Republic of Peru and Republic of Ecuador

FY 2015 Ex-Post Evaluation of Japanese Grant Aid Project
"Project for Construction of the New International Bridge of Macará"

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0. Summary

The Project for Construction of the New International Bridge of Macará (hereinafter referred to as "the Project") was implemented in order to secure smooth and stable traffic by constructing a new bridge and approach roads downstream of the deteriorated Macará International Bridge in the border region between Ecuador and Peru, thereby contributing to the development of the border region. The border region has been jointly developed by the two countries: in the national plans of both countries, construction of the international trunk highway including the Project has consistently been regarded as an important issue. Considering also that there was a strong need to rebuild the bridge and this is also consistent with Japan's aid policy, the Project has high relevancy. In the Project, the planned outputs were achieved. However, because the tender process repeatedly ended in failure due to escalation of material prices during the time taken for domestic procedures prior to the tender and also due to the remote distance of the Project site, it was necessary to conduct additional study and re-sign the Exchange of Notes. As a result, the period and the cost of the Project greatly exceeded the plan. Therefore, efficiency of the Project is low. Following completion of the Project, stable border traffic has been realized and large-size vehicles are able to safely cross the New International Bridge of Macará. It is possible to conclude that border crossing time has been shortened a little, however, it is anticipated that the time can be notably shortened when the bi-national border facilities which are currently under construction starts operation. Thanks to the bridge, traffic comprising mainly of small vehicles travelling short distances has doubled, and this has contributed to socioeconomic development in the border region. In addition, risk for inundation in the upstream areas at times of flooding has been reduced by sufficient flow section secured by the new bridge. Accordingly, the Project effectiveness and impact have been high. Both countries carry out appropriate operation and maintenance for the bridge with clear division of responsibilities, and since no major problems is identified in institutional setup, technical capacity and finances for operation and maintenance, the Project sustainability is high.

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

1. Project Description

Project Location

New International Bridge of Macará
(A view from Peru to Ecuador)

1.1 Background

Ecuador and Peru were involved in repeated military clashes triggered by border disputes from the 19th century onwards, however, they arrived at a Peace Agreement in October 1998. As a result, the two countries established the Bilateral Border Development Committee in order to conduct development based on bilateral cooperation in the border region where the prolonged dispute had stunted development. The committee compiled a 10-year development plan and aimed at realizing integration and development of the border region. One of the four major policies in this is the vitalization of border transit and trade based on construction of transportation infrastructure including border facilities. Within this, it is planned to rebuild international bridges and construct new border facilities on four out of five of the routes that span the border. Macará International Bridge is located on the "third axis" that links city of Loja, the capital of Loja Province in Ecuador, and the city of Piura in Piura Region, Peru. This route is also regarded as a part of the Pan-American Highway[1].

It was against such a background that JICA implemented "the Project Formulation Study (Border Region Development): Ecuador and Peru" in 1999. Within this, a project for construction of four bridges including Macará International Bridge on the border between the two countries was identified as a possible avenue of assistance. Based on the findings of the study, the governments of Ecuador and Peru issued a request to the Government of Japan for grant aid in August 1999 concerning the Project. After waiting for conclusion of border negotiation and an agreement of implementation setup for the Project among the two countries, JICA implemented the Preparatory Study in 2004 and a Basic Design Study in 2005, reaching

[1] The concept of a network of trunk roads connecting the countries of the Americas was first espoused as the Pan-American Highway in 1923, and trunk roads in each country today are being constructed and networked according to this concept. Major progress was achieved on realizing the concept in the 1940s and 1950s. The section linking Quito, the capital of Ecuador, to Piura in Peru is regarded as the main route of the Pan-American Highway, however, in reality more traffic uses the coastal route (Route 1 which is targeted by the Bilateral Border Development Committee).

the conclusion that reconstruction of Macará International Bridge was a valid proposition. After that, due to delay in the start of the Project because of time taken in making diplomatic adjustments between the two countries, the Implementation Review Study was needed in 2006. Then, the Exchange of Notes concerning Detailed Design was signed in 2007, paving the way for the start of the Project. Concerning the construction works of the Project, tender was conducted three times without success between 2008 - 2009. Accordingly, the second Implementation Review Study (2009) was carried out and the renewed Exchange of Notes (detailed design and construction works) was signed in March 2010, and the second Detailed Design and construction works were implemented after that.

Figure 1 Trunk road network of the border region and the location of Macará International Bridge

1.2 Project Outline

The objective of the Project is to secure smooth and stable traffic by constructing a new bridge and approach roads downstream of the deteriorated Macará International Bridge in the border region between Ecuador and Peru, thereby contributing to the development of the border region.

E/N Grant Limit G/A Grant Amount / Actual Grant Amount	E/N Grant Limit 2007 for detailed design: 19 million Yen (Ecuador), 19 million Yen (Peru) 2007 for construction 574 million Yen (Ecuador), 574 million Yen (Peru) 2010 for detailed design and construction 800 million Yen (Ecuador), 800 million Yen (Peru) G/A Grant Amount / Actual Grant Amount 2010: 1,600 million Yen / 1,330 million Yen (665 million Yen for Ecuador, 665 million Yen for Peru)
Exchange of Notes Date/ Grant Agreement Date	Exchange of Notes 2007 for detailed design: January (Ecuador), March (Peru) 2007 for construction: June (Ecuador), December (Peru) 2010 for detailed design and construction: March (Ecuador, Peru) Grant Agreement 2010: March (Ecuador), April (Peru)
Implementing Agencies	Ministry of Transport and Public Works (Ecuador) Ministry of Transport and Communications (Peru)
Project Completion Date	November 2012
Main Constructor	Hazama Corporation
Main Consultant	Nippon Koei Co., Ltd.
Basic Design	April 2005 - February 2006, (Implementation Review Studies: October - December 2006, August - December 2009)
Detailed Design	July - December 2007, April - May 2010
Related Projects	Project Formulation Study (Border Region Development): Ecuador and Peru (1999)

2. Outline of the Evaluation Study

2.1 External Evaluators

Hajime Sonoda, Global Group 21 Japan

Takeshi Yoshida, Global Group 21 Japan

2.2 Duration of Evaluation Study

The ex-post evaluation study for the Project was conducted over the following period.

Duration of the Study: July 2015 - August 2016

Duration of the Field Survey: October 26, 2015

November 2 - 21, 2015

November 26, 2015

April 3 - 5, 2016

2.3 Constraints during the Evaluation Study

The Basic Design Study for the Project was implemented in 2005, and the Implementation Review Study and Detailed Design were implemented in 2006, paving the way for the start of the

Project. However, due to failure of the tender for the construction works, it was necessary to conduct a second Implementation Review Study in 2009 and a new Detailed Design in 2010 before the works were commenced. The ex-post evaluation was conducted based on the plan that was compiled in the 2006 Implementation Review Study (Project Plan Sheet). Hereafter, "At the time of planning" refers to the planning as of 2006.

3. Results of the Evaluation (Overall Rating: B[2])

3.1 Relevance (Rating:③[3])

3.1.1 Relevance to the Development Plan of Ecuador and Peru

As was described in section 1.1 Background, at the time of planning, the Governments of Ecuador and Peru established the Bilateral Border Development Committee, which identified the construction of five road axes between the countries as one of the primary policies for developing the border region, and included the Project among these. It was originally scheduled for the Committee to conduct activities for 10 years from 2000 to 2009, however, its term was extended and an investment program was drawn up until 2016. The Committee's policies and strategies have remained consistent since its creation up to the time of ex-post evaluation.

The transportation sector has consistently been viewed as an important sector within the development plans of Ecuador and Peru since the time of planning the Project to the time of ex-post evaluation. In Ecuador's "National Plan for Good Living 2013-2017", positioning the transportation sector with importance, the Ministry of Transport and Public Works (hereinafter referred to as "MTOP") aims to establish an integrated and efficient transport network for improvement of economic competitiveness and domestic integration, and the Project is identified with the trunk highway network within the "Strategic Transport Plan 2012-2037". In "Plan Peru 2021" (2010), regional infrastructure investment for balanced development is regarded as a priority item, and the Ministry of Transport and Communications (hereinafter, referred to as "MTC") has raised the goals of paving 85% of the country's national highways by 2016 and keeping all paved highways in good condition.

Accordingly, construction of international trunk highways including the Project is regarded as important within the context of border region development as well as national development by Ecuador and Peru, and the Project has high relevance to development plans both at the time of planning and the time of the ex-post evaluation.

3.1.2 Relevance to the Development Needs of Ecuador and Peru

In 2005, when the Basic Design Study for the Project was implemented, some 40 years had elapsed since construction of Macará International Bridge. At that time, the bridge was

[2] A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory
[3] ①: Low; ②: Fair; ③: High

badly deteriorated with serious defects such as exposed and cracked reinforcing bars and free lime in evidence, and a 20-ton limit was enforced on passing vehicles. Moreover, because Macará International Bridge reduced the water flow where it crossed the river, and flow was impeded at the upstream of the river producing backwater during flooding[4], and this was washing away farmland and creating a risk of bridge collapse. In addition, both countries had established border crossing facilities (customs, immigration control offices, etc.) and conducted border control on both sides of the bridge, and congestion at the narrow approach roads was further exasperated by the presence of stalls and taxis waiting for customers on the road. There was thus a high necessity for the Project to rebuild Macará International Bridge at the time of planning.

The Project represents one out of five transportation axes stipulated by the Bilateral Border Development Committee, and it has the second largest traffic volume following the coastal route. Thus, the importance of the Project has been sustained up to the ex-post evaluation.

3.1.3 Relevance to Japan's ODA Policy

At the time of planning, in Peru, JICA regarded assistance for economic vitalization in the area of economic and social infrastructure construction for sustainable development as one of its priority assistance fields. In Ecuador, addressing the poverty issue was regarded as a priority assistance field, and in that context, assistance was extended to the promotion of development and construction of basic infrastructure in local areas. Accordingly, the Project had a high degree of relevance to Japan's ODA policies in both countries at the time of planning.

Summing up, implementation of the Project has been highly relevant to the development plans and development needs of Ecuador and Peru, as well as Japan's ODA policy. Therefore its relevance is high.

3.2 Efficiency (Rating: ①)

3.2.1 Project Outputs

The outputs of the Project were indicated in Table 1, and all were implemented as planned. According to the engineers in both countries' implementing agencies, the Project design and construction quality were good.

Concerning the type of bridge, a PC 2-span continuous box girder bridge using the overhang erection method was proposed in the Basic Design Study and Implementation Review

[4] Backwater refers to the phenomenon where river water is dammed, causing the water level to rise and reach back upstream.

Study in 2006[5]. Subsequently, in the second Implementation Review Study (2009) that was necessary after the unsuccessful tenders for construction, other bridge types that were easier to execute were also proposed with a view to making it easier for more companies to participate in the bidding. Eventually, the originally proposed PC 2-span continuous box girder bridge was adopted for the following reasons: 1) it offered the implementing agencies in both countries the opportunity to learn a new technical methods on overhang bridge construction, 2) there was concern that the re-approval procedure to change the bridge type that was already approved through the Basic Design Study would take too long on the Peruvian side, and 3) this approach had the advantage of enabling works to be implemented even at times of high water level.

Table 1 Comparison of Planned and Actual Outputs

Plan (2006)	Actual (as of December 2015)
<Facilities by Japan> Construction of the New International Bridge of Macará Length 110m, width 14.5m Approach roads Ecuadorian side 164m Peruvian side 290m	<Facilities by Japan> As planned
< Facilities by Ecuador and Peru> ・ Removal of the Old International Bridge of Macará ・ New river protection works	< Facilities by Ecuador and Peru> As planned

Source: Documents provided by JICA

3.2.2 Project Inputs

3.2.2.1 Project Cost

The cost of the Project was planned as 1,303 million yen, comprising 1,194 million yen on the Japanese side and 109 million yen on the side of the host countries. Due to the repeated Detailed Designs and tender and the price inflation between the Project cost estimation in 2006 and signing of the contract for construction in 2010, the cost on the Japanese side rose to 1,373 million yen, which was higher than planned as shown in the Table 2. On the side of the recipient countries, the cost of the old bridge removal work implemented by Peru was less than planned. However, the river protection work implemented by Ecuador was larger in scale and a lot more expensive than planned. As a result, the overall cost was much greater than planned at 217 million yen. Accordingly, the total Project cost was 1,590 million yen, higher than the planned amount (122% compared to the plan).

[5] This method entails extending the bridge body left and right from the bridge pier in blocks of 3 – 4 meters. This is conducted over a cycle of around 10 days. Because there are few constraints under the bridge girders, it can be applied in mountain areas, over rivers or even for overhead sections in city areas.

Table 2 Project Cost – Planned vs. Actual

	Planned (2006)	Actual (2015*)	Actual/Planned
Project cost on the Japanese side	1,194 million yen	1,373 million yen	115%
Detailed design and implementation management	130 million yen	184 million yen	
Construction works	1,064 million yen	1,189 million yen	
Project cost on Ecuador / Peru side	109 million yen	217 million yen	199%
Total Project cost	1,303 million yen	1,590 million yen	122%

Source: Documents provided by JICA, and materials provided by MTOP and MTC
Note: * The facilities by Japan were completed in 2012, while those by Ecuador / Peru were completed in 2015.

3.2.2.2 Project Period

Concerning the Project period, the facilities to be funded by the Japanese side (bridge and approach roads), including the Detailed Design and tender, were scheduled to be finished in 32 months[6]. The demolition of the old bridge was committed by the Peruvian side and construction of the river protection was committed by the Ecuadorian side and their works were scheduled to begin following completion of the bridge construction, however, no specific completion date was defined.

As shown below, the actual project period of the facilities to be constructed by the Japanese side was 68 months from signing of the exchange of notes (March 2007) to completion of the works (November 2012), significantly longer than planned (213% compared to the planned period).

April 2005 - February 2006	Basic Design Study
October - December 2006	Implementation Review Study (first)
March 2007	Exchange of Notes (detailed design)
July - December 2007	Detailed Design
December 2007	Exchange of Notes (construction works)
September 2008 - May 2009	Tender period (unsuccessful)
August - December 2009	Implementation Review Study (second)
March 19, 2010	Exchange of Notes (detailed design & construction works)
May 2010	Completion of Detailed Design
November 2012	Completion of construction works of the New Bridge (bridge opened on November 9)
June 2015	Completion of the related construction works by the recipient countries

[6] Based on the Implementation Review Study in 2006.

Following the Basic Design Study, because it took a long time for the Project to start due to the time spent on diplomatic adjustment between Ecuador and Peru, the Implementation Review Study was implemented in order to update the project cost estimation. In line with this, the Exchange of Notes was signed and the Detailed Design was implemented in March 2007. The tender geared to the contract for the construction works was started in 2008. However, in three tenders, either no bids were forthcoming or no contract was signed because bids exceeded the scheduled price. After that, the second Implementation Review Study was implemented in 2009; Exchange of Notes was signed again in March 2010, and the Detailed Design and construction works were implemented.

According to a Japanese consultant who assisted in the tender arrangement, the tenders were unsuccessful for the following reasons: the international prices of materials increased during the period from the Implementation Review Study to the tender for the construction contract, which was prolonged due to introduction of a new project approval system in Peru, and few contractors were based in the border region. In the construction works, however, although it took time to secure permission for the border crossing of construction machinery and people at the start of the works, this was not a major issue in the implementation of the works.

In summary, the project cost exceeded the planed amount and the project period was significantly longer than planned. Therefore, efficiency of the Project is low.

Vestige of the old bridge (Peruvian side)

The New Bridge (sight from Ecuadorian side)

3.3 Effectiveness [7] (Rating: ③)

The Project has the objective of rebuilding the Old Macará International Bridge (hereinafter, referred to as "the Old Bridge") and thereby securing smooth and stable traffic in the border region between both countries. The New International Bridge of Macará (hereinafter, referred to as "the New Bridge") that was constructed by the Project was opened to traffic in November 2012. As the bi-lateral border facilities on the Ecuadorian side that were planned to

[7] The rating for effectiveness is given upon taking impact into account.

house both countries' immigration inspection, customs, quarantine and police offices have not been completed[8], both countries have established temporary offices installed in simple structures such as containers, adjacent to the bridge and conduct border procedures there[9].

Based on a mutual agreement between the two countries, an area of approximately 40 kilometers on either side of the New Bridge including the cities of Macará on the Ecuadorian side and Suyo on the Peruvian side has been declared a free passage zone, where travelers do not need to conduct any immigration procedures at all if they have nothing to declare[10]. On both sides of the New Bridge, taxis from each country wait for passengers on each side of the road. On the Ecuadorian side, a cooperative association of taxi drivers operates a taxi stand. On the Peruvian side, there is no organized association or taxi stand, so taxi drivers wait for passengers without any particular order[11].

The following paragraphs analyze the situation regarding manifestation of the quantitative and qualitative effects of the Project and evaluate its effectiveness.

Temporary border facilities (left: Peru, right: Ecuador)

[8] Border facilities are not included in the scope of the Project. However, they were planned to be constructed in tandem with the Project and go into service at the same time of the completion of the Project. Construction was under the responsibility of the National Transportation Agency (*Agencia Nacional de Transito*). However, due to the site being located in such a remote location, there were no bids from contractors, and it also became necessary to cancel the contract and sign a new one due to issues with the implementation and funding capacity of the first contractor. After that, delays occurred due to replacement of the minister in charge and resulting modification of the plan, poor weather conditions and so on. As a result, MTOP took charge of the construction in February 2015. However, because payments to contractors were delayed due to financial difficulties on the Ecuadorian side, the works have been suspended since August 2015. As of April 2016, the works are roughly 50% complete but there is no prospect of their completion.

[9] Because customs stops vehicles to implement freight checks as needed, one out of two traffic lanes is closed. However, because the traffic volume is light at around 2,000 vehicles per day, this does not lead to much congestion in particular.

[10] According to the traffic volume survey implemented in the ex-post evaluation (24 hours, November 2015), most of the vehicles passing over the New Bridge traveled over this range and did not need to take border crossing procedures. However, because there are some vehicles that try to pass without taking the necessary procedures, the customs officers on both sides sometimes stop vehicles and conduct freight inspections. Moreover, there are additional customs offices on the main road outside of the free pass zone, and they conduct monitoring and customs clearance procedures for vehicular freight.

[11] There are some passengers who take a taxi on the Peruvian side (or the Ecuadorian side) arriving at the New Bridge, walk over the bridge, and then take another taxi to their destination on the other side. According to interviews with taxi drivers, 70% of taxi passengers on the Peruvian side and almost 100% on the Ecuadorian side travel within the scope of Macará and Suyo.


Inspection by custom (left: Peru, right: Ecuador)


(Left) View at the border facilities under construction from the Peruvian side

(Right) Slope protection work and illegal occupation by restaurants in Peru


Large-size vehicles stopping near the bridge for border procedures

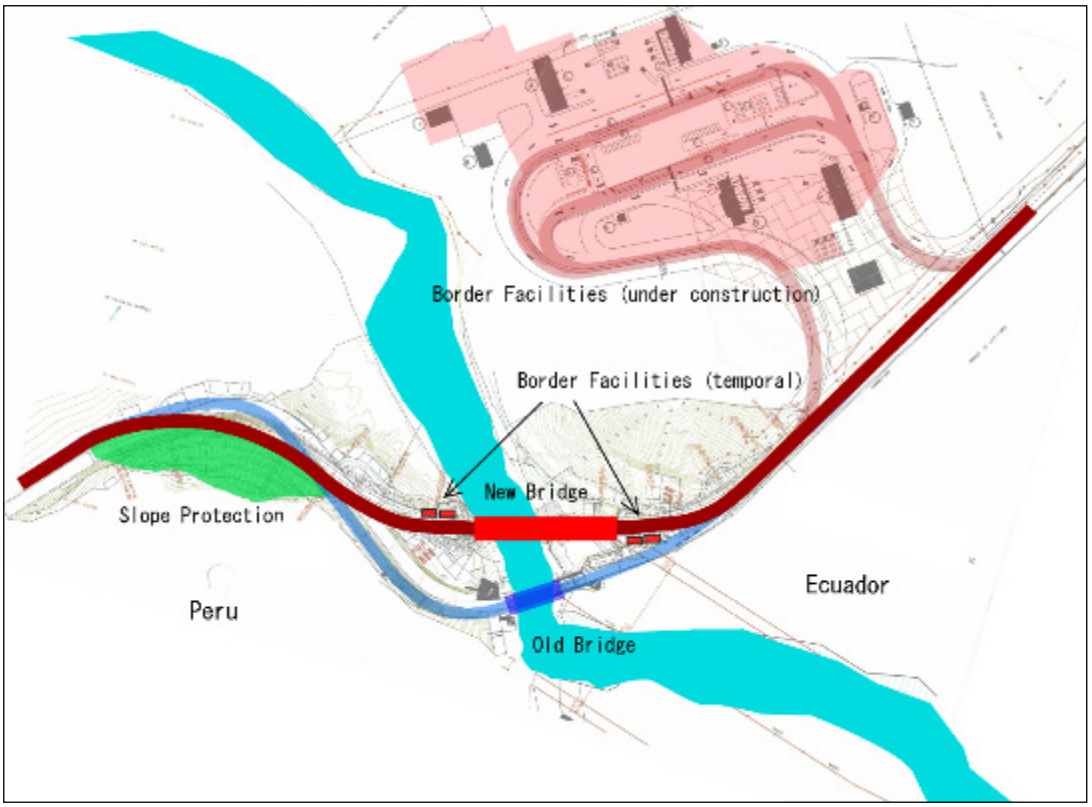

Figure 2 Map of the surrounding area of the Macará International Bridge

3.3.1 Quantitative Effects (Operational and Effect Indicators)

At the time of planning, two indicators were stipulated as quantitative effects of the Project: 1) the "weight restriction on vehicles crossing the bridge" is increased from 20 tons to 40 tons, and 2) the "traffic volume of large-size vehicles" (traffic volume of large-size buses and trucks, not including pickups) increases from 39 vehicles/day counted in 2004. In the ex-post evaluation, analysis was additionally conducted on the "number of days the border is closed per year" as an indicator of stable cross-border traffic, and "border crossing time (travel time to cross the border)" as an indicator of smooth cross-border traffic.

Concerning the traffic volume of large-size vehicles, traffic counting was carried out, and a supplemental analysis was carried out on changes in the value of imports and exports crossing the New Bridge. Also, a questionnaire survey of drivers and passengers crossing the New Bridge and group interviews with local residents were conducted to gauge the features of cross-border traffic[12].

[12] Refer the box article.

Table 3 Operation and Effects Indicators

	Baseline	Target	Actual
	2006	2015	2015
	At the time of planning	3 years after completion	3 years after completion
Weight restriction on vehicles	20 tons	40 tons	40 tons
Number of days the border is closed	Unknown	Decreased	0 days/year
Traffic volume of large-size vehicles	39 vehicles/day (2004)	Increased	78 vehicles/day
Border crossing time (travel time to cross the border)	Unknown	Shortened	Possibility of shortening

Source: Materials provided by JICA, materials provided by implementing agencies, traffic survey, beneficiary survey, etc.
Note: Large-size vehicles indicate all large-size buses and trucks apart from pickup trucks.

(1) Weight restriction on vehicles passing over the bridge

The total permissible weight (weight of vehicle and freight) on the Old Bridge was limited to 20 tons due to deterioration of the bridge. However, in reality large-size vehicles weighing more than 30 tons used the bridge and the situation was dangerous.

The total permissible weight on the New Bridge is 40 tons. Judging from the types of large-size vehicles (trailers, etc.) and contents of their loads crossing over the bridge, it is surmised that no vehicles using the bridge exceed this weight limit. However, because the weight of trucks passing over the bridge is not measured, weight restriction is not actually practiced[13].

(2) Number of days the border is closed

Since being opened to traffic in November 2012, apart from being closed for a few hours at a time when the two countries held joint events, the New Bridge hasn't been closed. Stable cross-border traffic is thus being achieved.

(3) Traffic volume passing over the bridge

Table 4 shows the results of the traffic volume survey. Compared to 2004, the total traffic volume has increased 2.4 times and the volume of large-size vehicles by 2.0 times. Whereas the volume of passenger vehicles has increased almost 3 times, the volume of freight vehicles (trucks and pickup trucks) declined from 193 vehicles/day in 2004 to 154 vehicles/day in 2015. On the other hand, a decrease in traffic volume of large buses can be seen. This is believed to be due to a decrease in trade using buses. As described

[13] Because a vehicle weight meter will be installed at the border facilities under construction, it will become possible to implement weight restrictions by, for example, imposing fines on vehicles over the limit and so on, when the said facilities are completed.

in the box below, almost all of the traffic that utilizes the New International Bridge of Macará is international traffic traveling short or medium distances.

Table 4 Traffic Volume by Vehicle Type on the New International Bridge of Macará

(Unit: vehicles/day)

	Passenger vehicle	Pickup truck	Mini bus	Large-size vehicles				Total	Large-size vehicles among these
				Bus	Truck (2-axle)	Truck (3-axle)	Truck (4-axle)		
2004	737	164	3	10	26	2	1	943	39
2015	2,086 (92%)	82 (4%)	11 (0.5%)	6	66	0	6	2,257 (100%)	78 (3.5%)
Rate of increase	283%	50%	367%	60%	254%	0%	600%	239%	200%

Source: Data for 2004 is based on actual measurements at the time of the preliminary survey (October 2004), while data for 2015 is based on measurements at the time of the ex-post evaluation (November 2015). In both cases, measurements were made over 24 hours on weekdays.

<Box: Characteristics of Cross-border Traffic at the New International Bridge of Macará >

In the ex-post evaluation, in tandem with the 24-hour traffic volume measurement survey (November 16 – 17, 2015), a questionnaire survey (beneficiary survey) was implemented targeting drivers (34 bus and truck drivers and 46 passenger vehicle drivers) and passengers of buses, taxis and cars (40 passengers) crossing over the New Bridge and taxi drivers waiting for customers at both ends of the bridge (10 drivers on each side). In addition, group interviews were conducted with residents living close to the bridge in the cities of Macará and Suyo on both sides of the bridge[14]. The major results are shown below.

- 92% of vehicles are passenger vehicles, but the ratio of buses and trucks is small.
- Almost all traffic that utilizes the New Bridge travels for short or medium distances. More than half of the trips are made within the free passage zone.

Origin and Destination	Drivers	Passengers
Free passage zone: Suyo - Macará (short distance)	74%	50%
Loja Province - Piura Region going beyond the free passage zone (medium distance)	21%	45%
Scope going beyond Loja Province - Piura Region (long distance)	5%	5%

- 80% of vehicles are Ecuadorian and most traffic is leaving Ecuador to Peru and coming back to Ecuador.

[14] Traffic volume was measured at the bridge end (on the Ecuador side). The questionnaire survey was conducted for 10 hours during the day, targeting all passing large-size vehicles and one out of every 20 other vehicles. The survey targeted drivers in trucks, drivers and passengers (one out of every five passengers) in buses, and drivers or passengers in passenger cars (passengers were selected from one out of every five cars). Ratios of female respondents were: 5% (vehicle drivers), 48% (passengers) and 0% (taxi drivers). Ratios of respondents of 41 years old or more were: 49% (vehicle drivers), 33% (passengers) and 55% (taxi drivers). Participants of the group interviews were 6 persons (including 4 females) in Macará and 61 persons (including 10 females) in Suyo.

- 50% of drivers and around 20% of passengers travel for commerce and work purposes, and other reasons for travel include tourism, shopping and family visits. Because prices in Peru are lower than in Ecuador, many people travel to Peru to go shopping (clothes, domestic electrical appliances, etc.) and eating, while Peruvians also travel to Ecuador to buy cheap medical supplies, farm materials and so on[15].
- Traffic for education and medical purposes accounts for almost 10% of the total traffic volume. Hospitals on the Ecuadorian side (Macará) receive Peruvian patients based on a bilateral agreement. There are also students who commute to high school or university in the neighboring country.
- Out of truck cargoes, building materials account for 32%, farm and livestock materials for 29%, and 14% of the trucks have no cargo.

On the other hand, the value of exports from Ecuador to Peru is less than 10% of the exports in the opposite direction since 2012, and the value has been going down since 2008. It is thought that this is because the price competitiveness of Ecuadorian products declined gradually as a result of the country's hyperinflation in the 1990s which led to the currency switch to dollar (2000) and the subsequent price increase. The total amount of exports from Ecuador to Peru was 1,930 million dollars in 2013 and 1,774 million dollars in 2014, and the share crossing over the Macará International Bridge was just around 0.3% of this.

The total amount of exports and imports in both directions has been decreasing since reaching the peak in 2012. As mentioned above, the volume of large freight traffic has doubled since 2004, and it is inferred that such change has been greatly impacted by economic conditions and export/import policy in each country.

Table 5 Exports/Imports through the Macará International Bridge (value declared at customs)

(Unit: 1,000 dollars)

	2008	2009	2010	2011	2012	2013	2014
Ecuador → Peru	3,520	2,005	1,235	1,077	703	504	525
Peru → Ecuador	4,405	7,487	7,247	8,826	10,150	4,624	6,908
Total	7,925	9,492	8,482	9,903	10,853	5,128	7,433

Source: Peru Customs

(4) Border crossing time

According to the beneficiary survey, almost 70% of drivers and passengers answered that border crossing time on the New Bridge was no different from that on the Old

[15] Based on the interviews with local population and custom officers, etc., while it did not surface through the questionnaire survey, it is said that organized gasoline smuggling is carried out under the guise of private travel because gasoline prices in Ecuador are half or less than what they are in Peru due to government subsidies.

Bridge. 20% of respondents said that the border crossing time decreased, more than those who said that it increased (10%), indicating that border crossing time on the whole have possibly become somewhat shorter. While, the beneficiary survey revealed that border crossing procedure on the Ecuadorian side takes longer than on the Peruvian side[16].

On the other hand, according to customs officials and other related officials in both countries, border crossing procedures have become a little faster due to the mitigation of congestion realized by the New Bridge. On the Peruvian side, the border facilities was previously located in front of the Old Bridge, located between hills where the road was narrow and there were numerous stalls, and it was difficult to park there. Even vehicles traveling to Ecuador without requiring border crossing procedure were caught up in the congestion and lost time. However, following completion of the New Bridge, the road is wider than the Old Bridge and the vehicles parking to conduct procedures do not cause congestion any longer. On the Ecuadorian side, it was previously necessary to conduct freight inspections at the customs office in Macará City located roughly 2 kilometers from the bridge. However, following completion of the New Bridge, it became possible to conduct the same procedure in a temporary office that was established next to the bridge without visiting Macará City, thereby enabling processing time to be greatly shortened. Moreover, when the bi-lateral border facilities currently under construction apart from the Project is completed, the border crossing time is expected to be shortened even more as it will be possible to implement both countries' border crossing procedures in one place.

3.3.2 Qualitative Effects

In the Project, in addition to the greater safety of bridge traffic due to increase in the weight restriction to 40 tons, other safety improvements have been realized as described below.

- No traffic accidents have been recorded since the New Bridge was completed. According to some drivers, it is now safer than before because the road alignment has been improved and visibility is better.
- On the approach to the Old Bridge on the Peruvian side, there was a steep cliff and there was a risk of landslide, however, now the approach road for the New Bridge has been moved to a different place away from the cliff. Instead, large-scale cutting work has been conducted and there is a steep slope, however, the slope is protected.

[16] According to drivers who were interviewed in the beneficiary survey, the procedure for entering Peru is approximately 10 minutes on average, and that for entering Ecuador is 30 minutes on an average. Customs officials conduct procedures according to the respective policies in each country, and import procedures on the Ecuadorian side tend to be stricter due to the government's more protective policy.

- Because lights have been installed on the New Bridge, the local residents and passengers have commented that they now feel safer to cross the bridge at night.

3.4 Impacts

3.4.1 Intended Impacts

In the Project, it was anticipated that the following contributions would be generated for development of the border region: i) strengthening and stabilization of transportation capacity on the international trunk highway, ii) alleviation of flooding upstream, iii) contribution to socio-economic development in the border region, and iv) contribution to promotion of friendly relations between the two countries.

(1) Strengthening and stabilization of transportation capacity on the international trunk highway

Macará International Bridge is located on the Pan-American Highway, and as described in the analysis of effectiveness, the Project has boosted the bridge safety and made it possible to cross the border without experiencing closure after the project completion to date. Moreover, it is possible to conclude that border crossing time has been shortened, and there is an expectation that time will be shortened even more after the border facilities starts operating. Accordingly, it is expected that transportation capacity between Ecuador and Peru will be strengthened and stabilized as impact of the Project.

(2) Alleviation of flooding upstream

Before the New Bridge was constructed, due to the narrow width of the river and insufficient flow around the pillars of the Old Bridge, the water level rose to the bridge girders and water overflowed and inundated paddies in upstream areas at the time of flooding. Following removal of the Old Bridge, the risk of such flooding has been mitigated and flooding hasn't actually occurred[17].

(3) Contribution to socio-economic development in the border region

The following impacts have been identified concerning the development of border region, rectification of regional disparities, expansion of markets, and stabilization of access to medical and education facilities as anticipated in the Project[18].

- Before the New Bridge was constructed, the informal export of daily necessities,

[17] The farmland that was inundated in the past has since recovered.

[18] Concerning the impact on border region development, interviews were conducted with Macará Chamber of Commerce and Industry and the Mayor of Suyo, while focus group interviews were conducted with residents of Macará and Suyo.

farm products and so on from the Peruvian side to the Ecuadorian side was prosperous, and the local residents were involved in this as "carriers". Following construction of the New Bridge, however, such trade has reduced due to the tightening of customs control and tariffs by the Ecuadorian side[19]. Instead, there has been an increase in people traveling from the Ecuadorian side to the Peruvian side in order to buy cheap products. Moreover, because there has been a decrease in trade and travel by merchants using buses, the number of bus services operating between Loja and Piura is decreasing.

- Concerning education, since there is no high school in Suyo on the Peruvian side, there are some students who commute to high school in Macará in Ecuador. Conversely, there are Ecuadorian students who commute to junior high schools and higher education institutions on the Peruvian side. Concerning medical care, a general hospital has been constructed in Macará on the Ecuadorian side as a bilateral project, and residents on the Peruvian side also use this.
- As for commercial activities around the bridge, a bilateral agreement by the two countries prohibits setting-up of stores within 500 meters from the center of the bridge. However, in spite of this, on the Peruvian side, a number of stores and restaurants have been built and new buildings continue to be constructed. Also it should be noted that all the shops and stores located near the demolished old bridge have been closed, while, some of them were re-opened at the above mentioned prohibited zone in the Peruvian side. In order to exploit the commercial potential of the border region, the mayor of Macará on the Ecuadorian side has hatched a plan to create a park with shops and restaurants at an area close to the border facilities being built. The local government, residents and mayor are hoping that this will be designated as a free zone in which taxes are exempted, however, the MTOP and other central government offices are not supportive of this, believing that the unified criteria concerning border region shouldn't be changed.

(4) Contribution to promotion of friendly relations between the two countries

The Bilateral Border Development Committee aims to maintain peace through conducting social, economic and institutional development of the border region and giving the name "Bridge of Friendship" to the New Bridge. The citizens of both countries strongly wish for the continuation of peace following their bitter experiences

[19] The tightening of customs controls was conducted separately from the Project, however, it is thought that the stricter enforcement of controls has been facilitated by the mitigation of congestion, introduction of lighting on the bridge, and installation of photographic monitoring equipment on the bridge by customs.

during the era of border dispute, and the New Bridge is widely recognized as a symbol of friendship between the two nations.

3.4.2 Other Impacts

(1) Impact on the natural environment

The environmental impact study report received approval on each of the Ecuadorian and Peruvian sides in March 2005. In both studies, it was forecast that the impact of works will be short-term and minor, and appropriate steps were taken according to the environmental management plan during the works.

In the site surveys, no negative environmental impacts in particular were confirmed.

(2) Land acquisition and resettlement

On the Ecuadorian side, resettlement of three households were planned. In reality, only one household was resettled while there were seven other cases of land acquisition not entailing resettlement. On the Peruvian side, resettlement of 12 households were planned. In reality, only two households were resettled while there were 19 other cases of land acquisition not entailing resettlement[20]. In both countries, there were no problems in particular regarding resettlement and land acquisition.

(3) Other impacts

One of the reasons behind selection of the bridge type was the opportunity to obtain a new technical knowledge, i.e. the overhang erection method, and this proved successful because the implementing agencies in both countries gained the opportunity to learn this method. During the work implementation period, numerous opportunities were provided by the contractor and the consultant to explain the new method to visiting engineers from both countries. Following completion of the Project, bridge projects utilizing the same method have been implemented in both countries. Therefore, it can be said that the Project contributed to the improvement of technical capacity regarding bridge construction in both countries.

It is prohibited to construct buildings within 500 meters from the center of the bridge. However, one building has been constructed on the Ecuadorian side, while there are around 10 stores and restaurants on the Peruvian side. Until completion of the joint border facilities on the Ecuadorian side, border crossing procedures are being implemented in temporary facilities close to the approach roads in both countries. When

[20] In Ecuador, $361,728 was paid to eight persons according to the country's compensation standard by August 2008. In Peru, according to that country's compensation standard, 513,409 Nuevos Soles was paid to 19 landowners; also, payment of 123,126 Nuevos Soles to the two resettled households was completed by March 2012.

traffic volume is heavy in daytime, general vehicles waiting to undergo crossing procedure sometimes stop on the road shoulder near the bridge temporarily, and this is thought to be a contributing factor to the unlicensed operation of stores.

Summing up, this project has largely achieved its objectives. Therefore effectiveness and impact of the project are high.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

Maintenance work on the approach road is outsourced by MTOP on the Ecuadorian side, and by PROVIAS NACIONAL (the road construction and maintenance body of MTC) on the Peruvian side. Bridge cleaning is carried out up to the center of the bridge by MTOP and PROVIAS NACIONAL respectively.

MTOP in Ecuador outsources "service level-based road maintenance". The Project bridge and approach road are covered by an outsourcing contract that covers 189 kilometers of national highways during the period of December 2011 - January 2016. Since the performance of the contractor was good, it was scheduled to extend the contract for another year[21]. In the service level-based maintenance contract, road periodic repair works are normally implemented in the first and second year of the contract period, while only routine maintenance is conducted in the remaining period. MTOP supervises the contractor via a consultant employed through a separate contract and pays the contractor according to its performance. Maintenance criteria have been established concerning the motorway, road shoulder, side ditches, road signs and so on; reward is paid if 90% or more of the criteria are achieved, and penalty is charged if the achievement rate is less than 90%. Cleaning and other routine maintenance activities are contracted to four micro enterprises (*Micro Empresa*: small enterprises composed of local residents).

In Peru, PROVIAS NACIONAL outsources "service level-based road conservation". Concerning the approach road in the Project, there is a contract for the period from April 2011 to April 2016. PROVIAS NACIONAL supervises the contractor via a consultant employed through a separate contract and pays according to performance. At the time of the ex-post evaluation, since the performance of the contractor was good, it was scheduled to extend the contract for another year and a half. This contract covers 400 kilometers of national highways and 117 bridges, and separate groups are responsible for roads and bridges. As is also the case in Ecuador, micro enterprises conduct routine maintenance activities. Under this contract, periodic repairs were conducted in 2011, and routine maintenance has been conducted ever since. As the

[21] An extension of the contract was under preparation as of April, 2016.

Project approach road on the Peruvian side has slope protection with greening works, periodical watering is required for its maintenance. However, because periodical watering was not included among the work items of the maintenance contract that was concluded on the Peruvian side before completion of the Project, they have not been carried out. It will be necessary to wait for the next contract renewal scheduled for October 2017 in order to include this work.

Concerning the operation and maintenance of lights on the bridge, considering that voltage differs between the countries, Ecuador is responsible for lights lined in the upstream lain of the bridge, and Peru for lights lined on the downstream lain. On each side, the local power company in each country outsources the maintenance work.

Adjustments between the two countries concerning bridge operation and maintenance are conducted via bilateral development committee meetings that are periodically held. However, the field personnel of both countries' implementing agencies do not have a direct channel for making routine communications and coordination. Therefore, it takes time to share information and make decisions regarding problems on the ground among related agencies in each country as well as among the both countries.

3.5.2 Technical Aspects of Operation and Maintenance

The implementing agencies in both countries (MTOP, PROVIAS NACIONAL / MTC) conduct maintenance through their respective outsourcing contracts.

In the Project, the consultant compiled a maintenance guidebook for the bridge, which is used for reference, but is not directly applied. Apart from this, the Bilateral Border Development Committee compiled a maintenance manual targeting multiple international bridges in the border region in October 2013. The Ecuadorian side plans to conduct periodic bridge repairs based on this[22].

As mentioned earlier, since the work performance of the contracted maintenance contractors in both countries have been good, there are no problems regarding technical matters.

3.5.3 Financial Aspects of Operation and Maintenance

The following table shows trends in the respective budgets of MTOP and PROVIAS NACIONAL (executed amounts in 2010-2014, budget amounts in 2015). As can be seen, the budgets are increasing.

[22] Since the manual prepared by the Bilateral Border Development Committee targets all four bridges on the border, its contents are general. On the other hand, since the guidebook prepared by the consultant in the Project is specially intended for the New International Bridge of Macará, for example, it gives product drawings on the lights and guardrails, it is more practical.

Table 6 Budget Trends of MTOP (Ecuador) / PROVIAS NACIONAL (Peru)

	MTOP	PROVIAS NACIONAL (maintenance)
2010	1,020 million dollars	5,008 million Nuevos Soles (1,535 million Nuevos Soles)
2011	1,020 million dollars	5,544 million Nuevos Soles (1,877 million Nuevos Soles)
2012	1,273 million dollars	4,956 million Nuevos Soles (1,529 million Nuevos Soles)
2013	1,692 million dollars	6,124 million Nuevos Soles (1,456 million Nuevos Soles)
2014	1,398 million dollars	6,234 million Nuevos Soles (1,515 million Nuevos Soles)
2015	2,201 million dollars	6,450 million Nuevos Soles (1,732 million Nuevos Soles)

Source: MTOP, PROVIAS NACIONAL

Note: Only total amount for the institution is shown for MTOP, as the amount only for maintenance was not obtained.

The contract amount for maintenance of the road network including the Project in Ecuador and Peru is 19.3 million dollars (4 years, including road repairs) and 29.2 million dollars (5 years, including road repairs; some 82 million Nuevos Soles) respectively. According to MTOP and PROVIAS NACIONAL, there are no particular budget restrictions concerning the outsourcing of maintenance for the Project.

3.5.4 Current Status of Operation and Maintenance

According to the site inspection at the time of the ex-post evaluation, the bridge structure has no particular problem and is being generally used without any problem. The bridge is cleaned once a week, however, litter etc. can be seen scattered on the bridge and surrounding roads. There is still no need to conduct repainting of the balustrades or other periodic maintenance. The road surface signs and road studs that were originally scheduled for repair every two years are still in good condition[23]. Lights that are supposed to be maintained by the Peruvian side on the downstream lain of the bridge were not working at the time of the field visit on November, 2015. Being prompted by the evaluator, PROVIAS NACIONAL investigated the cause via the electric power company responsible for operation and maintenance, and the device for controlling lighting time was repaired. There are no major problems regarding the lights on the upstream side that are managed by the Ecuadorian side, except for the need to change one bulb. There were signs proclaiming “Welcome to Ecuador” and “Welcome to Peru” on both ends of the Old Bridge. After the construction of the New Bridge, similar sign was installed on the Ecuadorian side. While no such sign has been installed on the Peruvian side of the New Bridge, it is not affecting the effects of the Project.

The approach roads and highways leading to the bridge are generally maintained in good condition. However, as was mentioned earlier, because maintenance is not conducted on the green slope protection work on the Peruvian side, vegetation and soil have been eroded and

[23] Road studs are metal studs that are implanted into the road in order to enhance visibility at intersections and so on. They frequently are fitted with lights and reflective materials. They are also known as cat’s eyes.

the slope drainage ditch is partially damaged. Some of the buildings that have been constructed alongside the approach road on the Peruvian side have caused damage to the side ditch and slope[24]. However, these have not directly affected the Project effects and are considered to be minor issues.

Summing up, no major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Project was implemented in order to secure smooth and stable traffic by constructing a new bridge and approach roads downstream of the deteriorated Macará International Bridge in the border region between Ecuador and Peru, thereby contributing to the development of the border region. The border region has been jointly developed by the two countries: in the national plans of both countries, construction of the international trunk highway including the Project has consistently been regarded as an important issue. Considering also that there was a strong need to rebuild the bridge and this is also consistent with Japan's aid policy, the Project has high relevancy. In the Project, the planned outputs were achieved. However, because the tender process repeatedly ended in failure due to escalation of material prices during the time taken for domestic procedures prior to the tender and also due to the remote distance of the Project site, it was necessary to conduct additional study and re-sign the Exchange of Notes. As a result, the period and the cost of the Project greatly exceeded the plan. Therefore, efficiency of the Project is low. Following completion of the Project, stable border traffic has been realized and large-size vehicles are able to safely cross the New International Bridge of Macará. It is possible to conclude that border crossing time has been shortened a little, however, it is anticipated that the time can be notably shortened when the bi-national border facilities which are currently under construction starts operation. Thanks to the bridge, traffic comprising mainly of small vehicles travelling short distances has doubled, and this has contributed to socioeconomic development in the border region. In addition, risk for inundation in the upstream areas at times of flooding has been reduced by sufficient flow section secured by the new bridge. Accordingly, the Project effectiveness and impact have been high. Both countries carry out appropriate operation and maintenance for the bridge with clear division of responsibilities, and since no major problems is identified in institutional setup, technical capacity and finances for operation and maintenance, the Project sustainability is high.

[24] These are unofficial buildings that haven't obtained building permission from Suyo City. PROVIAS is demanding their eviction, however, the procedures for forced removal are likely to take a number of years.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementation Agencies

- MTOP (Ecuador) needs to quickly complete the planned construction of the border facilities in order to further generate the effects and the impacts of the Project. Moreover, in conducting bridge maintenance, it is desirable that the guidebook developed in the Project be shared and utilized with the external contractor.
- PROVIAS NACIONAL (Peru) needs to promptly rehabilitate the slope protection work on the approach road and include slope protection maintenance in the operation and maintenance contract to be renewed with the contractor. Moreover, in order to remove the unofficial building close to the approach roads that cause damages to facilities and hinder traffic, it is necessary to examine appropriate measures including eviction based on law.
- Ecuador and Peru need to appropriately operate and maintain the New Bridge constructed by the Project in close collaboration between their respective officials. For prompt response and smooth information sharing regarding problems found on the site, establishing a working level committee composed of officials of MTOP, PROVIAS NACIONAL, border facilities (customs, police, quarantine, etc.), power company, and other related officials should be considered.
- Ecuador and Peru should take measures to fully utilize the tourism and commercial potential of the border region through discussion in the Bilateral Border Development Committee or similar bilateral forums. For example, establishing tourism information booth for both countries inside the border facilities, or building commercial facilities near the bridge as envisaged by the city of Macará can be good options.

4.2.2 Recommendations for JICA (None)

4.3 Lessons Learned

<u>Improvement of the border facilities and border crossing procedures in the international bridge project</u>

Physical improvement achieved through an international bridge project will not lead to sufficient improvement in border traffic unless the border facilities containing immigration, customs, quarantine and police are improved and border crossing

procedures are rationalized in parallel. In the Project, delay in construction of the border facilities, that were not included in the Project scope, affected the realization of some Project effects, particularly on shortening of the border crossing time. Therefore, when planning an international bridge project, it is necessary to examine the necessity to improve the border facilities and border crossing procedures and make necessary arrangement to enhance the feasibility, including an option to cover such improvements within the project.