

Bhutan

FY 2021 Ex-Post Evaluation Report of
Japanese Grant Aid Project

“The Project for Reconstruction of Bridges on Primary National Highway No. 1”

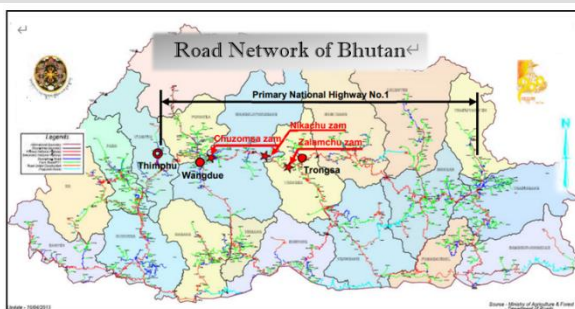
External Evaluator: Keiko Watanabe, Mitsubishi UFJ Research and Consulting Co., Ltd.

0. Summary

This project aimed to ensure smooth traffic and transportation access by constructing three bridges on Primary National Highway No.1 (hereinafter referred to as “PNH-1”) and improving bridge performance, thereby contributing to the promotion of local economic revitalization. In Bhutan, road traffic is the most important means of transportation and PNH-1 is the most important trunk road. This objective, therefore, is consistent with the policies and needs of the country both at the time of planning and ex-post evaluation. The project plan and approach considering people who are vulnerable to traffic accidents are appropriate. The project was also consistent with the ODA policy of Japan and collaborated with other projects within JICA and with organizations outside JICA. Concrete results of collaboration have also been confirmed. Therefore, relevance and coherence are high. Outputs were delivered mostly as planned. The project period exceeded the plan but the project cost was within the plan. Therefore, the efficiency is high. All quantitative effect indicators set at the time of planning achieved their goals. It was confirmed through the interviews with the executing agency and bridge users, along with specific grounds, that the project ensured the safety of the bridge, promoted the distribution of goods through smooth traffic flow, and contributed to the development of local economy. In addition, the interview with bridge users revealed that the project contributed to improving of subjective well-being, such as satisfaction with quality of life and satisfaction with life in general. Thus, effectiveness and impacts are high. Sustainability of operation and maintenance of this project is very high, as no major issues have been observed in terms of policy/system, institutional/organizational, technical and financial aspects, or current maintenance status.

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

1. Project Description



Project Location



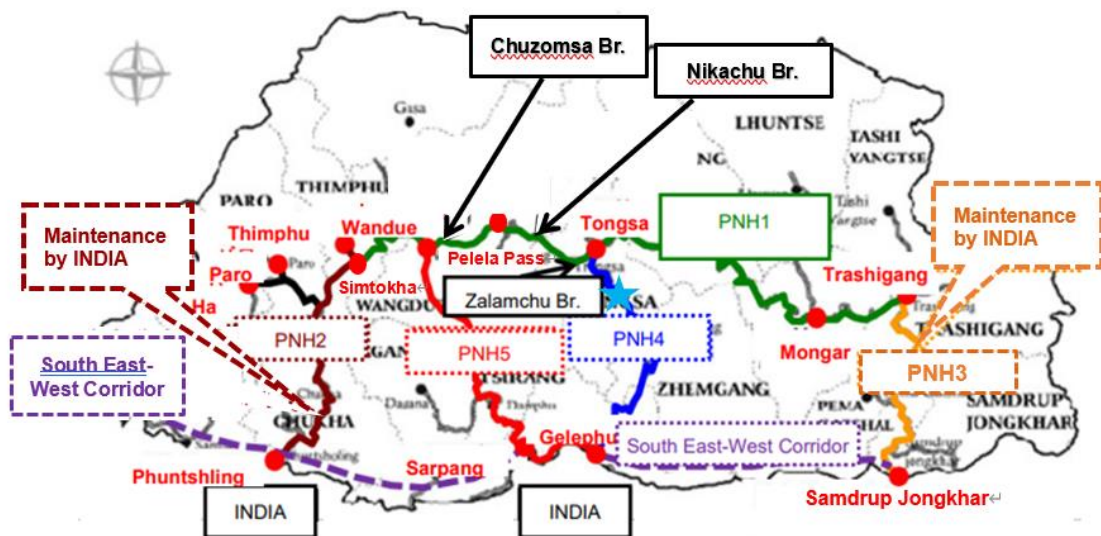
Nikachu Bridge

Source: Information provided by JICA

1.1 Background

In Bhutan, the majority of the national land is mountainous, and bridges play an important role in the road network, which is the most important means of transportation. The total road length was expanding from about 4,000 km in 2003 to about 10,600 km in 2013. However, due to topographical restrictions such as steep mountainous areas, there were a few trunk roads as well as detour and alternative routes. Besides, the roads were not always constructed to adequate specification (width, alignment, pavement, slope protection, etc.).

As shown in Figure 1, major road network in Bhutan has only PNH-1, which runs from east to west across the country and four national highways (PNH-2 to PNH-5) that run south to the borders with India. In particular, PNH-1 is the only trunk road connecting east and west in Bhutan, and is extremely important as transportation network. Although the Government of Bhutan is planning to develop a new Southern East-West corridor, about half of the sections are yet to be implemented. Nonetheless, PNH-1 will continue to play a major role in ensuring east-west connectivity as a trunk road starting from the capital, Thimphu, even after the Southern East-West corridor is completed. Although the section between Thimphu and Trongsa is particularly important connecting PNH-2, PNH-4 and PNH-5 going south, some of bridges in this section have deteriorated, posing a challenge in ensuring the east-west connectivity.



Source: Mangdechhu hydroelectric project site added on National Highway No.4 (light blue ★) in the information provided by JICA. Red circles are major towns.

Figure 1: Major Trunk Roads and Target Bridges

1.2 Project Outline

The objective of this project is to ensure efficient and stable transportation and traffic by reconstructing three bridges (Chuzomsa Bridge, Nikachu Bridge and Zalamchu Bridge) and improving

the performance of these bridges, thereby contributing to promoting the revitalization of local economy and poverty reduction.

Grant Limit / Actual Grant Amount	1,956 million yen / 1,956 million yen
Exchange of Notes Date / Grant Agreement Date	March 2015 / March 2015
Executing Agency(ies)	Department of Roads, Ministry of Works and Human Settlement (DoR/MoWHS)
Project Completion	May 2018
Target Area	Wandue Phodrang District, Trongsa District
Main Contractor(s)	Dai Nippon Construction
Main Consultant(s)	Oriental Consultants Global Co., Ltd./ INGEROSEC Corporation (JV)
Preparatory Survey	July 2014 - January 2015
Related Projects	<p><Technical Cooperation Project></p> <ul style="list-style-type: none"> · Human Resource Development in Bridge Planning, Designing, Construction and Maintenance (August 2006 - August 2007) · Technical Cooperation Project for Capacity Development in Construction and Maintenance of Bridges (CAMBRIDGE) (September 2016 - April 2022) <p><Grant Aid></p> <ul style="list-style-type: none"> · The Project for Reconstruction of Bridges (2001) · The Project for Reconstruction of Bridges, Phase 2 (2005) · The Project for Reconstruction of Bridges, Phase 3 (2009) · The Project for Reconstruction of Bridges on Primary National Highway No. 4 (2016) <p><The Government of India></p> <ul style="list-style-type: none"> · Widening work of Primary National Highway No. 1

2. Outline of the Evaluation Study

2.1 External Evaluator

Keiko Watanabe, Mitsubishi UFJ Research and Consulting Co., Ltd.

2.2 Duration of Evaluation Study

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

Duration of the Study: October 2021 – February 2023

Duration of the Field Study: April 25 - May 17, 2022, September 30 - October 18, 2022

(by local consultant)

2.3 Constraints during the Evaluation Study

Due to the new corona virus (COVID-19) pandemic, the external evaluator did not travel to Bhutan, and conducted online interviews with the executing agency, Department of Roads, Ministry of Works and Human Settlement (hereinafter referred to as “DoR”). Field surveys of the bridges reconstructed by this project and interviews with bridge users, including local residents, were conducted by a local consultant under the supervision of the external evaluator.

3. Results of the Evaluation (Overall Rating: A¹)

3.1 Relevance/Coherence (Rating: ③²)

3.1.1 Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Bhutan

Road traffic is the most important means of transportation both at the time of planning and ex-post evaluation. Improvement and strengthening of roads including bridges were priority issues. At the time of planning, the 11th Five Year Plan (2014-2018) prioritizes the improvement of PNH-1 and the improvement of access to construction sites for large-scale national projects such as a hydroelectric plant in the road and bridge sector. The Road Master Plan (2007-2027), which is effective at the time of ex-post evaluation, stipulates the implementation of road widening and maintenance/repair and reconstruction of bridges over the next 20 years until 2027.

The 12th Five Year Plan (2018-2023) at the time of ex-post evaluation positions the roads and bridges as priority issues, “Improvement of Infrastructure, Communication and Public services” and prioritizes improvement and strengthening of road networks nationwide.

Therefore, the project is in line with the Bhutan’s development policies at the time of planning and ex-post evaluation.

3.1.1.2 Consistency with the Development Needs of Bhutan

At the time of planning, although the PNH-1 is the only trunk road connecting east and west of Bhutan, many bridges on the route were dilapidated and did not meet the current

¹ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

² ④: Very High, ③: High, ②: Moderately Low, ①: Low

specification of design in terms of width and load capacity. There were 10 such aging bridges in the western part of PNH-1 to Trongsa. Among them, three bridges were technically difficult to reinforce or reconstruct due to bridge length, girder height, proximity to residents and so on. Therefore, technical assistance from abroad was required to reconstruct them. Furthermore, road widening work was on going on PNH-1 with the financial assistance from the Government of India and it was an urgent issue to bring the aging bridges to the current design standards along with these widening works in order to stabilize and smoothen the flow of traffic on the country's roads.

At the time of ex-post evaluation, the necessity to improve road network is stipulated in the 12th Five Year Plan (2018-2023). In particular, DoR, the executing agency is tasked with achieving development indicators of the road sector, which are “climate proof road accessible throughout the year in all types of weather,” “reduction in travel time,” and “quality infrastructure constructed and maintained.” In order to achieve these indicators, there was a high need for improvement and strengthening of PNH-1 including bridges. Therefore, the project has continued to meet the country's development needs.

3.1.1.3 Appropriateness of the Project Plan and Approach

Chuzomsa Bridge and Nikachu Bridge where residents live nearby, were designed with consideration given to the safety of pedestrians who are vulnerable to traffic accidents, such as children, people with disabilities and the elderly, by installing sidewalks based on the request from the executing agency. In addition, if the project bridges are installed at right angles to the river, accidents such as vehicles hitting the railings are likely to occur, so the project adopted the curved bridges for the first time in Bhutan with the emphasis on safety. The project plan, which emphasized the safety of pedestrians and drivers, was appropriate. (Details are in “5.2 Additionality”)

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

At the time of planning, improvement of roads and bridges was positioned as a priority issue in the “development of economic infrastructure,” one of priority areas of Japanese aid to Bhutan. The rolling plan for Bhutan states that assistance is provided for the development of road networks and bridges in order to secure efficient and stable transportation and to promote regional economic revitalization. Therefore, it can be said that this project was consistent with Japan's development cooperation policy at the time of planning.

3.1.2.2 Internal Coherence

The internal coherence with “Technical Cooperation Project for Capacity Development in Construction and Maintenance of Bridges” (September 2016 - April 2022) (hereinafter referred to as “CAMBRIDGE”) was confirmed. DoR officers who are responsible for the maintenance of this project received training in CAMBRIDGE and upgraded their capacity. In addition, the inspection manual and Bridge Management System (BMS), which were the outputs from CAMBRIDGE, were utilized in the operation and management of this project. (See “3.4 Sustainability” for the specific collaboration effects)

3.1.2.3 External Coherence

The road widening work on PNH-1 was being carried out with financial cooperation from the Government of India. The JICA Bhutan office and the Government of India had regular discussions on transportation infrastructure. Regarding this project, the timing of the construction work was coordinated with the widening work by sharing information such as the content and schedule. The project and the widening of PNH-1 have confirmed specific synergetic effects in terms of stabilizing and smoothing traffic, and the external coherence was recognized. (See “3.3.2 Impact” for specific synergetic effects)

The implementation of this project is consistent with Bhutan’s development policy and development needs, and the project plan and approach were appropriate. It is also consistent with Japan’s development cooperation policy, confirming internal and external coherence. Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

The project is to reconstruct three bridges, Chuzomsa Bridge, Nikachu Bridge and Zalamchu Bridge; to construct approach roads; and construct revetments and install sidewalks for Chuzomsa Bridge and Nikachu Bridge. Table 1 and 2 show the actual results of major outputs. Although there were minor design changes of about 1 m each in the overall width of the bridge and the length of the revetment, according to the executing agency and the implementing consultant, the alignment was changed in order to smoothly connect with the existing road adjacent to the approach road. It was found that the change was made appropriately. Therefore, there were no major changes in the outputs and the project was almost as planned.

The timely removal of the existing bridges, which was listed as a responsibility of the Bhutanese side, had not been carried out at the time of ex-post evaluation. Although the old Zalamchu Bridge was completely closed to traffic by both vehicles and pedestrians by the

executing agency, the other two bridges were still being used as foot bridges at the time of ex-post evaluation. There was a plan to remove the two bridges in FY 2021, but it was not implemented due to the effect of COVID-19. At the time of ex-post evaluation, the safety as foot bridges was secured, but it is desirable to remove them in the future.

Table 1: Outputs (Bridge)

Bridge	Item	Actual	Difference
Chuzomsa Bridge	Bridge Length	47.5 m	As planned
	Bridge Width	7.28 - 9.08 m	Minor Change
	Carriage Way	3.5 x 2 = 7.0 m	As planned
	Sidewalk	1.5 m	As planned
	Bridge Format	PC simply supported box girder bridge	As planned
	Revetment	A1: 35.7 m	Minor Change
Nikachu Bridge	Bridge Length	45.0 m	As planned
	Bridge Width	13.33 - 18.65 m	Minor Change
	Carriage Way	3.5 x 2 = 7.0 m	As planned
	Sidewalk	1.5 m	As planned
	Bridge Format	PC simply supported box girder bridge	As planned
	Revetment	A1: 36.87 m, A2: 41.19 m	Minor Change
Zalamchu Bridge	Bridge Length	46.5 m	As planned
	Bridge Width	8.08 - 10.81 m	Minor Change
	Carriage Way	3.5 x 2 = 7.0 m	As planned
	Bridge Format	PC simply supported box girder bridge	As planned

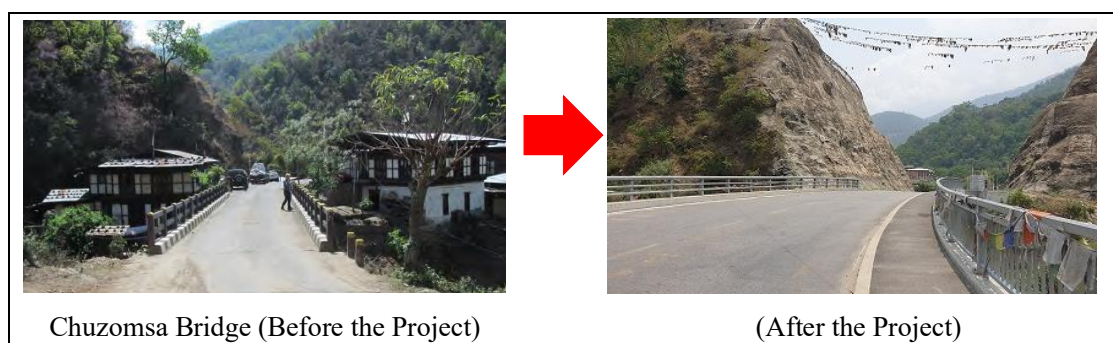
Source: Information provided by JICA

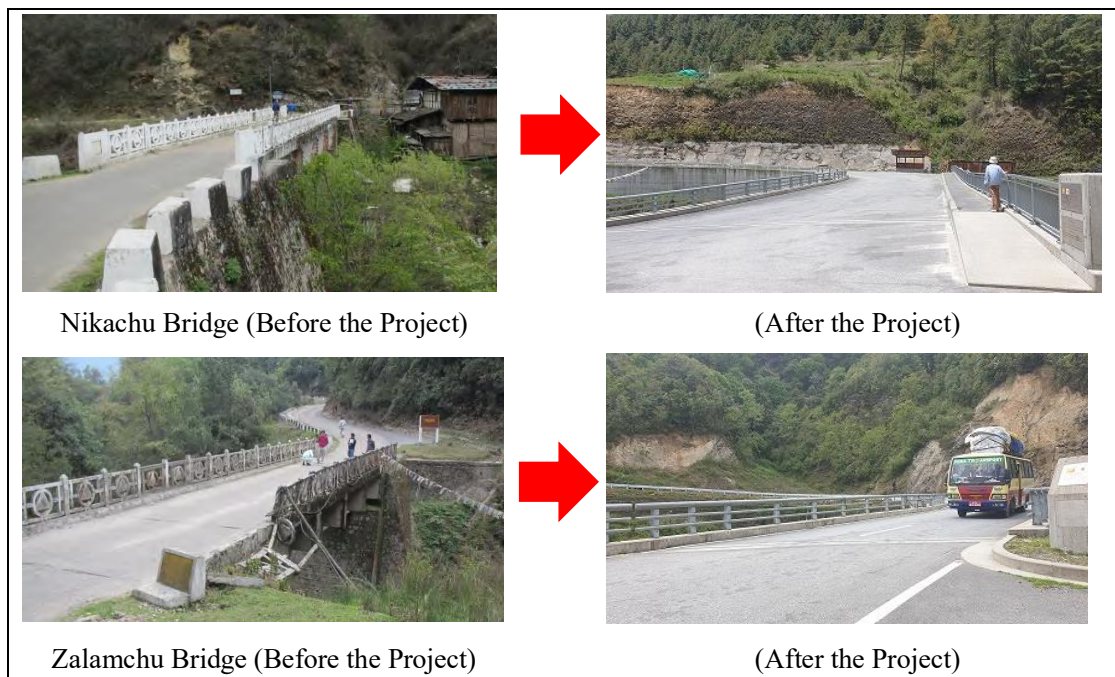
Table 2: Outputs (Approach Road) (All as planned)

	Chuzomsa Bridge	Nikachu Bridge	Zalamchu Bridge
Planned Length	75.5 + 97.0 m	47.0 + 41.3 m	113.5 + 71.9 m
Total Width	9.5 m (Lane 3.25 x 2 = 6.5 m, Shoulder 1.5 x 2 = 3.0 m)		

Source: Information provided by JICA

Below pictures are three bridges before and after the project.





Source: Photos before the project are provided by JICA. Photos after the project are taken by the local consultant at the time of ex-post evaluation field survey.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual cost of the Japanese side was 1,956 million yen compared to the planned cost of 1,956 million yen, which was within the plan (100% of the plan). It was not possible to confirm the actual cost of the project on the Bhutan side, as the executing agency did not have information.

3.2.2.2 Project Period

The project period was 39 months compared to the planned period of 29 months, exceeding the plan (134% of the plan). As a result of the bidding to select the contractor, the price offered by the bidder exceeded the planned price, but as result of price negotiations, the construction start date was pushed back and the construction period was extended. However, it can be judged that the extension was appropriate, as the project could be kept within the planned price range by extending the construction period.

Therefore, efficiency of the project is high.

3.3 Effectiveness and Impacts³ (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

At the time of planning, (1) Bridge load-carrying capacity, (2) Average travelling speed, and (3) Annual average daily traffic were set as quantitative effect indicators. Table 3 shows target and actual values of quantitative effects indicators. All indicators have achieved their target values.

Table 3: Quantitative Effect Indicators

		Baseline value	Target value	Actual value			
		2014	2020	2018	2019	2020	2021
			3 Years after Completion	Completion Year	1 Year after Completion	2 Years after Completion	3 Years after Completion
Indicator 1: Bridge load-carrying capacity (t)	Chuzomsa Bridge	55	100	100	100	100	100
	Nikachu Bridge	55	100	100	100	100	100
	Zalamchu Bridge	55	100	100	100	100	100
Indicator 2: Average travelling speed (km/h)	Chuzomsa Bridge	16	30	30	30	30	30
	Nikachu Bridge	16	20	20	20	20	20
	Zalamchu Bridge	13	20	20	20	20	20
Indicator 3: Annual average daily traffic (vehicle/day)	Wandue – Pelela Pass	434	541	—	492	611	646
	Pelela Pass - Trongsa	314	390	348	303	401	563

Source: Information provided by JICA and executing agency

Note: Indicator 2 is calculated based on road alignment. Indicator 3 is the average number of vehicles measured twice a year for about one week each by the two regional offices of DoR that have jurisdiction over the section. There were lockdowns due to the impact of COVID-19 in 2020 and 2021. However, the traffic surveys were implemented when the lockdowns were not in effect. There was a drop in traffic during the lockdown, but the extent to which it was affected is unknown since they have not measured.

By increasing the bridge load-carrying capacity (Indicator 1) from 55 t to 100 t, it became possible to handle the transport of transformers, the heaviest of the dam construction materials and equipment for the Mangdechhu hydroelectric power plant in Trongsa province. According

³ When providing the sub-rating, Effectiveness and Impacts are to be considered together.

to the Lobeyasa regional office which administers Chuzomsa Bridge and Nikachu Bridge, prior to the project, the load-carrying capacity was not sufficient and some of the heavy materials and equipment had to be unloaded in front of the bridges. It took time and effort to go over the bridges back and forth and carry the load separately. Not having to unload the truck has really enhanced the traffic flow. In addition, the load-carrying capacity has been improved, and the width has become compatible with two-lane driving, making it possible to load more.

Average travelling speed (Indicator 2) also reached the target value. The speed limit for all three bridges is 40 km/h.

Regarding the annual average daily traffic between Pelela Pass and Trongsa (Indicator 3), the widening works from 2016 to 2019 were implemented with assistance from India on the Chuserbu-Nangar section (approximately 100 km), resulting in a temporary decrease in traffic volume. However, three years after completion, the actual number was 563 vehicles, exceeding the target value (390 vehicles). In addition to Indicators 1 and 2, the dramatic improvement in convenience is also thought to be a factor behind the increase in traffic volume. For example, before the project, when large vehicles pass through the bridges, such as those used to transport heavy machinery during the construction of the Mangdechhu hydroelectric power plant project, the business operator had to notify the DoR regional office in charge for ensuring safety. DoR officers had to go to the spot every time they passed through and inspect the bridge after passing through. However, after the project, inspections by DoR officers are no longer necessary even when large vehicles carrying heavy machinery are passing through. Therefore, smooth traffic has been ensured.

3.3.1.2 Qualitative Effects (Other Effects)

The qualitative effects of “improving bridge safety / ensuring pedestrian safety⁴” and “revitalization of local economy by promoting and facilitating the distribution of goods” will be realized after the bridges are reconstructed. Therefore, these effects are regarded as impacts and shown in 3.3.2 Impacts.

3.3.2 Impacts

3.3.2.1 Intended Impacts

The project was expected to contribute to (1) “improving bridge safety / ensuring pedestrian safety” and (2) “revitalization of local economy by promoting and facilitating the distribution of goods.” These impacts were confirmed from the results of interview with the executing agency and qualitative survey conducted at the time of observation of the project

⁴ At the time of planning, “Improvement of bridge safety” and “Ensuring pedestrian safety” were separate effects. Since they have a lot in common, two were combined into one.

sites⁵.

(1) Improving bridge safety / Ensuring pedestrian safety

The following responses were received from the executing agency confirming safety improvement. Before the project, width was not enough for face-to-face driving, but after the project, roads width was enough for two-lane traffic, allowing two vehicles to pass each other safely at the same time. The vehicles can travel in both directions even with pedestrians, and heavy vehicles can now pass through without shaking or damaging the bridges.

From the qualitative survey, all the bridge users who were asked the questions (45 people) responded that safety had increased and they were able to cross the bridge with peace of mind. Specifically, “the bridge no longer sways while crossing, so I can cross the bridge without feeling uneasy,” “the sidewalks have made it possible to cross with peace of mind⁶,” and “even though there is no sidewalk, the bridge has enough width to walk even when the vehicles are passing by (user of Zalamchu Bridge).” In particular, the sidewalks are barrier-free and have no steps, and the width is 1.5 m, which is more than the required 1 m for a wheelchair. As a result, many people (28 out of 45 people) pointed out that children, people with disabilities and the elderly, and other vulnerable road users can now pass safely.

Furthermore, the driver crossing Chuzomsa Bridge answered that “during monsoon season, when the river overflows, I was worried that the bridge might collapse when the water approached, but now it is a solid bridge and I can cross it with peace of mind.” In addition, before the project, there were many accidents and road closures due to over speeding during the monsoon season, such as hitting the railings of the bridge and landslides near the approach road. However, it was pointed out that safety had increased and road closures had decreased after the project since mortar was sprayed on the slopes and the landslides had not occurred in the vicinity. In fact, it was confirmed by the executing agency that no accidents occurred near the three bridges after completion.

Thus, it can be said that the project has contributed to the bridge safety and pedestrian safety.

⁵ For the qualitative survey, interviews were conducted with 15 residents and users near each bridge, for a total of 45 people. The breakdown is as follows; (gender) 21 men, 24 women; (age) 7 in the 10s, 10 in the 20s, 9 in the 30s, 12 in the 40s, 5 in the 50s and 2 in the 60s and over; (occupation) 14 self-employed (restaurants, grocery stores, hotels, etc.), 6 drivers (public buses, taxis, etc.), 13 farmers, 8 students, 1 hydroelectric power plant contractor, and 3 employees in the clinic. Although there are no residents near Zalamchu Bridge, there is a village about 3 km east of the bridge. The interview was conducted with the villagers since they use the bridge.

⁶ Sidewalks were installed on two bridges, Chuzomsa Bridge and Nikachu Bridge where residents live nearby.



Sidewalk of Chuzomsa Bridge



Slope mortar spraying along the access road to Zalamchu Bridge

(2) Revitalization of local economy by promoting and facilitating the distribution of goods

According to the qualitative survey, 35 out of 45 people (78%) answered that local economy revitalized compared to before the project. Specifically, farmers and self-employed such restaurant and hotel owners answered that access to the capital and neighboring large towns has improved after the new bridges were installed since they no longer have to worry about road closures due to accidents or traffic jams; frequency of public buses between Thimphu and Trongsa has increased from once to twice a week; and the business became active due to frequent visits by people involved in hydroelectric power plant construction. In addition, 31 out of 37 people (84%), excluding students, answered that their income had improved. Many farmers raised that access to the market has improved. In particular, products such as milk, raw vegetables, and fruits, for which freshness is important, were able to be transported as planned, eliminating waste due to traffic jams and road closures. Furthermore, as mentioned above, the contractor of hydroelectric power plant answered that they had to coordinate with the DoR regional office in advance when heavy vehicles passed through the bridges, and had to wait until the officer arrived on the day. However, after the project, the smooth passage became possible without coordination with DoR office and materials and equipment could transport efficiently. In this way, it was confirmed by the bridge users that the project contributed to the revitalization of the local economy through improved market access and increased traffic⁷.

On the other hand, since this project is part of the road network, in order to promote and facilitate the distribution of goods, not only the effects from the project itself but also the status of the widening works that has been carried out on PNH-1, and the maintenance status of other aging bridges between Thimphu and Trongsa on the western part of PNH-1 are also relevant. Therefore, the status of the widening work and the status of the other 7 bridges that were candidates at the time of planning were confirmed by the executing agency.

In the 12th Five Year Plan (2018-2023), the widening works of PNH-1 (385 km from

⁷ During the period of lockdown due to the impact of COVID-19, business has been affected such as shrinking.

Simtokha, the starting point of South Thimphu, to Trashigang) divided into five sections, are planned to be completed by 2023 with financial cooperation from the Government of India. It was confirmed with the executing agency that all sections had been completed by 2021. It was also confirmed that the reconstruction of 7 aging bridges had been completed at the time of ex-post evaluation as shown in Table 4 although the implementation was delayed by one to two years due to the impact of COVID-19. PNH-1 is the major trunk road of Bhutan. The completion of the widening works of PNH-1 and the reconstruction of the other aging bridges by the executing agency, which could have become a bottleneck in the road network if not reconstructed on a timely basis, can be expected to lead to further revitalization of local economy, including contribution to the hydroelectric power plant business, together with the effects of this project.

Table 4: Condition of 7 Aging Bridges between Thimphu and Trongsa

	Bridge	Status
1	Banglapokto zam	Completed reconstruction (2021.8)
2	Bong zam	Completed reconstruction (2022.5)
3	Gaytsa zam	
4	Domkhar zam	
5	Rube zam	Completed reconstruction (2022.6)
6	Yamtrak zam	
7	Hurjee zam	

Source: Results from the questionnaire to the executing agency

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Natural Environment

The project does not fall under the category of large-scale projects in the bridge sector listed in the JICA Guidelines for the Confirmation of Environmental and Social Consideration (April 2010). It was determined to fall under Category B because the undesirable environmental impact was judged to be insignificant and it does not fall within the sensitive characteristics and sensitive areas listed in the Guidelines. An Initial Environmental Examination (IEE) was required for this project based on Bhutanese domestic law. After the executing agency implemented the IEE, it was confirmed that an environmental permit was obtained from the National Environment Commission in 2015, before the construction work.

According to the executing agency, during the construction, periodical monitoring was conducted and the project implemented countermeasures for air pollution, water pollution, noise/vibration and waste as planned. Based on the results of interviews with the implementing consultant and local residents as well as the results of site surveys at the project sites, it can be thought that there were no problems with the natural environment.

2) Resettlement and Land Acquisition

No resettlement occurred. On the other hand, land acquisition of 243 m² occurred for the reconstruction of Chuzomsa Bridge. The impact of the land acquisition was the scale initially assumed, and the crops and trees on the land of one affected household were subject to compensation. According to the executing agency, the compensation was paid according to the compensation process which was agreed at the time of planning. Based on interviews with the executing agency and the implementing consultant, there were no complaints, therefore, it is considered that there was no impact on the project.

3) Gender Equality, Marginalized People

As stated above, the sidewalks were installed at Chuzomsa Bridge and Nikachu Bridge where people are living nearby, which enabled vulnerable people in traffic such as women, children, people with disabilities and the elderly to walk safely.

4) Social Systems and Norms, Human Well-being and Human Rights

As a result of the interview with the 45 bridge users⁸, who underwent a qualitative survey, on their subjective well-being before and after the project, it was confirmed that the project contributed to improving their subjective well-being. Positive changes in safety were the biggest contributors to increased subjective well-being. All 45 respondents (100%) said they felt safer crossing the bridges than before. Both pedestrians and drivers rate the safety positively.

Health was the next contributor, with 39 people (87%) positive evaluations. In particular, many people pointed out that access to hospitals, including transportation by ambulance, has improved and that health concerns have decreased. It was thought that before the project, including access to large hospitals, even if an ambulance was called, it took a long time to get to the hospital.

In addition, 33 people (73%) gave a positive evaluation of the contribution to the relationship within the community. This project has made it easier for people to come and go to see relatives and friends, and reduced arguments over who should cross the bridge first when there was an oncoming vehicle. Furthermore, some commented that the beautiful and sturdy bridge became a source of pride for the community. It is considered that the project contributed to the solidarity of the community.

There were also 31 positive evaluations (69%) on the economic side. There was an opinion that the increase in the number of people coming and going led to the opening of new restaurant and cafe businesses, and sales of agricultural products increased due to improvement of access to the markets.

⁸ See footnote 5 for breakdown.

5) Unintended Positive/Negative Impacts

<Continuous Capacity Building of Bhutanese Construction Workers>

The contractor of this project also implemented past grant aid projects related to bridge reconstruction. Many Bhutanese construction workers were employed in these projects. Some of them became local employees of the contractor. It was confirmed that this project contributed not only to the capacity building of executing agency but also to the skills development of Bhutanese construction workers. According to the implementing consultant, at the completion ceremony of this project, the Minister of MoWHS expressed his appreciation for the continuous human resource development of Bhutanese workers.

In light of the above, this project has achieved its objectives. Therefore, effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ④)

3.4.1 Policy and System

At the time of ex-post evaluation, the 12th National Five-Year Plan (2018-2023) continues to position PNH-1 as the most important route. There is no change in the policy and system regarding the positioning of this project and maintenance. In addition, anticipating monsoon damage, a system is in place to allocate emergency response costs and repair costs according to damage to regional offices every year. In light of the above, the policy and institutional sustainability of this project have been ensured.

3.4.2 Institutional/Organizational Aspect

There is no change in the roles of maintenance from the time of planning. Basically, the regional office in the district where the bridge is located conducts routine inspections (cleaning, removal of sediment, etc.) and periodic inspections. The head office monitors the regional offices. The Maintenance Department of the head office inspects the condition of roads and bridges after monsoons and makes judgments on the necessity of repairs. Lobeysa Regional Office is in charge of Chuzomsa Bridge and Nikachu Bridge, and Trongsa Regional Office is in charge of Zalamchu Bridge⁹. A certain number of civil engineers are stationed at the head office and each regional office, and the system is in place to handle emergency repairs. The cleaning of roads, including bridges, is carried out by Bhutanese workers (National Work Force (NWF)) registered with the executing agency. NWF is cleaning the roads in its assigned section, including bridges. The amount of work

⁹ There are sub-branch offices in Trongsa regional office. Routine inspection of Zalamchu Bridge is carried out by the officer of sub-branch office nearby the bridge.

per NWF person is 1.5 km for national roads.

From the above, it can be judged that there are no particular problems with the institutional/organizational aspects.

3.4.3 Technical Aspect

At the time of ex-post evaluation, more than 20 engineers were stationed at each of the regional offices in charge, and they have the ability to perform maintenance of minor damage and emergency response. If there are technical problems, they can get advice from the engineers at the head office. According to the executing agency, technical training is basically focused on OJT, but the officers in charge of bridges at the executing agency have improved their technical capabilities through Japan's bridge reconstruction projects and technical cooperation assistance such as CAMBRIDGE. The BMS developed by CAMBRIDGE has enabled the executing agency to carry out planned maintenance and management, such as making evidence-based budgets. In addition, maintenance management guidelines and manuals for bridges have been prepared by CAMBRIDGE, and maintenance is being performed using those.

Based on the above, there were no particular problems with technical sustainability.

3.4.4 Financial Aspect

According to the executing agency, the budget for maintenance has been shrinking overall for the past two years due to the impact of COVID-19, but the budget for routine maintenance and maintenance for minor damage has been secured. The maintenance budget for regional offices is distributed according to the distance of roads under their jurisdiction and the number of bridges. Within the limited budget, each office is devising measures such as prioritizing bridges in need of repair according to the BMS.

In addition to the basic maintenance budget, 3 million Nu (approximately 5.4 million yen¹⁰) is allocated to each regional office at the beginning of each year as a monsoon emergency response, and additional repair costs are added as necessary after inspections after the monsoon¹¹.

The bridges that were reconstructed in this project are still new, therefore, no major maintenance costs will be required for the time being unless major damage occurs.

In light of the above, there were no particular problems with the financial sustainability of the maintenance of this project.

¹⁰ 1Nu=1.79 yen (November 2022)

¹¹ Since the limited budget is distributed nationwide, an additional 20 million to 25 million Nu (approximately 36 million to 45 million yen) is allocated to each office every year. In 2021, repair costs distributed to Lobeysa office was 25 million Nu and Trongsa office was 20 million Nu.

3.4.5 Environmental and Social Aspect

As a result of confirming with the executing agency, there were no unforeseen aspects related to environmental and social consideration.

3.4.6 Preventative Measures to Risks

Due to the impact of COVID-19, the maintenance budget has been reduced overall. Preventive measures are taking such as prioritizing maintenance and management according to the necessity.

3.4.7 Status of Operation and Maintenance

It was confirmed by inspection that there were no major damages on any of the three bridges, and the drainage outlets on the bridges surface, which are important for maintenance, had been thoroughly cleaned. Interviews with local residents also confirmed that the bridges and the roads leading to the bridges are being cleaned regularly (almost every week). According to the regional offices in charge, routine inspections are carried out at least once a week, and periodic inspections are carried out at least once a year. In addition, there was an answer that inspections were always carried out after the monsoon. Therefore, the maintenance status is considered to be good.



Drainage Outlet of Chuzomsa Bridge



Well-cleaned Zalamchu Bridge

No issues have been observed in the policy/system, institutional/organizational, technical, financial, and environmental and social aspects, including the current status of operation and maintenance. Risks have been well mitigated. Therefore, sustainability of the project effects is very high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aimed to ensure smooth traffic and transportation access by constructing three bridges on PNH-1 and improving bridge performance, thereby contributing to the promotion of local economic revitalization. In Bhutan, road traffic is the most important means of transportation and

PNH-1 is the most important trunk road. This objective, therefore, is consistent with the policies and needs of the country both at the time of planning and ex-post evaluation. The project plan and approach considering people who are vulnerable to traffic accidents are appropriate. The project was also consistent with the ODA policy of Japan and collaborated with other projects within JICA and with organizations outside JICA. Concrete results of collaboration have also been confirmed. Therefore, relevance and coherence are high. Outputs were delivered mostly as planned. The project period exceeded the plan but the project cost was within the plan. Therefore, the efficiency is high. All quantitative effect indicators set at the time of planning achieved their goals. It was confirmed through the interviews with the executing agency and bridge users, along with specific grounds, that the project ensured the safety of the bridge, promoted the distribution of goods through smooth traffic flow, and contributed to the development of local economy. In addition, the interview with bridge users revealed that the project contributed to improving of subjective well-being, such as satisfaction with quality of life and satisfaction with life in general. Thus, effectiveness and impacts are high. Sustainability of operation and maintenance of this project is very high, as no major issues have been observed in terms of policy/system, institutional/organizational, technical and financial aspects, or current maintenance status.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

The old bridges before the project had not been removed at the time of ex-post evaluation due to the impact of COVID-19. However, in consideration of safety, it is desirable to remove all three bridges in the future including those used for foot bridge.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

Implementation of technical cooperation projects for the executing agency contributes not only to this project but also to ensuring the sustainability of similar projects in the past

The maintenance of this project was carried out appropriately by utilizing the BMS and maintenance manuals which were the outputs of CAMBRIDGE. In previous ex-post evaluations of similar projects in Bhutan, it was pointed out that maintenance systems such as periodic inspections and maintenance guidelines prepared with grant aid were not being utilized. Given this situation, it is commendable that the executing agency is implementing a maintenance plan in order of priority with the limited budget allocated for maintenance. In Bhutan, grant aid projects for reconstruction of

bridges have been implemented since the 2000s, and the implementation of such technical cooperation projects has contributed not only to this project but also to ensuring the sustainability of bridges reconstructed in the past. If multiple similar grant aid projects are being implemented, it would be better to comprehensively address them through a technical cooperation project, instead of formulating maintenance manuals and guidelines for each grant aid project, in order to ensure the sustainability of all similar projects.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

None.

5.2 Additionality

As additionality of the project, two points are raised, installation of sidewalks on bridges on national highways and enhancement of value through installation of curved bridges. Both points were the first adoptions in Bhutan.

As for Chuzomsa Bridge and Nikachu Bridge, sidewalks were installed because there were settlements and frequent pedestrian traffic around the bridges. This was at the request of the executing agency, but this project provided the first bridges with sidewalks on the national highway in Bhutan. Even the bridges that were reconstructed with grant aid in the past did not have sidewalks. It has been confirmed that the presence of sidewalks increases the sense of safety and security for both pedestrians and drivers. In particular, the fact that children, people with disabilities, and the elderly, who are vulnerable to traffic accidents, can cross the bridge with peace of mind is an added value that enhances the effects of this project. In this respect, it was shown that this project can be a good example of future bridge construction in Bhutan.

In addition, this project adopted a curved bridge design for the first time in Bhutan. Including past grant aid projects, Bhutan usually uses the design of straight bridges that span rivers at right angles, which sometimes causes vehicles to collide with railings on both sides of the bridges, and there



Curving Zalamchu Bridge

were many bridges which do not have railings to avoid accidents. In this project, there was a risk that a straight bridge would cause such danger due to its location, so it was decided to design the front and rear of the bridge in a curved line rather than at right angles (straight lines) to the river

so that drivers can drive safely and smoothly. This proposal was made possible thanks to the knowledge and experience of the implementing consultant who was responsible for the implementation of past grant aid projects and is familiar with the bridge situation in Bhutan, as well as the lessons learned from the past years of JICA's continued support for bridges. In addition, due to the expansion of the width of the curved bridges, both sides of the bridges have a wider planar shape than straight bridges. As a result, the road safety has been further improved, and the design has become beautiful. Such added value creates even higher value, such as the bridge becoming a symbol of the local community.

END