

FY2017 Ex-Post Evaluation of Japanese Grant Aid Project

The Project for Construction of Manmunai Bridge

External Evaluators: Ayumi Hori, Yumiko Onishi, and Tsuyoshi Ito, IC Net Limited

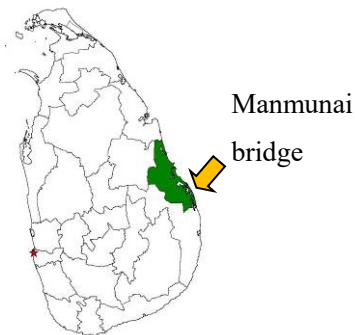
0. Summary

This project was implemented to facilitate smooth traffic flow and transportation of goods through the construction of a new bridge across the Batticaloa lagoon at Manmunai in Sri Lanka, and thereby contributing to vitalizing the local community and improving the quality of life for local residents.

The project is consistent with Sri Lanka's development policy and development needs as well as Japan's official development assistance policy, which was clear both at the time of the planning and the ex-post evaluation. The selection of the bridging route as well as the project's plan and approach were appropriate, making the project highly relevant. The project underwent design changes at the time of detailed designing. However, these changes were considered reasonable from the viewpoint of ensuring the quality and safety of the bridge, and the project was highly efficient because these changes did not affect the effects of the project as well as its cost and period, allowing the project cost to fall within the plan. With regard to effectiveness, the project failed to achieve the goal for the passenger car unit (hereinafter referred to as "PCU") as an operational indicator. However, when the target PCU was set in 2009, the movements of people other than residents who were engaged in post-civil war reconstruction projects might have been counted as part of the baseline, and the target might have been set higher. For this reason, the traffic volume was considered reasonable by comparing it with the 2017 data, which were calculated using traffic prediction software with various factors. Effectiveness and impacts of the project are high, as it was confirmed that other quantitative effects had been realized and that the promotion of exchange of people and goods had tremendous and diverse positive effects on the area around the bridge and its residents. Regarding sustainability, not much progress has been made in road repair because the roads leading up to the bridge are not placed under the control of the Road Development Authority (hereinafter referred to as "RDA"). The sustainability of the project's effects is fair because there is room for improvement in budget management and various types of regular inspections by the Eastern RDA, which supervises the bridge covered by the project.

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

1. Project Description



Project Location



Manmunai Bridge

1.1 Background

In the Eastern Province of Sri Lanka, the civil conflict had prevented proper maintenance and operation of roads and bridges for a long time, and their conditions had deteriorated. Furthermore, the after-effects of the tsunami disaster caused by the Sumatra Earthquake in December 2004 were still evident. Rehabilitation of pavement and roadbed, improvement of roads including widening, and replacement of old bridges as well as improvement of accessibility to economically vibrant coastal areas for the formerly conflict-affected inland were urgently required. After the tsunami disaster, priority was given to rehabilitation of trunk roads. In addition, because the Manmunai area is adjacent to Kokkaddicholai where an armed group named “Liberation Tigers of Tamil Eelam”¹ was based, restoration assistance from tsunami disaster in the area was delayed compared with other areas in the Eastern Province. After the end of the civil conflict in May 2009, reconstruction activities in the target area became finally operational and was fully launched. In this area, the ferry operation was the only means of transportation, but it was suspended during a flood; thus, the area was left without transportation under such circumstances. It was necessary to construct a bridge that would be functional even when floods struck the area. Improving accessibility by constructing the bridge was regarded as one of the most important elements for reconstruction of the Eastern Province. In light of the above, with Japan’s grant aid project, the project was implemented to construct a bridge in Manmunai located in the Eastern Province, where recovery from the civil conflict and the tsunami disaster had been slow.

¹ Anti-government armed group in Sri Lanka, organized in 1976.



Source: Preparatory Survey Report

Figure 1: Location of the Bridge Constructed in the Project

1.2 Project Outline

The objective of this project is to facilitate smooth traffic flow and transportation of goods through the construction of a new bridge across the Batticaloa lagoon in Manmunai, thereby contributing to vitalizing the local community and improving the quality of life for local residents.²

Grant Limit / Actual Grant Amount	1,206 million yen / 951 million yen
Exchange of Notes Date / Grant Agreement Date	September 2011/ September 2011
Executing Agency	Road Development Authority (RDA)
Project Completion	May 2014
Contractor	Wakachiku Construction, Co., Ltd.
Consultants	Chodai Co., Ltd. / Oriental Consultants Co., Ltd.
Preparatory Survey	(Outline Design Study) July 2010–March 2011

² The objective of this project indicated on the ex-ante evaluation sheet was “to construct a bridge in Manmunai with the aim of facilitating smooth traffic flow and transportation of goods between across the Batticaloa lagoon, thereby contributing to recovery from disaster, reduction of flood damage, encouraging socio-economic development of the Eastern Province, and making the bridge a symbol of lasting peace in the area.” However, “encouraging socio-economic development of the Eastern Province” and “a symbol of lasting peace in the area” are too much of a leap in logic as compare to the scope of the project. Thus, after review of the sequential logic of the project, “vitalization of local community and improvement in the quality of life for local residents.” was measured as the impact of the project.

Related Projects	<p><u>Japanese ODA loan</u></p> <ul style="list-style-type: none"> • Provincial Road Improvement Project (2002) • Pro-Poor Eastern Infrastructure Development Project (2005) <p><u>Grant Aid Projects</u></p> <ul style="list-style-type: none"> • The Project for reconstruction of Gampola Bridge and Muwagama Bridge (2000) • The Project for the Construction of a New Highway Bridge at Manampitiya (2004) • The Project for Construction of New Mannar Bridge and Improvement of Causeway (2006) • The Project for Reconstruction of 5 bridges in Eastern Province (2008) <p><u>Other Donors' Projects</u></p> <ul style="list-style-type: none"> • Saudi Arabia: Kinniya Ferry Bridge (2006) • Saudi Arabia: Thambalagamum - Kinniya Road (2006) • World Bank (WB): Jayanthipura – Thirikkondiyadimadu Road (2007) • Spain: Oddaimavadi Bridge, Irakkandi Bridge, Puddavaikattu Bridge and Yan Oya Bridge (2007) • Asian Development Bank (ADB): Peradeniya – Badulla – Chankaladi Road (2008) • European Union (EU)/ADB Siyambalanduwa – Pottuvil – Akkaraipattu Road (2008) • Agence Française de Développement (AFD): Batticaloa – Trincomalee Road (A15), Construction of five bridges and Alli – Kanthale Road/Coastal Road (2008) • ADB: Talankuda – Manmunai – Mavadimunmari Provincial Road Rehabilitation Project (2010)
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2. Outline of the Evaluation Study

2.1 External Evaluators

Ayumi Hori, Yumiko Onishi, and Tsuyoshi Ito, IC Net Limited

2.2 Duration of the Evaluation Study

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

Duration of the Study: October 2017 – January 2019

Duration of the Field Study: February 18–March 6, 2018; May 14–26, 2018

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

3.1 Relevance (Rating: ③⁴)

3.1.1 Consistency with the Development Policy of Sri Lanka

When this project was planned, the national development plan, *Mahinda Chintana 2005*, highlighted the importance of reconstruction of the Eastern Province. The road sector development was in one of

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

⁴ (3): High, (2): Fair, (1): Low

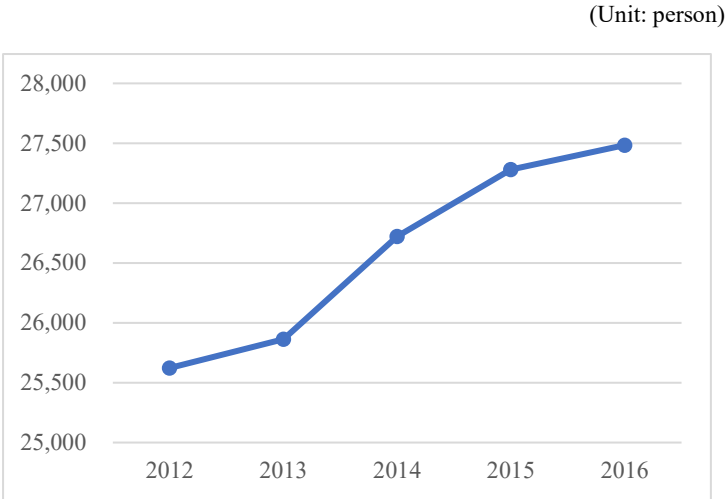
the main strategies to development and improvement of the regional and provincial road networks in the Eastern and Northern Provinces, which had been affected by the civil conflict and therefore underdeveloped compared with other parts of the country. Road rehabilitation in the tsunami-affected area was also considered a high priority. *Vision 2025*, Sri Lankan development plan both during the project implementation period and at the time of ex-post evaluation, underlines the importance of connecting between cities and towns inside and outside Sri Lanka, like development of trading or areas as hub, in order to facilitate further development of the country. As a mean to achieve this, investment in road construction is named. Furthermore, through replacement and construction of more than 70 bridges and development, the traffic system in the country will be improved. At the same time, as disaster countermeasure it will be realized of urban cities which are resilient against flood, drought and so on.

Mahinda Chintana 2005, which was referred to at the planning stage, and *Vision 2025*, which was referred to during the ex-post evaluation study, have a common policy direction: development and investment in road networks is indispensable to national development. Further, both recognize road rehabilitation as an important measure against natural disasters. Both have had consistent road policy of the country. Besides, the *National Road Master Plan (2007–2017)* is the latest official document of the RDA at the time of ex-post evaluation, which deals with the national road plan. It has consistently aimed to provide better accessibility for the entire population through improvement of road networks, thereby contributing to increased mobility of people and goods, and further development of the national economy. Thus, it is fair to say that this project was highly relevant to the development policy of Sri Lanka.

3.1.2 Consistency with the Development Needs of Sri Lanka

For this project, the needs survey was carried out in August 2008 and after the civil conflict ended in May 2009, Preparatory Survey was started on July 2010, which was approximately one year after the civil conflict. The timing of adopting and implementing this project when development support was needed for the area met the development needs. When it was planned, in order to rehabilitate the target area from the civil conflict and the tsunami disaster, rehabilitation of pavement and roadbed, improvement of roads including widening, and replacement of old bridges as well as improvement of accessibility to economically vibrant coastal areas for the formerly conflict-affected inland were urgently required to bring about the socio-economic recovery of the area. Improvement of accessibility by bridge construction was regarded as one of the most essential elements for restoration and reconstruction of the Eastern Province. In the target area, ferries had been the only mode of public transportation to cross the lagoon. Ferry services, however, were suspended during a flood, causing great inconvenience to local residents. Therefore, it was necessary to construct a bridge that remained functional when flooding occurred. At the time of ex-post evaluation, it was considered very important to improve poor road networks and accessibility, both of which were regarded as the bottlenecks to development of the transportation system and basic infrastructure in the Eastern Province. Therefore, the construction of the Manmunai bridge had been indispensable to enhance the safety and accessibility between Kattankudy and Kokkaddicholai across the lagoon.

At the time of ex-post evaluation, it was confirmed that there was no plan to construct another new bridge across the lagoon and the Manmunai bridge was the only bridge that connected both sides of the lagoon. The traffic survey carried out at ex-post evaluation corroborated the improved accessibility from the inland to the coastal areas. In addition, the population of the Manmunai South West area, which is located inland and is one of the most underdeveloped, has been rapidly growing since 2013 as shown in the figure below.



Source: Statistics handbook issued by the Batticaloa District Planning Bureau

Figure 2: Population Changes in Manmunai South West

As discussed above, it was confirmed that this bridge is the sole bridge that directly connects both sides of the lagoon, and its importance has been increasing as the traffic volume and population have swelled in size (see the details in “3.3 Effectiveness”). Improved accessibility by the bridge construction has greatly contributed to the fulfillment of socio-economic needs of inland communities. For these reasons, it is fair to say that this project met the development needs of the country both at the time of planning and ex-post evaluation.

3.1.3 Consistency with Japan’s ODA Policy

The *Country Assistance Program for Sri Lanka* prepared by the Ministry of Foreign Affairs in 2004 described two pillars of Japan’s ODA policy for Sri Lanka: (1) consolidation of peace and support for reconstruction and (2) assistance in line with mid- and long-term development visions. The latter required (a) development of economic infrastructure, (b) improvement of the country’s capability to acquire foreign currency and (c) poverty alleviation. “Building trunk roads and telecommunication networks” was stated as one of the means to improve the country’s capability to acquire foreign currency. Corresponding with the *Country Assistance Policy for Sri Lanka*, the *JICA Country-specific Program for Sri Lanka (2004)* also regarded (1) consolidation of peace and support for reconstruction and (2) assistance in line with mid- and long-term development visions as focus areas of JICA’s assistance for Sri Lanka. It aimed to achieve the latter through improvement of economic infrastructure. Pursuant to

the same, “the Program for strengthening of road transportation capacities” was formulated. After the end of the civil conflict in 2009, the Government of Japan announced the implementation of a development assistance program for Sri Lanka with a maximum budget of US\$ 1 billion. The Manmunai bridge construction project was incorporated into this program.

Because of the above reasons, Japan’s development assistance at the time of the planning which aimed to support consolidation of peace and recovery from conflict and disaster through development of economic infrastructure and improvement of trunk roads and telecommunication networks was highly relevant to Sri Lanka’s development plan,

3.1.4 Appropriateness of the Project Plan and Approaches

The Preparatory Survey report indicated that three options of bridge routes were proposed at the planning stage of the project. The ex-post evaluator asked a project management consultant in the Preparatory Survey to assess the bridge selection process and learned that the Manmunai route was adopted based on future prospects, traffic volume, distance from the closest bridge, and availability of ferry services. The evaluator confirmed the validity of the selection process. Further, through discussion with the consultant and the RDA, it was confirmed at the time of ex-post evaluation that there were no event that could undermine the appropriateness of the selection of the Manmunai route from the time of the selection prior to the implementation of the project.

In light of the above, this project has been highly relevant to Sri Lanka’s development policy and needs as well as Japan’s ODA policy. Therefore its relevance is high.

3.2 Efficiency (Rating: ③)

3.2.1 Output

In this project, the bridge and the causeway indicated in the table below were constructed as planned. Table 1 shows the details of the project outputs.

Table 1: Outputs

(1) New Bridge		
Bridge length		210 m
Bridge Width	Carriageway	7.4 m (two lanes)
	Walkway	Both sides 2.4 m (one side: 1.2 m)
Superstructure		
• Bridge type: PC simple deck slabs with pretension girder		
• Construction method: Girder erected by crane		

Substructure		
• Pier: Pile bent		
• Abutment: Inverted T-type abutment		
(2) Causeway improvement		
(1) Length		West approach: 195 m East approach: 293 m
(2) Roadway width	Carriage way	6.2 m (two lanes)
	Shoulder	3.6 m (one side: 1.8 m)

Source: Materials provided by JICA

However, some modifications were made after the Preparatory Surveys and Detailed Designing and outline is as followed.

After the Preparatory Survey, the following four modifications were made, and the reasons of modification are described as followed:

- 1) Modification of installation method of pile foundations: The supplementary geological survey carried out during the Detailed Designing revealed that the soil layers of the area were not as assumed at the time of the Preparatory Survey. The installation method of pile foundations and pile length were revised accordingly.
- 2) Change of extension joints: With regard to extension joints of the bridge, more appropriate joints were identified later compared with the type suggested at the time of the Preparatory Survey.
- 3) Installation of curb stones on the causeway: During the Detailed Designing, the width information of the causeway was clarified. Based on the information, it was suggested that curb stones, not hand rails, be installed on the causeway for better continuity.
- 4) Modification on bank protection of the causeway: The foundation of concrete block masonry was planned to be a cast-in-place concrete structure. However, based on the drawing of the causeway, it was decided to use mortar masonry for the foundation, which is widely used in the country and can be easily maintained and managed.

After the Detailed Designing, the following four additional modifications were made, and the reasons of modification are described as followed:

- 1) Modification of pile length: During the pile load test, it was not confirmed that the identified piles had the required bearing capacity. Then the bearing layers of the bridge required to be reviewed.
- 2) Revision of countermeasures against scouring: Original countermeasures against scouring required to be reviewed, taking into account of the outcomes of flood inundation at the construction site and riverbed measurements undertaken by the contractor.
- 3) Modification of revetment height and traffic safety measures: The revetment height was modified to widen the space under the bridge, thereby making bridge inspection easier. Further, concrete poles

were additionally installed on curb stones to easily recognize the carriageway from the shoulders even when flooding. This is because during a flood, some vehicles may try to pass the causeway, which is partially submerged.

- 4) Additional installation of ducts pipe for the electrical lines of streetlights: Ducts were installed for the electrical lines of streetlights between the bridge and the causeway.

The modifications from the Preparatory Survey to the construction stage were attributable to changes in the pile length, which resulted from changing the bearing layer of the bridge. Both the consultant and the RDA ensured that the modifications was necessary to enhance the quality and safety of the bridge and it was highly relevant modification. It was fair to say that the bridge design was modified at the right time in light of preventing the shoddy basement construction or delay in the construction schedule, attributed to lack of the bridge pile length. In regard to the possibility of whether modification of pile could be included in the planning stage or not, it would have been difficult for them to include the pile modification in advance, taking into account the natural environment and its change because lagoon environment including water level and flow velocity and geological strata condition were considerably different from those in Japan and also there were no relevant record available in Sri Lanka. For the reasons above, this evaluation study confirmed the validity of the design modifications reflecting the results of the geological survey. It was assured with the consultant and the RDA that the modifications had no negative resultant impact on the project effect, cost and time period.

3.2.2 Inputs

3.2.2.1 Project Cost

Although the total project cost was initially estimated to be 1,350 million yen (1,206 million yen borne by Japan and 140 million yen borne by Sri Lanka), in reality it was 988 million yen (951 million yen borne by Japan and 37 million yen borne by Sri Lanka), which is less than planned (73% of the estimate).

Table 2: Planned and Actual Project Cost

(million yen)

Category		Plan	Actual
(1) Construction cost		1,063	829
	Main works	715	662
	Others	348	167
(2) Design and maintenance cost		122	121
Total		1,185	951

Source: Materials provided by JICA

The Government of Sri Lanka made payments to the contractor in two installments. The first payment was delayed by one month because of a change in the banking arrangements, and the second payment was effected as scheduled, and the consultant confirmed there were no problems.

Table 3: Project Cost Borne by the Sri Lankan Side

	Plan (2010) (LKR 10,000)	Actual (LKR 10,000)
Land acquisition and compensation	0	0
Relocation of public facilities	0	25
Value Added Tax (VAT)	12,900	740
Cost to process Banking Agreement (B/A) and Authority to Pay (A/P)	100	0
Utility supply and installation of telephone lines	750	97
Installation of utility poles	Added	890
Administrative cost		3,015
Miscellaneous (local tax and others)		363
Total	13,750	5,130

Source: Materials provided by JICA

The Japanese Government expended only 79% of the planned budget. This was because of a reduction in the cost of the construction road in the lagoon that was changed from pier structure to embankment structure. In accordance with a proposal from the contractor, this change was approved after a thorough consultation with the RDA, which made sure that embankment structure would not negatively affect the volume of water supply during construction. It was confirmed that the change in the structure had no negative effect on the quality of the project outputs.

With regard to the Sri Lankan responsibility and expenditure, actual expenditure of VAT was significantly lower than planned amount. This was because originally the RDA was planning to pay VAT and then get reimbursed. However, a request for VAT exemption to the Ministry of Finance was made and approved, and thus, the payment on VAT was exempted. Besides, the Sri Lankan Government duly fulfilled all the requirements agreed at the planning stage.

3.2.2.2 Project Period

The planned project period was 33 months⁵ between August 2011 and March 2014. The actual period was a total of 33 months from September 2011 to May 2014 (100% of the plan). Any changes made after the Detailed Designing are outlined above. The reason that the changes caused no extension of the project period was efforts exerted by the project management consultant and contractor during the project implementation period as discussed 2 points below:

- 1) Communication between the headquarters of the project management consultant in Japan and the supervisor in construction site was smooth. The trusting relationship between them had been developed. The headquarters immediately carried out necessary technical backstopping and

⁵ Both the ex-ante evaluation sheet and Preparatory Survey Report do not clearly indicate the definition of starting and completion of the project. Thus, the project period is based on the ex-ante evaluation sheet, taking the G/A date as beginning and completion of the construction as project completion, totaling to 33 months, counting both the beginning and ending months with 32 months of implementation.

engaged in consultation with JICA over applications and procedure to get approval for design changes upon receipt of information from the supervisor. The procurement of materials in the construction site was also facilitated based on information from the headquarters.

- 2) The construction schedule was flexibly adjusted taking into account weather conditions of the area. Construction work is generally delayed during the rainy season. However, some works that can be carried out during the rainy season were implemented earlier than planned. This changed order of construction process helped avoiding extension of the construction period.

Although there were modifications to the design that was prepared at the time of the Detailed Designing, the project was completed as planned. In this regard, the efforts exerted by the contractor is noteworthy.

From the above, this project had design modifications however, it was confirmed that the design modifications were reasonable to enhance the quality and safety of the bridge and had no any impact on the project effect, cost and time period. The efficiency of the project is high because the project was implemented as planned with regard to cost and period.

3.3 Effectiveness and Impacts⁶ (Rating: (3))

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The quantitative indicators set at the planning stage were (1) average daily traffic volume⁷ (PCU/12 hours), which is the operation indicator, and (2) travel distance between Western and Eastern shores, (3) travel distance from Western shore to Batticaloa town (km), (4) travel time between Western and Eastern shore,⁸ (5) interrupted hours (hours/day) and (6) interrupted period due to flood (day), which are the effect indicators.

Because the executing agency had no data related to the above indicators, a traffic volume survey was undertaken.

Table 4: Baseline, Target and Actual Performance of Operation Indicator

Indicator	Baseline (2009)	Target (2017)	Actual (at the time of ex-post evaluation)
(1) Average daily traffic volume ⁹ (PCU/12 hours)	456	1,827–1,969	1,440

Source: Materials provided by JICA and Traffic Survey

Note: The baseline data was calculated on the condition of 12–24 ferry services per day.

⁶ Sub-rating for Effectiveness is to be put with consideration of Impacts.

⁷ The traffic volume survey used the same categorization of traffic means and PCU coefficient as Preparatory Survey.

⁸ The ex-post evaluation study team actually drove a total of four times on the bridge; in the morning and in the afternoon on weekdays both towards the Eastern shore and the Western shore. Then, the driving time was averaged.

⁹ The traffic survey was conducted under the same conditions as the Preparatory Survey (it was done between 6:00 and 18:00 for two weekdays and the collected data were averaged.) Each enumerator was assigned at West and East sides of the bridge to count the number of vehicles. The number of vehicles was recorded by vehicle type. The PCU was calculated by adding each vehicle type count multiplied by a PCU coefficient.

The PCU calculated based on the data collected in the ex-post evaluation was 1,440, which was below the target. Then the calculation approach was examined and the target was calculated based on the baseline data. There was a possibility that baseline data were not properly and accurately counted. According to the RDA Planning Department, the baseline survey was conducted in 2009 immediately after the end of the civil conflict, when the number of visitors to the area increased significantly. Then the baseline data might have included not only the number of local residents but also that of the visitors because of the difficulty in differentiating the visitors from local residents. In view of this, to examine validity of actual data, 1440, estimated traffic volume data of the year 2017¹⁰ was obtained from the RDA Planning Department at the time of ex-post evaluation. The projected traffic volume excluding the number of bicycles on the Manmunai bridge was 1,006 and in reference to the method used for the projection, the PCU from the Traffic Survey was recalculated to 1,362 which was considerably higher than 1,006 and considered satisfactory. To crosscheck the validity of the projected data, PCU data at the point where the national road A4 meets with B344, which is at the end of bridge across the lagoon like Manmunai was compared.

In addition, looking into the number of the traffic, approximately 70% of the whole traffic volume was motorcycles and slightly more than 10% were cars and three-wheelers respectively. Between AM 6:00 to 8:00, a lot of bicycles, three-wheelers and large buses passed from Manmunai (West shore) to Batticaloa (East shore) while throughout the day a lot of medium goods vehicle passed from Batticaloa to Manmunai. It meant that people move from Manmunai to Batticaloa commuting to workplace and school in the morning while agricultural and livestock products are transported from Batticaloa to Manmunai as economic movement.

It was confirmed that the targets on all the five effect indicators were successfully achieved at the time of ex-post evaluation.

Table 5: Baseline, Target, and Actual Effect Indicators

Indicators	Baseline (2009)	Target (2017)	Actual (at the time of the ex-post evaluation)
(2) Travel Distance between Western and Eastern Shores	Approx. 32 km	Approx. 300 m	Approx. 300 m
(3) Travel Distance from Manmunai Western Shore to Batticaloa town	Approx. 27 km	Approx. 15 km	Approx. 15 km
(4) Travel Time between Western and Eastern Shore	Approx. 60 mins. (waiting time: 30-60 mins. + 10 mins. travel time by ferry)	Less than 1 min.	Less than 1 min.

¹⁰ Variables included population (daytime and nighttime population, employed and unemployed), land use (area by land use purpose, floor area by use purpose and population density) and socio-economic issues (commodity prices both at shipping and in the market, income and the number of vehicles owned).

(5) Interrupted Hours (hours/day)	12 hours in night time (18:00–6:00)	0	0
(6) Interrupted period due to flood	Approx. 14 days	Approx. 1-2 days	Approx. 1-2 days ¹¹

Source: Ex-ante Project Evaluation Sheet

Reference of the actual data at the time of the ex-post evaluation was as follows

- (2) Travel Distance between Western and Eastern Shores: Referred to the materials provided by JICA
- (3) Travel Distance from Manmunai Western Shore to Batticaloa town: Verified on the map of the area
- (4) Travel Time between Western and Eastern Shore: Confirmed through actual measurement
- (5) Interrupted hours: Confirmed through interview with the RDA
- (6) Interrupted period due to flood: Confirmed through interview with the RDA

3.3.1.2 Qualitative Effects (Other Effects)

The interviews with stakeholders¹² around the target area were used and qualitative effects on (1) stable transportation of agricultural products and (2) distribution of goods and interaction among local residents were examined.

(1) Stable transportation of agricultural products

The CEO of the Batticaloa Chamber of Commerce described: Before the bridge construction, to transport large-sized materials or any materials during a flood, they were required to use and travel on maintained roads with sufficient width, which increases the travel distance by 20–25 km. However, since the construction, it has become easier to transport products. They can travel three to four times a day now while it was only once a day in the past. They can now ship marine products to Colombo without losing their freshness and the volume of products transported has increased by more than 50%. Before the bridge construction, products were used to be delivered only to places on main roads. Now it has become possible to deliver products to villages and places far away from main roads.

A shop owner who sells and transports chicken, eggs and livestock feed, said that before the bridge construction, his delivery limitation was one to two bags of animal feed (100 kg/bag) in a day by ferry but after the construction he can transport up to 15–20 bags by truck. He added that it took 1.5 hours to transport materials to the other side of the lagoon in the past but now takes only five minutes.

A shop owner, who collects, sells and transports raw milk, said that he collected 50 liters of milk a day before the bridge construction but after the bridge construction he collects 250 liters a day because more dairy farmers come to him to sell raw milk.

(2) Distribution of goods and interaction among local residents between both shores

According to interviewees from schools, hospitals and the CEO of the chamber of commerce, religious

¹¹ It was due to the submergence of roads that connect with the bridge, not that of the bridge itself.

¹² The attributes of the respondents to the qualitative survey on the effectiveness and impacts of the project, are indicated in each part. The total number of interviewees in the survey was 36 (23 men and 13 women).

and cultural exchange has been increasing. More residents from the Eastern shore visit the Hindu temple in Kokkaddicholai, which is located on the Western shore. School principals from both shores said that their schools started to have interaction with each other through joint sports, cultural and music festivals, and school excursions are organized for students from Eastern shore schools to visit villages and different places on the Western shore. Before the bridge construction, children living on the Western shore felt culturally and socially inferior to their counterparts on the Eastern shore owing to underdevelopment of their area. However, at present, they attend schools on the Eastern shore and have more friends from the Eastern shore.

Bridge construction contributed to local residents by the reduction in such matters as distance and time to transport agricultural products. They can transport products in less time by truck, thereby maintaining the quality of the products. Therefore, it can be evaluated that the construction of the bridge has successfully provided a stable transportation of agricultural products. Further, by the bridge construction, residents interact more with those living on the other side and consequently cultural, religious and educational connections and interactions have been increased. It is fair to say that the construction of the bridge helped boost the interactions.

3.3.2 Impacts

3.3.2.1 Intended Impacts

The evaluation team confirmed the impacts of this project from two perspectives: (1) vitalization of the local community and (2) improvement of the quality of life for local residents.

(1) Vitalization of the local community

To find out how far this project contributed to vitalization of the local community, the evaluation team confirmed three points: (a) development of local industries, (b) the ripple effects of improved distribution of agricultural products, and (c) those of the exchange of people and goods between both shores.

(a) Development of local industries

According to Batticaloa District's statistics, 17% of the companies located in Batticaloa at the time of ex-post evaluation were mainly established after the construction of the bridge. After the civil war, a total of 145 new companies were registered with the county office between 2009 and 2017, and the number of registered companies, which stood at 2,033 in 2009, increased to 2,450 in 2017. According to the CEO of the chamber of commerce, business was being generated slowly but steadily, and these changes have made people more and more enthusiastic toward business. Furthermore, in June 2017, Brandix, the second largest apparel firm in Sri Lanka, invested US\$ 19 million to build a factory on the eastern-shore side of the bridge. An officer of the company said that the bridge's construction was one of the decisive factors for the establishment of the factory in the area. Of the firm's 2,400 employees, 550, a little more than one fourth, commute to work from the west-bank side of the bridge.

Residents in the more southern part of the west bank, much of which is covered in jungle, say that they

no longer need to go over to the more developed eastern shore because villages on the western shore started to prosper after the bridge was built and that they now visit villages on their side of the bridge for shopping. This trend means growing economic demand on the western shore, suggesting that it is helping develop the western-shore side's economy.

(b) Ripple effects of stable transport of agricultural products

According to the CEO of the chamber of commerce, thanks to the construction of the bridge, the volume of Batticaloa's agricultural products supplied to the market grew by 50–60%. The CEO also said that, since construction of the bridge, shorter transport routes have enabled fuel cost reductions, lowering transport and delivery costs by 25%. The CEO of the chamber of commerce and the shop owner who sells and transports chicken, eggs and livestock feed emphasized that after the bridge was constructed, improved roads and truck transport helped reduce damage to such products, and that shorter transport and delivery times helped keep them fresh, allowing the stores to ship fresher ones. Before the construction of the bridge, products were often damaged during transport. For example, during ferry transport, blazing sunshine killed chickens, and livestock feed got wet as it was washed by waves in the lagoon. However, these problems were solved, which pleased the CEO and the owner. In addition, they commented that they were now able to ship products continuously even during the rainy season, contributing to stable product supply to the market.

(c) Ripple effects of the exchange of people and goods between the two shores

The CEO of the chamber of commerce added that Sinhalese and Muslims had started to do business together, lowering cultural barriers, and that a value chain had been built more firmly, attracting more business partners as well as buyers and sellers of products.

(2) Improvement of the quality of life for local residents

The evaluation team confirmed how the project had impact on improvement of the quality of life for local residents from three points of view: (a) improvement of access to emergency medical care, (b) improvement of access to educational institutions, and (c) improvement of access to public transportation.

(a) Improvement of access to emergency medical care

The results of on-site surveys indicated that at the time of the ex-post evaluation, among medical institutions that accepted emergency outpatients, all core hospitals not only in the city of Batticaloa but also on the western shore had an emergency outpatient system. Patients who are considered difficult for a local core hospital to treat are brought to a general hospital in Batticaloa. An officer at Mahiladitivu Hospital, located on the western-shore side of the bridge, said that since the construction of the bridge, the number of patients brought to the general hospital had risen, although the frequency was not so high. The officer also said that the construction of the bridge helped reduce the labor and cost needed to arrange an ambulance from the eastern to western shores when not enough ambulances were available.

After construction of the bridge, it became easy for doctors and their staff members to travel between the two shores, leading to a steady improvement in the quality of medical services, and after the bridge was built, an emergency outpatient system was established at hospitals on the western shore, enabling them to treat 30 emergency outpatients. A department of gynecology and obstetrics, which often treats emergency outpatients, was also newly installed in hospitals on the western-shore side after the bridge was constructed. The officer added that Mahiladitivu Hospital has had part-time doctors (supporting doctors called when hospitals on the western-shore side of the bridge could not treat patients sufficiently) come to the hospital since the bridge was constructed. Before the bridge was built, personnel who commuted to the hospital from the eastern-shore side sometimes stayed in the hospital and worked overnight, but today, they are commuting to work every day.

Furthermore, according to the officer, a sufficient amount of medicine and medical equipment has started to be delivered periodically since the construction of the bridge. The number of bus departures, a public means of transportation, on the western-shore side of the bridge (mainly from the south) increased from one to 12 per day, boosting the number of patients at the hospital.

(b) Improvement of access to educational institutions

According to schools on the western-shore side, students on the western-shore side attended school there because they basically liked a school to which they could commute from home (this tendency remains unchanged even today). Thanks to the construction of the bridge, however, schools on the western-shore side are now able to employ better-qualified teachers (especially math and science teachers) from the eastern-shore side (37 persons/40 persons), and this has improved the overall academic performance of students significantly. Another benefit is that teachers commuting from the eastern-shore side by ferry have arrived late for school much less frequently. Many students attend a prep school after school is over, but it seems that an increasing number of students attend a prep school on the eastern-shore side since the construction of the bridge.

According to schools on the eastern-shore side, there is no school for ninth-grade or higher students on the western-shore side, but the construction of the bridge has made it easy to attend a high school on the eastern-shore side. It seems that the construction of the bridge has led many students, who had formerly given up the idea of attending a school on the eastern-shore side because of the inconvenience of commuting, to decide to attend one. The number of students from the western-shore side has tripled. Many female students had commuted to a school on the eastern-shore side from the western-shore side by bus every day because their parents were worried about their children living in a dormitory away from home. Before the bridge was constructed, they sometimes could not commute to school during the rainy season because of the rising water level of the lagoon, but since the construction of the bridge, they said that they could attend school without being affected by weather. Male students live in the dormitory of a school on the eastern-shore side and return to the western-shore side over the weekend to see their family whenever they like because their parents object less to a dormitory life. They are pleased that they can return home easily across the new bridge.

(c) Improvement of access to public transportation

It was confirmed that private bus services had also increased since the construction of the bridge. Before the bridge was built, there were only government-run bus services, but at the time of ex-post evaluation, there were seven private and five public bus services between Manmunai and Batticaloa. Buses depart every 30 minutes between 5:30 a.m. and 6:30 p.m. Before the construction of the bridge, there was no bus service in the south, and southern people complained that they had had great difficulties in going to the city hall or banks because they had to go to the eastern-shore side using a cattle-pulled cart or on foot. Moreover, when there was no bus service, they had to go through the jungle to visit the city and were afraid that they might encounter an elephant, but since the bridge was built, the western-shore side, including the south, has developed economically, making new bus services from the south to the eastern-shore side available.

With regard to vitalization of the local community, the construction of the bridge has led to the development of local industries; economic benefits brought by the stable transport of agricultural products; and growing business opportunities due to exchange between both sides of the lagoon. Thus, it is fair to say that the project has had a tremendous impact on the local community. Regarding improvement of the quality of life for local residents, the project had painted a scenario in which the local community would benefit directly from better access to the coastal area from the inland in terms of emergency medical care, education and public transportation, but indirect development was observed as the convenience of the inland improved and the inland developed. As a result, the quality of life for local residents, which affects the fundamental aspects of their lives, has improved significantly.



Photo 1: Emergency ambulance transportation to the east-bank side of the bridge became easy



Photo 2: The opening of the bridge contributed to reducing truck delivery time and cost

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the natural environment

Under Sri Lankan domestic law, when constructing a new bridge, it is necessary to conduct environmental impact assessment and obtain permission from the Central Environmental Authority (CEA) of the Ministry of Environment and Natural Resources. After the CEA checked the lagoon environment, it concluded that environmental impact assessment was not necessary because this project would not lead to crucial environmental problems and potential negative impact was under control. Besides, this project obtained permission from the CEA and satisfying both the conditions, fulfilling the

environmental standards established under the domestic law. In addition, during the construction work, contractors carried out environmental monitoring and shared information with the RDA. From October 2012 to March 2014, they conducted environmental assessments every day and issued a monthly report (15 reports in total) that summarized the results of assessments of such factors as air, water quality (pH value, electric conductivity, dissolved oxygen, turbidity, temperature and salinity), soil, land subsidence, vibration, noise, drainage at construction sites, the living environment of workers and so on¹³. Based on the standard of Environmental Management Plan, this survey used figures for October 2012 as its baseline which was before the construction, and during the monitoring, various indicators did not exceed the baseline. It was confirmed that mitigation measures described in Environmental Management and Monitoring Plan and monitoring items were implemented. Besides, it was also confirmed from the reports that residents had not filed any complaints. After the construction work, the RDA has been visually observing the impacts on environment (air pollution, noise, water quality, wastewater, soil, and living organisms) and there has been no issues.

At the time of the planning, there was concern that the transfer of fish traps near the former ferry station might affect fisheries, but it was confirmed through interviews with RDA officials and local residents that the newly constructed bridge did not affect fisheries. The fish traps are removable, and they were transferred from where they were before the bridge was built to both sides of the bridge today, and it was confirmed through local interviews that there was no problem with the catching of fish.

(2) Resettlement and Land Acquisition

In the implementation of this project, one case of land acquisition was confirmed, but appropriate actions were taken in accordance with Sri Lankan domestic law and the *JICA Guidelines for Environmental and Social Considerations (2004)*. According to the RDA, it was confirmed that the transfer and removal of existing utilities at the project site as required; necessary regulations for road traffic and ship; the maintenance of temporary yards and ensuring of safety at the project site were dealt with. Furthermore, it was necessary to transfer the ferry station on the western-shore side to the middle south during the construction work to connect the bridge to the road repaired by ADB, but it was confirmed that there had been no particular problem due to the transfer of the ferry station, according to RDA and Road Development Department (hereinafter referred to as “RDD”).

(3) Other positive and negative impacts

Regarding ethnic composition in Batticaloa District, Tamils represent an overwhelming majority of the population, with 72.2%, 26.8% by Sri Lankan Moors,¹⁴ and 1.0% by others. For this reason, this area has long been controlled by the Liberation Tigers of Tamil Eelam, and construction projects by Sinhalese businesses tend to cause troubles with local residents and problems happened to construction operation in the past. Therefore, in implementing construction projects, it was necessary for contractors to give priority to labor management, consisted of Tamils. When this project was carried out, the

¹³ Various items on flora and fauna were also monitored.

¹⁴ Sri Lankan Moors are the third largest ethnic group in Sri Lanka and mainly believe in Islam.

contractors hired Tamils as workers, but problems attributed to ethnic conflicts did not occur. The contractor gave much consideration to maintaining the accuracy of work by, for example, instructing unskilled Tamil workers to take measurements using sticks whose measurement has been marked on it. Meanwhile, negative impacts on the local community because of discontinuation of the ferry service was not confirmed. The ferry company undertook RDD projects with a time limit fixed on contract, so there were no layoffs of workers or other problems due to the discontinuation of the ferry service, nor were any other negative impacts confirmed.

Regarding effectiveness, the PCU, an operational indicator, did not achieve the target, but it is fair to say that the volume of traffic is sufficient: the way the target was calculated was not necessarily appropriate, and it was considered appropriate when the data obtained from surveys of traffic volumes were compared with those computed using traffic volume prediction software. It was confirmed that other quantitative effects had almost achieved their target values and that the bridge's construction had promoted exchange of people and goods, resulting in tremendous and diverse positive impacts on the area around the bridge and its residents. Based on the foregoing analysis, this project has achieved its objectives. Therefore, effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

As different agencies are responsible for managing the maintenance of the bridge and its access roads in this project, the RDA supervises the bridge including causeways, and the RDD oversees the access roads.¹⁵ This project was implemented on a provincial road. However, because the provincial road had a traffic volume of over 250 vehicles¹⁶ per day and connected national highways, the RDA had intended to upgrade the provincial road, including the bridge, to a national highway after the project to repair and widen it using loans from this project and ADB. With this upgrading, the RDA was supposed to become a maintenance and management agency for this project. After the project's completion, the plan for upgrading to a national highway was put on hold because of a change of government. However, at the time of ex-post evaluation, it was confirmed with the RDA's Planning Department and Batticaloa bureau chief that the procedures for upgrading were being followed again.

The RDD performs maintenance work for provincial roads once a year, but because of a lack of budget, it repairs roads with a higher order of priority, and the roads up to the Manmunai bridge are left unrepaired. The on-site survey at the time of ex-post evaluation confirmed large holes at several locations on the roads leading up to the bridge. These holes are believed to have been caused by the traffic volume increased after the opening of the bridge, worsening the points requiring further repair.

RDA Batticaloa, a subordinate organization of the Eastern RDA, assigns one engineer, one work supervisor, and four workers for maintenance management. These personnel are enough to handle

¹⁵National highways (Class A and B roads) are supervised by the central government's RDA and provincial roads (Class C and D roads) by the RDD.

¹⁶ Reference from Preparatory Survey.

maintenance and repair if such work deals with minor repairs or issues of only the Manmunai bridge, but they are supposed to cover roads and bridges other than the Manmunai bridge. If maintenance and repair are urgently needed, it cannot be said that RDA Batticaloa has a sufficient number of personnel. Because the bridge is relatively new, the RDA believes that its current workforce is sufficient. However, based on experience with other bridges, it has nine maintenance assessment engineers, three senior engineers, a bridge inspection vehicle and other resources in the Eastern Province, and can take all necessary actions in the future.

3.4.2 Technical Aspect of Operation and Maintenance

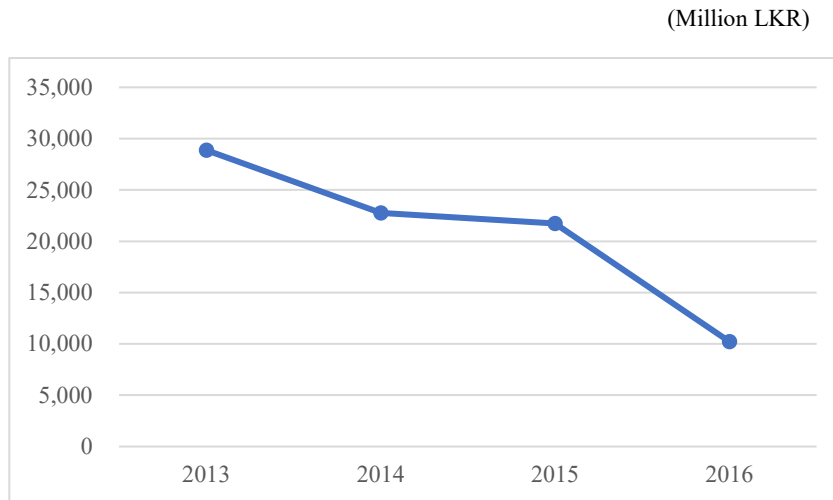
At the time of planning, the RDA was an organization that specialized in road and bridge planning, design, construction, and maintenance management, and it was confirmed that its personnel were striving to receive various kinds of technical training, accumulate experiences in receiving training and studying abroad, and acquire and improve their technical capabilities. The RDA can maintain bridges using its own technical capabilities if they are small in scale (particularly concrete bridges). The RDA has a sufficient track record of road and bridge maintenance because it has so far implemented such projects with the support of various foreign countries. It was determined that there was no problem with the RDA's technical standards as an executing agency when this project was carried out. In addition, the technical level of its personnel required for operation and maintenance management improved through JICA's three-year technical cooperation named "Project for the Capacity Development on Bridge Management," including the training provided from November 2014 to November 2017 and JICA Group and Region-Focused Training. At RDA Batticaloa, after the training, senior engineers provided on-the-job training (OJT) on a daily basis. Training needs are collected mainly through baseline and questionnaire surveys. After the training, a bridge maintenance and evaluation unit was established.

The manual for management and maintenance/inspection systems, which the RDA compiled in 1985, is used even today. Bridges and causeways are visually inspected by RDA Batticaloa personnel once a month. In the future, the RDA plans to effectively use an inspection, diagnosis and repair manual made through "Project for the Capacity Development on Bridge Management" by the end of 2018.

The RDA's inspection equipment includes a bridge inspection vehicle provided through this JICA technical cooperation project which is used to inspect the structural part of bridges, but there is only one such vehicle in Sri Lanka; in the Eastern Province, it has not been used to inspect all bridges. The Manmunai bridge has never been repaired or reinforced because it is a relatively new one, but the possibility of the bridge requiring serious repair in the future cannot be denied; therefore, daily inspection is important so that any signs of the need for such repair are not overlooked. At the RDA, a repair and reinforcement system, including the bridge maintenance and evaluation unit, is being established. The JICA technical cooperation project developed engineers over the three years. In addition, information on management is updated appropriately based on current situation, and a manual for maintenance and inspection have been compiled. Given this state of affairs, it is fair to say that the RDA has sufficient operation and maintenance technology.

3.4.3 Financial Aspect of Operation and Maintenance

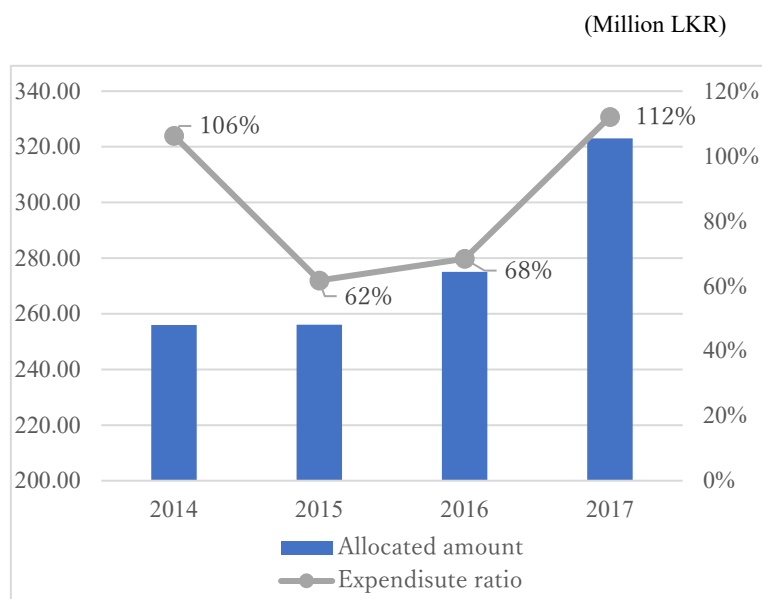
While the RDA’s overall expenditure has continued to grow, results show that its spending on road development and maintenance has gradually fallen each year since 2013. Because of growth in overall expenditure, the percentage of budget allocated to road development and maintenance within the RDA has changed.



Source: Executing agency

Figure 3: RDA’s Road Development and Maintenance Expenses

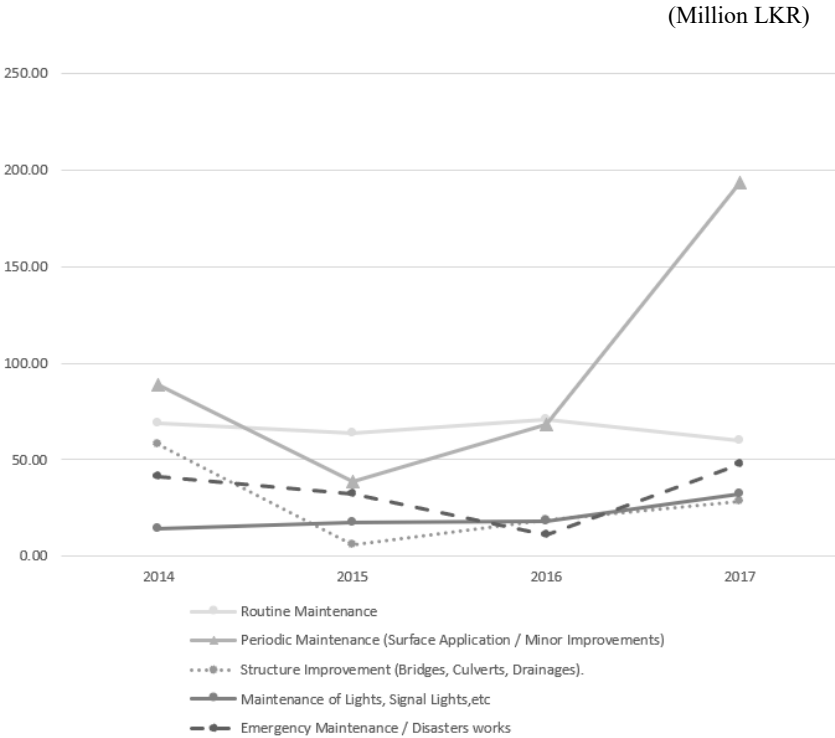
The amount of national budget allocated to the Eastern RDA continued to increase from LKR 256 million in 2014 to LKR 323 million in 2017, but the percentage of expenditure varied from one fiscal year to another. The RDA’s budget related to road maintenance (Road Maintenance Trust Fund) is estimated at LKR 500 million annually from 2018 to 2020, indicating that sufficient budget is expected to be secured for the future.



Source: Executing agency

Figure 4: Budget for the Eastern RDA

In 2015 and 2016, RDA did not use up the budget allocated to it as the percentage of expenditure to total budget remained low, at 60–70%. In 2017, expenditure exceeded the allocated budget as the percentage stood at 112%. As shown by the graph below, regular maintenance expenditure (surface/minor repair) varied from one fiscal year to another. This suggests that the accuracy of predicting future expenditure is low although maintenance work is performed periodically. If the fact that while expenditure exceeded allocated budget in 2014 and 2017, the percentage of expenditure to total budget in 2015 and 2016 remained at 60–70% is taken into consideration, the accuracy of estimating maintenance budget is also low. In the future, appropriate budget management is essential to secure the RDA’s budget for, and make investments for maintenance .



Source: Executing agency
 Figure 3: Results of the Eastern RDA’s Expenditure

According to RDA Batticaloa, the Eastern RDA’s budget is spent on roads and bridges based on the order of priority. A look at the Eastern RDA’s budget and expenditure shows that it can make investments in various types of equipment at the right time as required if the Eastern RDA appropriately grasps and manages the amount of budget required for proper maintenance management for roads it covers, including bridges, and actually allocated maintenance management expenses. Meanwhile, the RDA’s overall road development and maintenance expenses have continued to fall, but this trend does not affect the Eastern RDA’s expenditure. Under the present circumstances, however, it is difficult to say that the Eastern RDA grasps the difference between the amount of budget required for proper maintenance for roads it covers, including bridges, and actually allocated maintenance expenses. The Eastern RDA needs to estimate and allocate budgets appropriately according to the budget the RDA

requests for the area under its supervision, the order of priority, and provincial policy. Therefore, it has some issues to address when financing its operation and maintenance.

3.4.4 Status of Operation and Maintenance

Structures to be repaired, including the bridge, causeways, and incidental equipment, were visually inspected (seen directly and from far away), and no damage, cracks, and other defects were detected, indicating that the bridge was in a favorable condition. The operation and management of their maintenance are visually inspected once a month according to the manual compiled by the RDA in 1985. In the past, prior to the ex-post evaluation, there was no situation that required repair. When evaluators visually inspected the bridge and causeways at the time of ex-post evaluation, they found graffiti on the road surface, concrete walls, and bridge clearance abutments, garbage stuck in the drainage, and other relatively minor problems. It is desirable to devise and take measures to prevent passers-by lacking in moral sense from tarnishing facilities. To manage serious repair work that may arise in the future without being too late, it is important to perform inspection duties (at normal times, periodically, and under abnormal circumstances) reliably and maintenance work at the places pointed out as required. To use targeted facilities effectively in the long run, it is necessary to establish and perform inspection duties and maintain the places pointed out during inspections.

The foregoing indicates that RDA Batticaloa has established a maintenance management system, but not much progress has been made in road repair because the roads leading up to the bridge are not supervised by the RDA. However, improvements are expected to be made if the fact that procedures are being followed to upgrade the road sectors concerned is taken into account. There is room for improvement in the lack of budget management and periodic inspections by the Eastern RDA, but it still has elbowroom for better budget management, has a maintenance management system, and trained engineers are working hard to further develop their organization through OJT.

Therefore, some minor problems have been observed in terms of the institutional, technical and financial aspect in this project's operation and management. Therefore sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented to facilitate smooth traffic flow and transportation of goods through the construction of a new bridge across the Batticaloa lagoon at Manmunai in Sri Lanka, and thereby contributing to vitalizing the local community and improving the quality of life for local residents.

The project is consistent with Sri Lanka's development policy and development needs as well as Japan's official development assistance policy, which was clear both at the time of the planning and the ex-post evaluation. The selection of the bridging route as well as the project's plan and approach were appropriate, making the project highly relevant. The project underwent design changes at the time of detailed designing. However, these changes were considered reasonable from the viewpoint of ensuring

the quality and safety of the bridge, and the project was highly efficient because these changes did not affect the effects of the project as well as its cost and period, allowing the project cost to fall within the plan. With regard to effectiveness, the project failed to achieve the goal for the passenger car unit PCU as an operational indicator. However, when the target PCU was set in 2009, the movements of people other than residents who were engaged in post-civil war reconstruction projects might have been counted as part of the baseline, and the target might have been set higher. For this reason, the traffic volume was considered reasonable by comparing it with the 2017 data, which were calculated using traffic prediction software with various factors. Effectiveness and impacts of the project are high, as it was confirmed that other quantitative effects had been realized and that the promotion of exchange of people and goods had tremendous and diverse positive effects on the area around the bridge and its residents. Regarding sustainability, not much progress has been made in road repair because the roads leading up to the bridge are not placed under the control of the Road Development Authority RDA. The sustainability of the project's effects is fair because there is room for improvement in budget management and various types of regular inspections by the Eastern RDA, which supervises the bridge covered by the project.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Upgrading roads leading up to the bridge to national highways

The improvement of traffic access is not completed with the construction of bridges, and unless roads leading up to bridges are maintained and managed properly, improving traffic access and ensuring safety further cannot be expected. To that end, the RDA should upgrade roads leading up to the bridge to national highways soon.

(2) Implementation of careful monitoring and maintenance

Because the bridge is relatively new, it has never been diagnosed as requiring repair and reinforcement. However, the possibility of serious repair work becoming necessary in the future cannot be denied. Thus, in order not to overlook signs of the need for such work, it is proposed that RDA Batticaloa should establish a system to perform maintenance work to eliminate small abnormalities detected through periodic monitoring as required.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

Response for unexpected design changes take place

Despite design changes, the project was completed as planned because there was smooth communication between the consultant's head office in Japan and the site supervisor, and the construction process was flexibly changed considering local weather. When modifying the design of the

bridge, on-site investigations by specialized engineers are necessary. Engineering consultants in infrastructure can be classified into two major areas: (1) surveys and planning design and (2) supervision of construction work. When it is necessary to take actions in respect to natural conditions unforeseeable at the design stage, conditions of construction are not expected at the time of design or other events, engineers who exceed in (1) need to deal with the issues. However, in the case of unforeseeable significant design changes of this bridge made after Detailed Designing, it took time to solve the problem because (1) engineers were not able to visit the construction site. If (1) engineers can travel to the construction site, the additional effects listed below can be expected.

(a) Issues to address can be recognized properly.

If construction work proceeds with such issues vaguely recognized, it is unlikely that the most suitable actions will be taken.

(b) Surveys can be conducted swiftly and reliably to obtain necessary data in order to cope with problems.

It often takes time to collect data if laymen do so. Also, the accuracy of data collected could be low, it is likely that corrective actions may have to be taken on a larger scale.

(c) Delays in construction work can be minimized.

In some cases, construction work has to be stopped until the problem is solved, and this delays construction work.

(d) Appropriate explanations can be given to the implementing country and JICA.

Full explanations by the designer to the client contribute to voluntary, sustainable operation and maintenance management on the part of the recipient country.

If information or problems not expected at the design phase are revealed at the site, requiring design changes like this case, it is desirable that specialized engineers can travel to the site to confirm the situation and conduct on-site investigations.