monitor progress.

4.3 Lessons Learned

(1) Importance of technical transfer for local contractors and people in island countries

Although local contractors and the people of Bougainville Island did not have an adequate level of technical capability at the beginning of the bridge construction, they acquired the necessary civil engineering knowledge and skills as they were engaged in the construction of the bridges under the Japanese contractor. This enabled them to complete the necessary repair work after the bridge construction was completed. In particular, since Bougainville Island had limited transportation access from other islands and transportation was costly, it was difficult to bring in contractors and workers from outside the island. Therefore, they had to train local contractors and local people.

This experience indicates that when local contractors and local people do not have an adequate level of technical capability at the beginning of project implementation in island countries, they may have to be trained through the engagement in the construction, so that they can engage in maintenance and repair work after project completion. Even if the project involves contractors from outside the island, the necessary repair work may not be done after project completion because the contractors with adequate technical capability may not stay on the island. Considering such necessity and possibilities, it may be useful to consider hiring local contractors and providing the necessary training and include it in the plan as a note.

(2) Importance of monitoring when the implementing agency does not have adequate operation and maintenance capability

ABG was only established in 2000 and it does not have adequate organizational capability. Appropriate operation and maintenance of the project is carried out through the individual efforts of the official in charge. When the implementing agency does not have adequate organizational capability, JICA should monitor the maintenance condition in order to ensure adequate operation and maintenance after project completion. If operation and maintenance is not adequately carried out, JICA should point this out, and it is desirable to include it in the plan as a note.

(3) Importance of ensuring the strength of structures surrounding the bridges

In this project, increased river water at the time of heavy rain washed away the approach road of the Rotaovei Bridge, and the bridge was closed because the river was not trained. The plan should have considered not only the structural tolerance of the bridge but also that of the other structures, and foreseen potential situations for all the concerned structures. JICA should have urged the implementing agency to make adequate arrangements accordingly and should have engaged in

follow-up activities during project implementation. As a lesson, in order to avoid situations where different structures with different strengths face stress and breakdown, the responsible parties should be clarified and implement the necessary work, and this should be included in the plan as a note to ensure its implementation.