Kingdom of Cambodia

FY2020 Ex-Post Evaluation Report of Japanese Grant Aid Project

"The Project for the Improvement of the National Road No.1 (Phases 1-4)

/ The Project for Improvement of the National Road No.1 Urban Section

/ The Project for Construction of Neak Loeung Bridge"

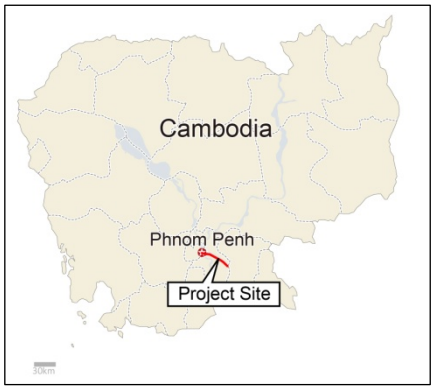
External Evaluator: Nobuyuki Kobayashi, OPMAC Corporation

0. Summary

This project conducted the improvement of a road and repairing/construction of bridges in the Phnom Penh - Neak Loeung section of National Road No. 1 and its objective was to expand transportation capacity, improve efficiency, and enhance flood control in the above section, thereby contributing to a strengthening of international logistics and a revitalization of the society and economy of the project area. With Cambodia's policy goal of enhancing international corridor development, the amount of trade between Cambodia and Vietnam was on rise. This project has been highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high. Both the project cost and the project period exceeded the plan. Therefore, the efficiency of the project is fair. The effects (an improvement in traffic efficiency, flood protection, etc.) were found in the improved section of National Road No.1, and the opening of the Neak Loeung Bridge brought about smoother crossing of the Mekong River. Cargo volume between Cambodia and Vietnam was increasing, and the economy in the project affected area was also expanding. This project has achieved its objectives. Therefore, the effectiveness and impacts of the project are high. Given the responsibilities and personnel assignment of the executing agencies, it is feasible to carry out routine and periodic maintenance of the infrastructure constructed by the project. The maintenance of the improved section of National Road No.1 is within the technical level of the Department of Public Works and Transport (DPWT), but the maintenance of Neak Loeung Bridge requires the Ministry of Public Works and Transport (MPWT) to obtain higher technical skills to cope with the special features of the cable-stayed bridge. In terms of budget, it was expected that the maintenance budget would be allocated for the improved section of National Road No.1, but budget allocation for the periodic maintenance of Neak Loeung Bridge needed to be reassessed. Nevertheless, no severe damage occurred affecting transport in the infrastructure constructed by the project. From the above, some minor problems have been observed in terms of the technical aspect and financial aspect on the operation and maintenance of this project. Therefore, the sustainability of the project effects is fair.

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

1. Project Description



Project Location


Neak Loeung Bridge

1.1 Background

Cambodia is located between Thailand and Vietnam, and National Road No.1 in Cambodia is part of the international corridor connecting Ho Chi Minh and Bangkok. National Road No.1 is also a major trunk road for domestic logistics connecting the capital city, Phnom Penh, and the southeast area of Cambodia.

As the section of National Road No.1 from Phnom Penh to Neak Loeung is along the Mekong River and lies on its flood plain, design and construction of the road were difficult. In the early 2000s, with Asian Development Bank (hereinafter called ADB) support, National Road No.1 at the section from Neak Loeung to Bavet (the border with Vietnam) was improved, but improvement of the section from Phnom Penh to Neak Loeung was not started due to the technical concerns stated above. After a flood in 2000, the above section was damaged significantly, which resulted in extremely low travel speed. In the flood in 2000, two locations of National Road No. 1 were intentionally cut to block inflow from the river and prevent flood damage in the city of Phnom Penh. After the flood, one-lane Bailey bridges[1] was built for passage. However, these bridges needed to be replaced immediately as the locations became bottlenecks of traffic. The National Road improvement part of the project, whose contents are the Grant Aid "the Project for Improvement of National Road No.1 (Phase 1 through 4) / the Project for Improvement of National Road No.1 Urban Section", was to support the improvement of the above unrepaired section of National Road No.1.

National Road No.1 crossed the Mekong River at Neak Loeung in Cambodia without a bridge in the 2000s, with a ferry service being the only way to cross the river. In 2008, the traffic volume crossing the river in Neak Loeung was expected to soon reach the limit of the ferry service capacity. For the efficient logistics of National Road No.1, a new transport measure to replace ferries for river crossing was required. The bridge construction part of the project, the Grant Aid

[1] A type of temporary bridge

"the Project for the Construction of Neak Loeung Bridge", was to support the construction of a cable-stayed bridge on National Road No.1, thus eliminating the need for ferry transportation.

1.2 Project Outline

The objective of this project is to expand transportation capacity, improve efficiency, and enhance flood control in the Phnom Penh- Neak Loeung section of National Road No. 1 by the improvement of the road and the repairing/construction of bridges in the aforementioned section, thereby contributing to a strengthening of international logistics and a revitalization of the society and economy of the project area.

[The Project for Improvement of National Road No.1 (Phases 1-4)/The Project for Improvement of the National Road No.1 Urban Section]

Grant Limit / Actual Grant Amount	(Phase 1) JPY 786 million / JPY 777 million (Phase 2) JPY 4,746 million / JPY4,571 million (Phase 3) JPY 2,005million / JPY 1,138 million (Phase 4) JPY 1,585 million / JPY 1,543 million[2] (Urban section) JPY 251 million
Exchange of Notes Date /Grant Agreement Date	(Phase 1) June 2005[3] (Phase 2) June 2006 (Phase 3) July 2009 / July 2009 (Phase 4) December 2013 / January 2014 (Urban section) November 2014 / December 2014
Executing Agency	MPWT
Project Completion	July 2017[4]
Target Area	Phnom Penh capital city, Kandal province
Main Contractor(s)	(Phases1 and 2) Obayashi Corp., (Phase 3) Daiho Corp., (Phase 4 and Urban section) Hazama Ando Corp.
Main Consultant	Katahira & Engineers International
Basic Design	March 2004 – March 2005
Related Projects	[Technical Cooperation] "Project on Capacity Enhancement of Environmental and Social Considerations for Resettlement" (2010 - 2012) [Grant Aid] "Project for Flood Disaster Rehabilitation and Mitigation" (2012) [Others] "Study on the Road Network Development in the Kingdom of Cambodia" (2005 - 2006) [Other Aid Agencies] ADB "Greater Mekong Subregion: Phnom Penh to Ho Chi Minh City Highway Project" (1999)

[2] The actual grant amount includes that of the Project for the Improvement of the National Road No.1 Urban Section.
[3] As Phases 1 and 2 were agreed before October 2008, the grant agreements were not signed. For this reason, only the Exchange of Notes Date is shown.
[4] At the time of the construction completion in the target section for the Urban Section

[The Project for Construction of Neak Loeung Bridge]

Grant Limit / Actual Grant Amount	(Detailed Design) JPY 239 million / 218 million (Construction) JPY 11,940 million / JPY 9,777 million
Exchange of Notes Date /Grant Agreement Date	(Detailed Design) March 2010 / March 2010 (Construction) June 2010 / June 2010
Executing Agency	MPWT
Project Completion	April 2015
Target Area	Kandal province, Prey Veng province
Main Contractor	Sumitomo Mitsui Construction
Main Consultant	Chodai・Oriental Consultants (JV)
Preparatory Survey	February 2009 – March 2010
Related Projects	[Technical Cooperation] "Project on Capacity Enhancement of Environmental and Social Considerations for Resettlement" (2010 - 2012) [Grant Aid] "Project for Flood Disaster Rehabilitation and Mitigation" (2012) [Others] "Study on the Road Network Development in the Kingdom of Cambodia" (2005 - 2006) [Other Aid Agencies] ADB "Greater Mekong Subregion: Phnom Penh to Ho Chi Minh City Highway Project" (1999)

2. Outline of the Evaluation Study

2.1 External Evaluator

Nobuyuki Kobayashi, OPMAC Corporation

2.2 Duration of Evaluation Study

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

Duration of the Study: October 2020 – January 2022

Duration of the Field Study: July 2021 (conducted by field assistants in Cambodia)

2.3 Constraints during the Evaluation Study

In the ex-post evaluation, survey assistants in Cambodia conducted a field survey as it was difficult for the external evaluator to travel due to the COVID-19 pandemic. Due to safety considerations across Cambodia, the survey assistants conducted the survey on the resettlement of residents at only two relocation sites[5] where the locations had been identified in advance and support for the survey was obtained. Moreover, as the number of respondents was small and selection was not conducted using systematic sampling, their answers could be biased. There were

[5] Six relocation sites were built for resident resettlement in the Project for the Improvement of National Road No.1.

the same issues in the sample size and sampling method for the beneficiary survey and, therefore, the survey results may not represent the overall project benefits appropriately. The analysis of the negative impacts on the environment is based on the information from MPWT and the Consultant, as environment impact assessment reports, monitoring reports, and monitoring data were not available.

3. Results of the Evaluation (Overall Rating: B[6])

3.1 Relevance (Rating: ③[7])

3.1.1 Consistency with the Development Plan of Cambodia[8]

At the time of the planning of the Project for Improvement of National Road No.1, the national development strategy, the *Rectangular Strategy* (2004), had the further rehabilitation and construction of the transportation network at Rectangle 2 "Continued Rehabilitation and Construction of Physical Infrastructure" among its four basic strategies. The transportation network was emphasized in particular, with the roads and bridges connecting Cambodia with neighboring countries, seen as important in integrating the Cambodian economy into the regional and global economies. Similarly, in the *Socio-Economic Development Plans Phase II* (2001 - 2005), the development goals of the transport sector were the rehabilitation, maintenance, and enhancement of the transportation infrastructure to promote market integration and trade, and thus the improvement of National Road No.1 had a higher priority, as it was a part of the international corridor connecting Bangkok and Ho Chi Minh.

At the planning time of the Project for Construction of Neak Loeung Bridge, the national development strategy, the *Rectangular Strategy Phase II* (2008) aimed at the further rehabilitation and construction of the transport network, stated at Rectangle 2 "Further Rehabilitation and Construction of the Physical Infrastructure". The transport sector was prioritized for the integration of the domestic economy itself as well as integration into the regional and global economies. In addition, the *National Strategic Development Plan Update 2009-2013* had the policy of continuing the construction of important national roads to integrate the country domestically and with neighboring countries, as mentioned in the above-mentioned *Rectangular Strategy Phase II.*

At the time of the ex-post evaluation, the national development strategy, the *Rectangular Strategy Phase 4* (2018), had improvement of the logistics network at Rectangle 2 "Economic Diversifications" among its four basic strategies. A major policy goal was to establish a logistics

[6] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[7] ③: High, ②: Fair, ①: Low
[8] This project is consisted of the Project for Improvement of the National Road No.1 and the Project for Construction of Neak Loeung Bridge, but the subjects to be assessed in development policy and development needs are mostly common between the two phases. Therefore, the relevance was evaluated at three timings: the planning time of the Project for Improvement of the National Road No.1, the planning time of the Project for Construction of Neak Loeung Bridge, and the time of ex-post evaluation.

network linking the country with key global economic centres. The *National Strategic Development Plan 2019-2023* had the policy of road rehabilitation and construction of more than 3,000 km, and roads between major provincial cities and the Special Economic Zones were to be improved to a higher standard (expansion to 4-lane roads, etc.). The same plan also promoted studies to improve roads and bridges in the section of National Road No.1 between Phnom Penh and Bavet. The development plan for the road sector, the *National Road Network Master Plan* (2006)[9], was still a basic strategy at the time of the ex-post evaluation, and the development of National Road No.1 had a higher priority in terms of the enhancement of the international corridor, economic development in provincial cities and linkages between main domestic cities (multipolar development).

At both the times of the ex-ante and the ex-post evaluation, improvement of the transport network had been prioritized in the national development plans and the sector plans, especially the development of the international corridor linking Cambodia and neighboring countries. As the target section of the project is a part of the main national road connecting the capital city Phnom Penh to the border with Vietnam, the objective of the project, especially its impact, was therefore consistent with the continuing policy goals of the national development plans.

3.1.2 Consistency with the Development Needs of Cambodia

The Greater Mekong Subregion Ministerial Conference (1998) adopted the economic corridor approach (east-west, north-south and southern) proposed by ADB. The Southern Economic Corridor was an international corridor from Ho Chi Minh to Bangkok via Phnom Penh, and National Road No.1 in Cambodia was a part of this Southern Economic Corridor. National Road No.1 in Cambodia was also part of Asian Highway AH1 and had an important role in the country's international and domestic logistics. However, the flooding in 2000 caused severe damage to that national road and only temporary repairs were conducted. Taking into consideration future transport demand, large-scale rehabilitation was inevitable. At the time of planning of the Project for the Improvement of National Road No.1, although the section east of Neak Loeung was to be improved by ADB, details of the improvement of the section between Phnom Penh and Neak Loeung had not yet been decided.

In Neak Loeung, National Road No.1 crosses the Mekong River. At the planning time of the Project for Construction of Neak Loeung Bridge, ferry crossings at this location were a bottleneck on the Southern Economic Corridor, with a waiting time of up to 7 hours. With the traffic capacity of the ferry service expected to reach its limit in 2012, the construction of a bridge was an urgent issue for smooth transport.

At the time of the ex-post evaluation, National Road No.1 was still a part of the Southern Economic Corridor and Asian Highway AH1 and was used for land trade between Cambodia

[9] JICA "The Study on the Road Network Development" (2006) supported the formulation of the above master plan.

and Vietnam. From the year before the commencement of the Project for Improvement of National Road No.1, the share of Vietnam in both Cambodian exports and imports increased (see the following table). Exports from Cambodia to Vietnam have shown an increasing trend on a monetary basis. Vietnam has become the third most important country as the import from Vietnam have also increased on a monetary basis.

Table 1: Trade between Cambodia and Vietnam

Unit: USD million

	2004*	2017*	2018	2019	2020
Exports	2,795.14	11,313.38	12,739.26	14,866.3	14,436.5
to Vietnam (amount)	42.4	325.8	361.8	359.2	318.1
for Vietnam (%)	1.5%	2.9%	2.8%	2.4%	2.2%
Imports	2,032.8	14,800.9	18,130.6	21,058.4	20,858.9
from Vietnam (amount)	168.7	1,682.3	2,221.0	2,724.9	2,687.2
from Vietnam (%)	8.3%	11.4%	12.3%	12.9%	12.9%

Source: IMF - Direction of Trade Statistics
Note: * the year before the project commencement, for 2004, the project completion year, for 2017.

National Road No.1 is the shortest route from Phnom Penh to Ho Chi Minh, and there is no bridge on the Mekong River south of the Neak Loeung Bridge in Cambodia. Consequently, that bridge is an important part of the road infrastructure from the point of view of smooth transport between Phnom Penh and the south-eastern part of Cambodia (Prey Veng Province and Svay Rieng Province). JICA's "Basic Information Survey on National Road Network Development Plan" (2013) forecasted the traffic volume of major national roads in Cambodia by 2030 and proposed four prioritized projects for road improvement. In terms of the promotion of investment and the response to transportation demand, the above priority projects included the construction of the second Neak Loeung Bridge, and the importance of bridging at Neak Loeung was proved again.

At the times of both the ex-ante and the ex-post evaluation, National Road No.1 was a part of the international corridor and an important route for international and domestic logistics. The amount of trade between Cambodia and Vietnam has shown an increasing trend, and the share of Vietnam in imports to Cambodia has been especially high. Moreover, Neak Loeung Bridge has an important role for smooth transport in the south-eastern part of the country. The scope of this project is the improvement of National Road No.1 and the construction of Neak Loeung Bridge, the project has therefore been consistent with the development needs of Cambodia.

3.1.3 Consistency with Japan's ODA Policy

At the time of planning for the Project for Improvement of National Road No.1 and the Project for Construction of Neak Loeung Bridge, Japan's Country Assistance Program for Cambodia

(2002) referred to "sustainable economic growth and the realization of a stable society" as priority areas of assistance, and its policy was "promotion to improve socio-economic infrastructure and to enhance the environment for economic growth". In addition, the program also mentioned road damage caused by flooding of the Mekong River and aimed to improve the infrastructure with consideration of protection from natural disasters. Furthermore, the program referred to the development of "the second East-West Economic Corridor" (the international corridor from Ho Chi Minh to Bangkok via Phnom Penh) with the policy of the development of the Greater Mekong Sub-region for the reduction of disparity among ASEAN[10] countries.

The goal of the project was the enhancement of smooth transport and logistics through road improvement and the construction of bridges on National Road No.1, a trunk road in the country as well as an international corridor. The impacts of the project were expected "to stimulate socio-economic activities in the area along the road" and "to enhance international logistics." In addition, National Road No.1 was elevated as an embankment road of the Mekong River in the project, and this contributed to infrastructure improvement for disaster protection. Thus, the objective of the project was consistent with ODA policy at the time of planning.

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

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

(1) The Project for Improvement of National Road No.1

The road improvement of National Road No.1 (the section between Phnom Penh and Neak Loeung) and the construction and replacement of bridges were implemented in the Project for Improvement of National Road No.1 (see the following table). For improvement of the road, the road surface was elevated (elevation by approximately 70 cm on average) to prevent overflow at the same water level as the flooding of 2000. At the project implementation, consulting services such as detailed design, tender assistance, and construction supervision were carried out. The survey on compensation and replacement costs for the resettlement of residents was added to the consulting services during the project implementation. The plan and actual outputs of the project are shown in the following table.

[10] Association of South-East Asian Nations

Table 2: Outputs for The Project for Improvement of National Road No.1 (Plan and Actual)

Plan	Actual
• Road Improvement (widening, raising, pavement): Total length 55.98 km (4-lane section 1.8 km, 2-lane section 54.18 km) • Bridge construction: Total length 240.6 m (replacement of two bridges, construction of one bridge)	• Road Improvement (widening, raising, pavement): Total length 55.98 km (4-lane section 4.0 km, 2-lane section 51.98 km) • Bridge construction: Total length 239.8 m (replacement of two bridges, construction of one bridge)

Source: Basic design study report, documents provided by JICA

A notable modification of the project scope was the extension of the 4-lane section (before the scope change 1.8km, after the scope change 4.0km). The above modification was appropriate as this change was caused by the significant increase of traffic volume during project implementation. Assuming the same number of lanes as the initial plan, the traffic volume (at a 3.5 km point) would be more than 80 percent of road capacity in 2014 and cause serious traffic congestion.

At the time of planning of the Project for Improvement of National Road No.1, the Government of Cambodia was expected to provide compensation payments to the affected residents and relocate existing infrastructure as their responsibilities. The compensation for the affected residents was changed significantly, as described later ("3.3.2.2 Other Positive and Negative Impacts").

(2) The Project for Construction of Neak Loeung Bridge

New bridges and approach roads were constructed at the crossing points of the Mekong River of National Road No.1 by the Project for Construction of Neak Loeung Bridge. The main bridge is a prestressed concrete cable-stayed bridge with a 640 m of bridge length and a 330 m of maximum span length. In the project implementation, consulting services such as detailed design, tender assistance, and construction supervision were carried out. Due to the existence of unexploded ordnances, the clearance of unexploded ordnances was also added to the consulting services during project implementation. The plan and actual outputs of the project are shown in the following table.

Table 3: Outputs for The Project for Construction of Neak Loeung Bridge (Plan and Actual)

Plan	Actual
• Main bridge: PC cable-stayed bridge (640 m) • Approach bridges: PC composite bridges (1,575 m) • Approach road: 3.1 km, 2-lane	• Main bridge: as planned • Approach bridges: as planned • Approach road: 3.25 km, 2-lane

Source: Preparatory survey report, documents provided by JICA

A major change in the technical specifications was modification of the pavement structure. This change is considered appropriate from the viewpoint of sustainability because it responds

to future increases in traffic and reduces the risk of pavement damage. As Neak Loeung Bridge was one of the longest bridges in Cambodia, supplemental construction was added to the project scope, such as for monuments (at two locations), during the project implementation.

At the planning time of the Project for Construction of Neak Loeung Bridge, the Government of Cambodia was expected to undertake the costs for land acquisition, for the resettlement of residents (including surveys and compensation for the affected residents), the clearance of unexploded ordnances and the installation of various kinds of infrastructure. The Cambodia side kept their obligations. However, there was an issue in the disposal of unexploded ordnances, which caused a delay in the project implementation, as described later.

National Road No.1
(at the completion of Phase 3)

Approach road of Neak Loeung Bridge

3.2.2 Project Inputs

3.2.2.1 Project Cost

(1) The Project for Improvement of National Road No.1

The planned project cost was JPY 8,219 million in total (Japan side: JPY 7,984 million[11], Cambodia side: JPY 235 million), and the actual was JPY 9,632 million in total (Japan side: JPY 8,030 million, Cambodia side: JPY 1,602 million). Consequently, the actual project cost exceeded the plan (117% against the plan).

The planned project cost of the Japan side was JPY 7,562 million in the basic design study report. However, there was a significant modification of the project scope (extension of 4-lane sections) of the Project for the Improvement of National Road No.1. For a proper comparison, the planned project cost of the Japan side is adjusted to JPY 7,984 million[12] including the additional cost of the above modification, reflecting the advice from the Consultant. The actual project cost of the Japan side was JPY 8,030 million.

[11] The amount is based on the plan of the basic design study report.
[12] Based on the proposal of the Consultant, the increased project cost (plan) for extension of 4-lane sections was estimated by using a comparison between the remainder of the project cost of Phase 3 and the estimated project cost at the planning of Phase 4, which was then added to the project cost of the Japan side (plan).

For the project cost of the Cambodia side, only the amount of the costs for land acquisition and resettlement of resident was obtained. Comparing the plan and the actual of that portion, the actual project cost was JPY 1,602 million against the plan of JPY 235 million. The significant difference between the plan and the actual was due to a significant revision of the policy on the compensation to the affected residents. The increase of the project cost on the Cambodia side was necessary to mitigate the negative impact on the affected residents, especially for compensation for the involuntary resettlement of residents. For this reason, it is concluded that this expenditure was appropriate.

(2) The Project for Construction of Neak Loeung Bridge

The planned project cost was JPY 12,115 million in total (Japan side: JYP 12,005 million[13], Cambodia side: JPY 110 million), and the actual was JPY 10,141 million in total (Japan side: JPY 9,996 million, Cambodia side: JPY 145 million). Consequently, the actual project cost was within the plan (84% of the plan). While the planned project cost of the Japan side was JPY 12,005 million, the actual project cost was JPY 9,996 million, which was 83% of the plan. The actual project cost was within the plan. The reason for the reduction in project cost was that the construction cost was lower than the estimation due to competitive bidding. Regarding the project cost of the Cambodia side, only the cost for land acquisition and resettlement was obtained. Comparing the plan and the actual of that portion, the actual project cost was JPY 145 million against the planned project cost of JPY 110 million, which was 132% of the plan.

The actual project cost for the Project for Improvement of National Road No.1 and the Project for Construction of Neak Loeung Bridge was 101% of the plan on average, which was higher than the plan.

3.2.2.2 Project Period

As described above, a significant modification (extension of 4-lane sections) of the project scope was made for the Project for Improvement of National Road No.1 at the time of planning for Phase 4 (2013). For a proper comparison, adopting the planned project period at the time of project scope modification as the planned target, the project period (plan) was 10 years and 9 months (June 2005 to February 2016). The project period (actual) was 12 years and 2 months (June 2005 to July 2017, 113% against the plan) and exceeded the plan[14].

At the time of appraisal, it was initially planned that the Project for the Improvement of National Road No.1 would be divided to 3 phases. However, it was actually implemented in 5

[13] The amount is based on the plan of the preparatory survey report and does not match the amount of grant limit.
[14] The Project for the Improvement of National Road No.1 was completed at the completion of the entire target section. In addition, the interval period was 2 years and 3 months between the completion of Phase 3 to the E/N of Phase 4 in consideration of the progress of resident resettlement and the timing of the Cambodian government election.

phases. The section from the starting point to the 4 km point was separated from Phase 3 to Phase 4, due to a design modification for the construction of the second Monivong Bridge and the laying of water supply pipes for the ODA Loan Project Niroth Water Supply Project. In addition, Phase 4 and the Urban Section were separated as the project cost was anticipated to exceed the budget due to the depreciation of the yen and the change of pavement structure during the implementation of Phase 4.

The project period of the Project for Construction of Neak Loeung Bridge was planned to be 4 years and 9 months (March 2010 to November 2014). The project period (actual) was 5 years and 2 months (March 2010 to April 2015, 109% of the plan) and exceeded the plan[15]. The reasons for the delay were mainly 1) a longer bidding period (Actual: 4 months versus Plan: 2 months), and 2) the suspension of construction due to the unexploded ordnances (approximately four months).

Taking an average of both figures above, the project period was 111% of the plan, which was longer than the plan.

Both the project cost and project period exceeded the plan. Therefore, efficiency of the project is fair.

3.3 Effectiveness and Impacts[16] (Rating: ③)

3.3.1 Effectiveness

The Project for Improvement of National Road No.1 and the Project for Construction of Neak Loeung Bridge each had their own outputs, and different effect indicators were separately selected to measure the quantitative effects at the time of planning. For this reason, the effectiveness of each project is to be analysed separately.

3.3.1.1 Quantitative Effects

(1) The Project for the Improvement of National Road No.1

For the five indicators selected at the time of the planning, the achievement level was 93% on average (see the following table). Targets on heavy cargo traffic, flood countermeasures, and the submerged section in National Road No.1 were fully achieved (achievement level 100%), the reduction of travel time was mostly achieved (achievement level 88%), and the average travel speed was fairly achieved (achievement level 75%). It can be presumed that the actual figures for travel time and average travel speed show that the smooth flow of traffic has

[15] In the plan, the completion of construction works and bridge opening were to be at the same time, but the completion of construction works was at 1 year later from the opening of the bridge due to supplemental construction works. For a proper comparison, the project period was defined from the project commencement to bridge opening at the above judgment.

[16] Sub-rating for Effectiveness is to be put with consideration of Impacts.

been accomplished mostly in line with the targets. The development of a detour route to avoid the congested section of National Road No.1 and the enhancement of traffic enforcement also contributed to the above project effects. Through interviews with MPWT, it was learned that traffic jams occurred at some sections because intersections with low traffic capacity and on-street parking in the vicinity of markets are considered to have prevented smooth traffic flow[17]. As the project also was planned to replace deteriorated bridges, maximum vehicle weights were expected to increase. In a part of the improved section, the pavement structure was modified to a higher standard during project implementation and the increase in the maximum vehicle weight was also achieved. As the improved section is an embankment road of the Mekong River, the elevation of the road contributes to protection from flooding in Phnom Penh, as well as flooding on the road. The project effects through the road elevation were as planned.

Table 4: Quantitative Indicators for the Project for the Improvement of National Road No.1

	Baseline	Target	Actual			
	2000	2020	2017	2018	2019	2020
		3 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
Reduction of Travel Time (minutes)*	-	62.5	40	45	50	55
Average Travel Speed (km/h)	30	80	45	50	55	60
Heavy Cargo Traffic (max weight)	15	20	25	25	25	25
Flood countermeasures	Overflowed the banks of Phnom Penh City	Did not overflow the banks of Phnom Penh City	Did not overflow the banks of Phnom Penh City	Did not overflow the banks of Phnom Penh City	Did not overflow the banks of Phnom Penh City	Did not overflow the banks of Phnom Penh City
Submerged section of National Road No.1(m)	1,100	0	0	0	0	0

Source: Ex-ante evaluation sheet of Phase 4, questionnaire answers from MPWT
Note: * In the ex-ante evaluation sheet of Phase 4, "Reduction of travel time" mentioned travel time and, therefore, this table modifies the figures to show a reduction of travel time. For travel time, the baseline (2000) was 110 minutes, the target (2020) 45-50 minutes, and actual (2020) 55 minutes.

In addition to the above indicators, to examine the utilization of the improved section, traffic volume was also analyzed by comparing the target and baseline with actual figures (see Table 5 and Table 6). According to the traffic volume survey at the improved section after project completion (2018, 2019), the actual data for six locations where the traffic volume survey was conducted exceeded the planned targets significantly. Furthermore, the traffic volume was

[17] JICA "Data collection survey on development of roads and related facilities in National Road No.1 and around border of Cambodia and Vietnam" Final Report for National Road No.1 (2019)

measured in 2004 before project implementation. In a comparison of the baseline and the actual data, substantial increases in traffic volume over the entire improved section were found. In 2013, Phnom Penh New Port was constructed at the 25 km point on the improved section of National Road No. 1 with the support of the Chinese government and started handling containers. The improvement of National Road No. 1 and the development of the port progressed at the same time and this contributed to the stabilization of cargo transportation to the capital city, Phnom Penh. From the above, it can be concluded that the improved section has been sufficiently utilized.

Table 5: Traffic Volume of the Improved Section of the Project for the Improvement of National Road No.1 (March 2004)

Location*	Actual (Number of Vehicles) **			Actual (PCU)		
	Light Vehicles	Heavy Vehicles	Total	Light Vehicles	Heavy Vehicles	Total
0.1 km point	9,205	562	9,767	11,507	2,106	13,613
1.5 km point	7,112	618	7,730	8,890	2,316	11,206
3.5 km point	6,607	468	7,075	8,258	1,755	10,013
5.0 km point	6,055	361	6,417	7,569	1,355	8,925
7.0 km point	4,156	358	4,514	5,195	1,341	6,536
12.5 km point	3,303	247	3,550	4,129	926	5,055
14.5 km point	2,876	316	3,192	3,595	1,185	4,779
34.5 km point	2,239	398	2,636	2,798	1,492	4,290

Source: Base design study report
Note 1: * km point started from the Phnom Penh side of the section improved by this project
Note 2: ** The data were converted into 24-hour traffic volume with the day/night ratio of 1.30. The target of the basic design study report was daytime 12-hour traffic volume. Types of vehicles were light vehicles (passenger cars, etc.) and heavy vehicles (buses, heavy trucks, trailer trucks, etc.).

Table 6: Traffic Volume of the Improved Section of the Project for the Improvement of National Road No.1 (September 2018)

Location*	Actual (Number of Vehicles)**			Actual (PCU)***			Target (PCU)****
	Light Vehicles	Heavy Vehicles	Total	Light Vehicles	Heavy Vehicles	Total	
0.1 km point	40,314	3,131	43,445	50,393	9,393	59,786	23,864
1.5 km point	31,370	3,253	34,623	39,213	9,759	48,972	19,601
2.5 km point	23,449	3,233	26,682	29,311	9,699	39,010	18,569
3.5 km point	19,764	2,524	22,288	24,705	7,572	32,277	17,537

Source: Documents provided by JICA, basic design study report
Note 1: * km point started from the Phnom Penh side of the section improved by this project
Note 2: ** Actual data is 24 hour traffic (average of 2 week days and one weekend day). Types of vehicles are light vehicles (passenger cars and light trucks) and heavy vehicles (buses heavy trucks, trailer trucks, etc.).
Note 3: *** Conversion factors of PCU are 1.25 for light vehicles and 3 for heavy vehicles (JICA "Data collection survey on development of roads and related facilities in National Road No.1 and around the border of Cambodia and Vietnam").
Note 4: **** The data were converted into 24-hour traffic volume with the day/night ratio of 1.30. The target of the basic design study report was daytime 12-hour traffic volume.

Table 7: Traffic Volume of the Improved Section of the Project for the Improvement of National Road No.1 (January 2019)

Location*	Measurement Date**	Actual (PCU)***				Target (PCU)****
		Motorcycles	Small Vehicles	Large Vehicles	Total	
Kokir Market (13.5 km point)	Weekday	7,737	12,667	10,803	31,207	
	Weekend	9,360	13,506	10,236	33,102	
	Average	8,549	13,087	10,520	32,155	14,029
Phnom Penh New Port (24.5 km point)	Weekday	3,897	9,282	12,048	25,227	
	Weekend	4,376	9,332	12,510	26,218	
	Average	4,137	9,307	12,279	25,723	11,780

Source: JICA "Data collection survey on development of roads and related facilities in National Road No.1 and around border of Cambodia and Vietnam" Final Report for National Road No.1, basic design study report
Note 1: * km point started from the Phnom Penh side of the section improved by this project
Note 2: ** Traffic volume is for 24 hours (average of one week day and one weekend day). Motorcycles includes motor cycles, three wheelers, and motor cycles with carts. Small vehicles includes passenger cars and light trucks. Large vehicles includes buses, heavy trucks, and trailer trucks.
Note 3: *** Conversion factors of PCU are 0.3 for motor cycles, 1.25 for small vehicles, and 3.00 for large vehicles.
Note 4: **** The data were converted into 24-hour traffic volume with the day/night ratio of 1.30. The target of the basic design study report was daytime 12-hour traffic volume.

(2) The Project for Construction of Neak Loeung Bridge

For two indicators selected at the time of planning, the achievement level was 100% on average (see the following table). The target for the time for suspension of river crossing was achieved (achievement level 100%), and the target on travel time for river crossing was mostly achieved (achievement level 99%). By the elimination of ferry crossing, the travel time for river crossing was significantly reduced in line with the plan, smooth transport was still being maintained at the time of the ex-post evaluation. As, before the project, the ferry service was not operated during the night, night river crossing was not possible. For this reason, the target was river crossing at all hours. After project completion, river crossing became possible anytime regardless of traffic volume, weather conditions, or time of day.

Table 8: Quantitative Indicators for the Project for the Construction of Neak Loeung Bridge

	Baseline	Target	Actual			
	2009	2015	2015	2018	2019	2020
		Completion Year	Completion Year	3 Years After Completion	4 Years After Completion	5 Years After Completion*
Travel time for river crossing (minutes)*	Maximum 420 (Peak time)	5	NA	15	15	10
Time for suspension of river crossing (minutes)	300 (0 - 5 AM)	0	0	0	0	0

Source: Preparatory survey report, questionnaire answers from MPWT
Note: * The data for the completion year (2015) could not be obtained. As the change of the target is considered small over time, the judgment was made by a comparison of the target and the actual figure at the time of ex-post evaluation. The achievement of travel time for river crossing is based on the reduction of travel time (target: 415 minutes, actual 420 minutes).

In addition to the above indicators, to examine the utilization of Neak Loeung Bridge, traffic volume was also analyzed by comparing the target and baseline with the actual data (see the following table). Based on the traffic volume survey immediately after the project completion (2015), the actual figures at two locations where traffic volume surveys were conducted exceeded the planned targets significantly. At the planning of this project, the traffic demand for 2009 was estimated at 3,549 vehicles per day (PCU equivalent), and the comparison of the baseline and the actual data suggests that the traffic volume increased significantly from before and after the project. From the above, it can be concluded that Neak Loeung Bridge is being fully utilized to cross the river.

Table 9: Traffic Volume of Neak Loeung Bridge (2015)

Measurement Location	Actual (Number of Vehicles)*					Actual (PCU)**	Target (PCU)
	Motor cycles	Small Vehicles	Medium Vehicles	Large Vehicles	Total		
In Neak Loeung (58.1 km)	13,626	4,046	855	1,066	19,593	14,908	7,118
Out Neak Loeung (64.2 km)	12,969	4,633	865	1,887	20,354	17,938	

Source: The survey team for JICA Technical Cooperation "The Project for Strengthening Capacity for Maintenance of Roads and Bridges," preparatory survey report (2010)
Note 1: * Traffic count was for 24 hours. Motorcycles includes motorcycles and motorcycles with carts. Small vehicles includes passenger cars and 4WD. Medium vehicles includes mini-buses and buses. Large vehicles includes heavy trucks, and trailer trucks.
Note 2: ** Conversion factors of PCU are 0.30 for motorcycles, 1.25 for small vehicles, and 3.00 for medium and large vehicles.

3.3.1.2 Qualitative Effects (Other Effects)

(1) The Project for Improvement of National Road No.1

As a qualitative effect of road improvement projects, road improvement is expected to bring driving comfort in general. In the beneficiary survey[18] at the time of ex-post evaluation, drivers and proprietors along the road stated that driving comfort had been increased in the improved section compared to the time before project implementation (2004) (see Table 10). The reasons were reductions in vibration, easy-to-read traffic signs and the expansion of road width. According to the answers of drivers and proprietors, sections submerged in heavy rain had been reduced (see Table 11). Based on the answers of drivers and proprietors, it can be concluded that driving comfort was significantly improved, even in the rain.

[18] For the beneficiary survey, a questionnaire survey was conducted with drivers and proprietors along the road and 12 persons responded (7 drivers, 5 proprietors) at four locations from Phnom Penh (east bank of the Bassac River) to Neak Loeung (east bank of the Mekong River).

Table 10: The Result of the Survey on Drivers and Proprietors along the Road
(Driving Comfort)

Q. Compared with 2004 (before project), is driving in the national road No.1 more comfortable?

	Yes	Yes, to Some Extent	Same	No, to Some Extent	No	Total
Responses	9	3	0	0	0	12
%	75%	25%	0%	0%	0%	100%

Table 11: The Result of the Survey on Drivers and Proprietors along the Road
(Submerged Section)

Q. Compared with 2004 (before project), is the submerged section reduced when it is heavy rain?

	Yes	Yes, to Some Extent	Same	No, to Some Extent	No	Total
Responses	10	2	0	0	0	12
%	83%	17%	0%	0%	0%	100%

(2) The Project for Construction of Neak Loeung Bridge

One of the qualitative effects of the Project for Construction of Neak Loeung Bridge is convenience of logistics through the elimination of hours of river crossing suspension. According to MPWT, large cargo vehicles were banned from entering Phnom Penh during daytime[19] at the time of the ex-post evaluation and, therefore, cargo delivery was allowed only from night-time to early morning. Had Neak Loeung Bridge not been opened, and 24-hour river crossing not been available, logistics in Phnom Penh City would have been interrupted. It was also suggested that the opening of Neak Loeung Bridge had made the shipping of fresh food products to Phnom Penh more convenient for the grocery producers on the east bank of the Mekong River. According to Svay Rieng Agro-Products Cooperative, the elimination of the long waiting time for the ferry service had led to an improvement in customer satisfaction as vegetables need to maintain their freshness[20].

3.3.2 Impacts

3.3.2.1 Intended Impacts

Both the project areas of the Project for Improvement of National Road No.1 and the Project for Construction of Neak Loeung Bridge were in the same vicinity, and separating the impacts was difficult. For this reason, the impacts are to be set in common for both projects. The enhancement of international logistics and the stimulation of socio-economic activities in the

[19] MPWT stated that large cargo vehicles were banned from entering from 5 to 21 o'clock at the time of the ex-post evaluation.
[20] https://www.jica.go.jp/cambodia/office/information/event/20170405.html (accessed on August 27th, 2021)

project area are analysed, integrating the impacts of the Project for Improvement of National Road No.1 and the Project for Construction of Neak Loeung Bridge together.

(1) Cross-border Logistics Vehicles between Cambodia and Vietnam

Bavet is located along National Road No.1 at the border of Cambodia and Vietnam. The number of cargo vehicles (cargo trucks and container trucks) passing through Bavet almost doubled from 2014 (the year before the completion of Neak Loeung Bridge) to 2018 (see the following table). For the same period, the number of container trucks increased, which meant a qualitative change of logistics. The Gross Domestic Product (GDP) of Cambodia increased about 1.5 times from 2014 to 2018 in USD terms, while the GDP of Vietnam increased about 1.3 times in USD terms over the same period[21]. The elimination of ferry transport at Neak Loeung was essential for the realization of smooth land trade between Cambodia and Vietnam. Although the economic growth of both Cambodia and Vietnam have also contributed to the increase, the completion of the bridge has presumably been one of the factors contributing to the increase in the number of cargo vehicles passing through Bavet, promoting trade between both countries. Furthermore, container transport requires roads with a higher standard (extension of road width and increase of maximum weight). Thus, the higher standard of road achieved by the project presumably became one of the factors allowing the increase of container trucks.

Table 12: Number of Cargo Vehicles Crossing the border at Bavet

Unit: Number of vehicles per year

Type / Year	2014	2015	2016	2017	2018
From Vietnam to Cambodia					
Cargo trucks	14,270	21,532	24,683	12,420	15,737
Container trucks	37,309	40,115	44,784	60,494	78,672
Subtotal	51,579	61,647	69,467	72,914	94,409
From Cambodia to Vietnam					
Cargo trucks	2,590	2,693	3,335	4,268	4,451
Container trucks	11,947	12,800	15,276	17,641	20,198
Subtotal	14,537	15,493	18,611	21,909	24,649
Total	66,116	77,140	88,078	94,823	119,058

Source: JICA "Data collection survey on development of roads and related facilities in National Road No.1 and around border of Cambodia and Vietnam" Final Report for National Road No.1

(2) Stimulation of Socio-Economic Activities in the Project Area

With the stimulation of socio-economic activities in the project area, cargo volume was expected to increase in the same area. In the beneficiary survey at the time of the ex-post

[21] The World Bank: https://data.worldbank.org/country/Cambodia、https://data.worldbank.org/country/VN (accessed on August 27th, 2021)

evaluation, more than 80% of drivers and proprietors along the road said that cargo volume had increased compared to the time before project implementation (2004) (see the following table). In particular, all the proprietors along the road (five persons) were of the opinion that it had increased. Agricultural products and construction materials were quoted as the items with more volume. As mentioned above ("3.3.1.2 Qualitative Effects (Other Effects)"), vibration was reduced on the improved section of National Road No. 1 and the opening of Neak Loeung Bridge shortened shipping time, and, thus, the project is contributing to the shipment of agricultural products. Moreover, the increase in construction materials reflects the progress of development in the project area.

Table 13: The Survey Result of the Survey with Drivers and Proprietors along the Road (Increase of Cargo)

Q. Compared with 2004 (before project), has the cargo volume increased?

	Yes	Yes, to Some Extent	Same	No, to Some Extent	No	Total
Responses	7	3	1	1	0	12
%	58%	25%	8%	8%	0%	100%

As mentioned above ("3.3.1 Effectiveness"), travel time on the improved section of National Road No.1 was shortened and driving comfort was improved by the project. On the other hand, the beneficiary survey[22] at the time of the ex-post evaluation found that frequency of visits to the downtown area of Phnom Penh (west of the Bassac River) decreased. Specifically, about 50% (8 persons) answered that opportunities to visit the downtown area of Phnom Penh by themselves or with intimates (family, neighbors, etc.) had decreased compared to 2004, the year before the project. Shopping was the main reason for going out at the time of the ex-post evaluation. Based on the interviews with the residents along the road, it was discovered that they tended to shop in their neighborhoods, as commercial areas were expanding around the residential areas. The progress of development and the promotion of consumption in the vicinity were observed in the project area, though factors other than the project (such as urbanization in the suburb of Phnom Penh) have also contributed to this change.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

As the Project for Improvement of National Road No.1 was requested prior to the *JICA Guidelines for Environmental and Social Considerations* (2004) coming into effect, no

[22] For the beneficiary survey, a questionnaire survey was conducted with residents along the road and answered by 15 persons (6 male, 9 female) at 4 locations from Phnom Penh (east bank of the Bassac River) to Neak Loeung (east bank of the Mekong River).

category was selected, but an environmental baseline survey was conducted at the time of planning. Based on the questionnaire survey with the Consultant, it was found that countermeasures and mitigation measures against environmental impacts had been taken, such as the utilization of low-noise and low emission equipment, the suspension of construction works during night, and water sprinkling. However, periodic collection of environmental data was not conducted as monitoring items were not specified. Based on the questionnaire survey with MPWT, it was concluded that (1) no negative impact on the natural environment occurred either during project implementation or after completion, (2) after project completion, no concerns such as serious air pollution were confirmed in the project area by air quality monitoring of the Ministry of Environment in Cambodia.

Based on the *JICA Guidelines for Environmental and Social Considerations* (2004), the Project for Construction of Neak Loeung Bridge was classified as Category A (likely to have significant adverse impacts on the environment and society). MPWT implemented an environment impact assessment, and its report was approved by the Ministry of Environment in Cambodia. Based on the questionnaire survey with the Consultant, it was found that during project implementation, the contractor operated cleaning works and water sprinkling and periodically monitored the noise and water quality of the river. Based on answers to the questionnaire from MPWT, it was concluded that no negative impacts on the natural environment had occurred either during, or after, project implementation.

(2) Resettlement and Land Acquisition

In the Project for the Improvement of National Road No.1, resettlement along with land acquisition had been anticipated at the time of planning. In 2006, during project implementation, issues regarding compensation for affected residents were pointed out by NGO. Taking those issues into account, the resettlement action plan (hereinafter called "RAP") was revised based on the *JICA Guidelines for Environmental and Social Considerations* (2004) or the *Japan International Cooperation Agency Guidelines for Environmental and Social Considerations* (2010). In response to the results of JICA's Review Board for Environmental and Social Consideration, this project took numerous actions such as strengthening public relations for advance explanations to affected residents, the agreement of project implementation with residents, securing nearby and convenient relocation sites, prevention of unclear price reductions in asset assessments, the participation of local residents in grievance committees,

A House after Resettlement

and impact mitigation of changes in road alignment. Many of the above measures went beyond the usual considerations given to affected residents previously taken by the Cambodian government. For this reason, a regular meeting was held once every two weeks between the Government of Japan/JICA and the Government of Cambodia (Inter-ministerial Resettlement Committee) for promoting better understanding and an appropriate response on the Cambodian side. Additionally, the JICA technical cooperation project "Project on Capacity Enhancement of Environmental and Social Considerations for Resettlement" (2010 to 2012) was implemented for the enhancement of administrative capacity for resettlement by the Government of Cambodia. As well as the project by ADB, which supported a neighboring road section, compensation for affected residents was based on replacement costs, and additional compensation was implemented for affected residents during Phase 1 and 2. At the completion of the Project for Improvement of National Road No.1, the number of affected residents was 4,474 households (including resettled residents of 364 households).

In the Project for Improvement of National Road No.1 (Phase 3), a study to verify compensation for resettlement and replacement costs was conducted. Based on the study results, compensation during Phase 1 to 3 was based on replacement costs, which were calculated using the appropriate measuring method, and external monitoring confirmed that resettlement had been appropriately implemented. Moreover, claims were handled with the grievance window[23]. Based on the questionnaire survey with the expert in the JICA technical cooperation project "Project on Capacity Enhancement of Environmental and Social Considerations for Resettlement," a grievance redress system was established for the resettled residents at all phases. Information was given at stakeholder meetings, and claims were resolved through this system.

In this ex-post evaluation, a survey was implemented regarding resettlement in the Project for the Improvement of National Road No.1[24]. The questionnaire survey showed that infrastructure in the relocation sites was adequately developed, and no negative impact was found on the quality of living (see Table 14 and Table 15). Compensation was paid to all affected residents. Some residents insisted the compensation rates were not sufficient (see Table 16 and Table 17). The calculation of replacement costs was based on the average prices of market costs for materials and assets. A shortage in the compensation amount occurred at some households presumably due to the above calculation method. However, none of the above residents filed a claim as the amount of shortage was presumably not significant enough to harm their quality of living. No issues on compensation payment based on replacement costs, the public relations

[23] Katahira & Engineers International (2012) "Follow-up Study on the 2007 Replacement Cost Study of the Project for the Improvement of National Road No.1"

[24] Data was collected in July 2021 for this survey from 2 sites out of 6 relocation sites built for the Project for the Improvement of National Road No.1. A questionnaire survey was conducted with 12 resettled residents (6 males, 6 females), and interviews were held with 2 leaders of communes and 1 government official in charge of resettlement.

of RAP, or the grievance redress system were pointed out at the interviews with the commune chiefs of the relocation sites and a government official in charge of resettlement.

Table 14: The Result of the Survey with Resettled Residents (Infrastructure in New Locations)

Q. Was the infrastructure of the new location sufficiently developed (water supply, electricity, access to public transportation, etc.)?

	Yes	Yes, to Some Extent	Neither Yes nor No	No, to Some Extent	No	Total
Responses	11	1	0	0	0	12
%	92%	8%	0%	0%	0%	100%

Table 15: The Result of the Survey with Resettled Residents
(Living Standard and Convenience)

Q. Compared with the pre-relocation, has the standard of living and convenience improved?

	Yes	Yes, to Some Extent	Neither Yes nor No	No, to Some Extent	No	Total
Responses	8	2	2	0	0	12
%	67%	17%	17%	0%	0%	100%

Table 16: The Result of the Survey with Resettled Residents
(Uncompensated Affected Residents)

Q. Was there any resident in the previous commune who was negatively affected by this project but was not compensated?

	Many residents were not compensated	Some residents were not compensated	All residents were compensated.	Total
Reponses	0	0	12	12
%	0%	0%	100%	100%

Table 17: The Result of the Survey with Resettled Residents (Compensation Amount)

Q. Was the compensation amount enough to replace lost assets?

	Yes	Yes, to Some Extent	Neither Yes nor No	No, to Some Extent	No	Total
Reponses	4	3	1	4	0	12
%	33%	25%	8%	33%	0%	100%

At the time of planning, land acquisition was expected to cause resettlement for the Project for Construction of Neak Loeung Bridge, as well. RAP was formulated for proper resettlement and the avoidance and reduction of resettlement was implemented. At the time of completion of the Project for Construction of Neak Loeung Bridge, the number of the affected residents was 197 households (including resettled residents of 7 households). Based on the questionnaire

answers from the expert of JICA technical cooperation project, “Project on Capacity Enhancement of Environmental and Social Considerations for Resettlement”, no particular issue was observed on resettlement as RAP was formulated in accordance with the guidelines of 2010 and compensation was implemented accordingly.

(3) Advanced Design and Construction and a symbol of Japan-Cambodia Friendship

Neak Loeung Bridge won the Japan Construction International Award and the Japan Society of Civil Engineers Tanaka Award for both its advanced design and construction and its contribution to friendship between Japan and Cambodia. The reasons for the winning were that the management of construction had been undertaken under severe field conditions, the reduction of the construction period and cost by adopting new technology, and the contribution to the friendship between Japan and Cambodia. The bridge has become a sight-seeing spot for the aesthetic appearance of the cable-stayed bridge, and it is also depicted on the 500 riel bill of Cambodia.

In the improved section of National Road No. 1, project effects such as improvement of road efficiency and flood protection were found, and by the opening of Neak Loeung Bridge, transport crossing the Mekong River became smooth. The volume of logistics between Cambodia and Vietnam was increasing, and stimulation of economic activities was also seen in the project area. For the above reasons, this project has achieved its objectives. Therefore, the effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

At the time of ex-post evaluation, DPWT had been established in 25 cities/provinces as local offices of MPWT. DPWT is in charge of 3 types of road maintenance (routine, periodic, and emergency),[25] and MPWT is responsible only for maintenance which requires advanced technical skills. The Phnom Penh City DPWT and the Kandal Province DPWT are in charge of maintenance for the improved section of the Project for Improvement of National Road No.1. In MPWT, the Department of Expressway, Bridges and Investment (hereinafter called “DEBI”) is responsible for the bridges under the Project for Construction of Neak Loeung Bridge, and Kandal Province DPWT and Prey Veng Province DPWT are in charge of the approach roads. In general, the maintenance of national roads is implemented mainly by internal personnel, and outsourcing is also utilized when required. Based on the interviews with MPWT, it was

[25] Routine maintenance covers inspection, cleaning, and minor repair works, regular maintenance covers repair works (overlay, etc.), and emergency maintenance covers disaster relief works.

discovered that maintenance of Neak Loeung Bridge is not outsourced, but external engineers are hired occasionally for technical support.

The number of personnel assigned for the maintenance of the project is as in the following table. The assigned personnel can implement routine maintenance on the sections for which they are in charge, and the periodic maintenance is also expected to be managed by utilizing internal and external resources.

Table 18: Staff Assignment for Operation and Maintenance

Types of Infrastructure	Sections in Charge	Number of Staff	Number of Engineers in the Staff
Improved Section of National Road No.1	Phnom Penh DPWT	10	2
	Kandal Province DPWT	10	2
	Total	20	4
Neak Loeung Bridge	DEBI	12	4
	Kandal Province DPWT	8	2
	Prey Veng DPWT	8	2
	Total	28	8

Source: Questionnaire answers and interview from MPWT

The responsibility for each type of maintenance work is clear, and there was no uncertainty regarding the departments responsible for infrastructure or maintenance activities. MPWT and DPWT related to the project are considered capable of maintenance of the infrastructure constructed by the project. From the above, it is considered that there is no notable issue in the institutional and organization aspects for operation and maintenance.

3.4.2 Technical Aspect of Operation and Maintenance

MPWT and DPWT related to the project were performing the maintenance of paved roads prior to project implementation. Considering the types of improvement works, maintenance for the improved section of National Road No.1 is expected to be managed at the same technical level as for other national roads. Through the JICA technical cooperation project “the Project for Strengthening Capacity for Maintenance of Roads and Bridges” (2015-2018), capacities such as those for road inspection (measurement and evaluation of road surface), preventive maintenance, and bridge maintenance cycles (inspection, assessment, planning, repair works, and maintenance of asset ledgers) were enhanced. By the questionnaire answers from MPWT, it was confirmed that MPWT possessed the manuals for road maintenance (routine and periodic) and bridge maintenance at the time of ex-post evaluation.

The Consultant prepared maintenance manuals for the equipment of Neak Loeung Bridge (stay cables, electrical equipment, expansion joints, and bearings), which required maintenance works with advanced technical skills. Based on the interviews with MPWT, it was confirmed that bridge inspection vehicles had been obtained and stay cable inspection utilizing robots was also

being planned at the time of the ex-post evaluation. Furthermore, JICA's technical cooperation project, mentioned above, implemented a pilot project for the control of overloaded vehicles on Neak Loeung Bridge (measurement of trucks, reporting, and analysis). However, JICA's technical cooperation project did not support the formulation of an inspection plan reflecting the structural properties of a cable-stayed bridge, the implementation of inspection works, nor the preparation of maintenance plans based on inspection results, which are the foundation for periodic maintenance. Capacity enhancement for these is required in future. As described below ("3.4.3 Financial Aspect of Operation and Maintenance"), the MPWT budget for periodic maintenance is limited. Thus, it is preferable to reassess the maintenance system including the introduction of cost-saving technology (the utilization of drones, robots, etc.).

MPWT holds annual workshops for the maintenance of roads and bridges, and 84 persons attended from MPWT and DPWT in 2019. Based on the interviews with MPWT, it was confirmed that the contents of the workshops covered wide topics on the maintenance of roads and bridges.

The maintenance of National Road No.1 is managed with the technical level of DPWT, and maintenance manuals and workshops were also provided. On the other hand, the maintenance of Neak Loeung Bridge requires more advanced technical skills to handle the special features of a cable-stayed bridge (formulation of inspection plans reflecting the structural properties of a cable-stayed bridge, inspection works, the preparation of maintenance plans based on inspection results, cost-saving technology). Thus, some issues are found in terms of the technical aspect of operation and maintenance.

3.4.3 Financial Aspect of Operation and Maintenance

In accordance with the responsibility for maintenance described above ("3.4.1 Institutional / Organizational Aspect of Operation and Maintenance"), Phnom Penh City DPWT and Kandal Province DPWT provided the maintenance costs for the improved section of the Project for Improvement of National Road No.1. The maintenance costs for the bridge section of the Project for Construction of Neak Loeung Bridge were provided by MPWT, and the maintenance costs for the approach roads were provided by Kandal Province DPWT and Prey Veng Province DPWT.

The maintenance budget of MPWT at the time of the ex-post evaluation is shown on Table 19, and the maintenance budget provided from MPWT to DPWT is shown on Table 20. As the budget of DPWT is also provided from each province, the actual amounts of the budget available for the maintenance of DPWT exceed the amounts shown in the following table. The maintenance budget (the sum of routine maintenance, periodic maintenance, and emergency maintenance) of MPWT has stayed at around USD 70 million for the past 3 years. Based on the

interviews with MPWT, it was discovered that the allocation of the maintenance budget for National Road No.1 is highly prioritized as the national road is a major trunk road.

Table 19: Maintenance Budget in MPWT

Unit: USD million

	2017	2018	2019
Maintenance Budget	70.00	70.00	67.13
for Routine Maintenance	41.75	40.00	41.03
for Periodic Maintenance	18.25	20.00	18.60
for Emergency Maintenance	10.00	10.00	7.50

Source: Questionnaire answers from MPWT

Table 20: Maintenance Budget Provided from MPWT to DPWT

Unit: USD million

	2017	2018	2019
Phnom Penh DPWT	0.19	0.17	0.18
for Routine Maintenance	0.19	0.17	0.18
for Periodic Maintenance	0.00	0.00	0.00
for Emergency Maintenance	0.00	0.00	0.00
Kandal Province DPWT	2.23	2.05	2.21
for Routine Maintenance	1.25	1.18	1.50
for Periodic Maintenance	0.98	0.87	0.71
for Emergency Maintenance	0.00	0.00	0.00
Prey Veng State DPWT	1.25	1.57	1.73
for Routine Maintenance	1.25	0.86	1.20
for Periodic Maintenance	0.00	0.71	0.53
for Emergency Maintenance	0.00	0.00	0.00

Source: Questionnaire answers from MPWT

At the time of planning for the Project for Improvement of National Road No.1, the maintenance costs for the improved section were estimated at USD 21,970 per year in 2005. The maintenance budget of Phnom Penh City and Kandal Province DPWT is considered sufficient to finance the maintenance cost of the improved section.

At the time of planning of the Project for Construction of Neak Loeung Bridge, it was assumed that the maintenance works of Neak Loeung Bridge would mainly be visual inspections for the first 10 years after completion, and that large expenditure would not be required. However, the periodic maintenance cost of USD 3.7 million was estimated to be required every 10 years after completion. If scaffolding is built on the entire bridge for visual inspection and repair works, the above-mentioned cost for periodic maintenance is expected to be incurred at the time of the ex-post evaluation. Neak Loeung Bridge was completed in 2015, and periodic maintenance will be required within a few years. At the time of the ex-post evaluation, the planning of the periodic maintenance for Neak Loeung Bridge had not yet started, but the cost for the periodic maintenance of Neak Loeung Bridge was approximately 20% of the annual budget for periodic

maintenance of MPWT, which is a significant amount of expenditure to be financed in a single year. For this reason, the allocation of additional budget will be required.

It is concluded that it is possible to secure the budget for the maintenance of the improved section of the Project for Improvement of National Road No.1. It is necessary to reassess how the budget for the periodic maintenance for Neak Loeung Bridge will be obtained. Therefore, there are some issues in the financial aspect of operation and maintenance.

3.4.4 Status of Operation and Maintenance

According to the questionnaire to MPWT, among the follow-up items pointed out by the defect inspections of the Project for Improvement of National Road No.1, repairing cracks in the bridge had not been performed at the time of the ex-post evaluation. However, the interviews with MPWT indicated that the inspection of the bridge was continuing and there was no serious issue affecting transport. At the on-site inspection of the ex-post evaluation, the expansion joints of the bridge needed to be repaired, and the pavement of the road shoulder was stripped in the section with heavy traffic. Based on the questionnaire answers from MPWT, it was clear that the follow-up items pointed out by the defect inspection of the Project for Construction of Neak Loeung Bridge had mostly been managed at the time of the ex-post evaluation. At the defect inspection, friction noise was heard from the attachment section of the vibration dampers, but at the time of the ex-post evaluation, there was no serious damage observed at the same component. At the on-site inspection of the ex-post evaluation, the drainage outlets of Neak Loeung Bridge were clogged with sand and garbage.

The JICA “Data Collection Survey on Development of Roads and Related Facilities in National Road No.1 and around Border of Cambodia and Vietnam” in 2019 pointed out that the above-mentioned bridge repairs had not yet been conducted and that, in addition, the road markings on National Road No.1 were not clear. According to the consultant of the JICA technical cooperation project “the Project for Strengthening Capacity for Maintenance of Roads and Bridges,” clogging by sand was observed at the drainage outlets of Neak Loeung Bridge during an on-site visit in January 2020. However, no severe damage affecting transport was found at the improved section of National Road No.1 and Neak Loeung Bridge.

While the routine maintenance needs to be improved for some activities, the infrastructure constructed by the project is considered to have no serious damage affecting transport. From the above, it is considered that there is no notable issue regarding the status of operation and maintenance.

Some minor problems have been observed in terms of the technical aspect and financial aspect. Therefore, the sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project conducted the improvement of a road and repairing/construction of bridges in the Phnom Penh- Neak Loeung section of National Road No. 1 and its objective was to expand transportation capacity, improve efficiency, and enhance flood control in the above section, thereby contributing to a strengthening of international logistics and a revitalization of the society and economy of the project area. With Cambodia's policy goal of enhancing international corridor development, the amount of trade between Cambodia and Vietnam was on rise. This project has been highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high. Both the project cost and the project period exceeded the plan. Therefore, the efficiency of the project is fair. The effects (an improvement in traffic efficiency, flood protection, etc.) were found in the improved section of National Road No.1, and the opening of the Neak Loeung Bridge brought about smoother crossing of the Mekong River. Cargo volume between Cambodia and Vietnam was increasing, and the economy in the project affected area was also expanding. This project has achieved its objectives. Therefore, the effectiveness and impacts of the project are high. Given the responsibilities and personnel assignment of the executing agencies, it is feasible to carry out routine and periodic maintenance of the infrastructure constructed by the project. The maintenance of the improved section of National Road No.1 is within the technical level of DPWT, but the maintenance of Neak Loeung Bridge requires MPWT to obtain higher technical skills to cope with the special features of the cable-stayed bridge. In terms of budget, it was expected that the maintenance budget would be allocated for the improved section of National Road No.1, but budget allocation for the periodic maintenance of Neak Loeung Bridge needed to be reassessed. Nevertheless, no severe damage occurred affecting transport in the infrastructure constructed by the project. From the above, some minor problems have been observed in terms of the technical aspect and financial aspect on the operation and maintenance of this project. Therefore, the sustainability of the project effects is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

<u>Enhancement of Maintenance Technical Skills of Long Bridge</u>

Neak Loeung Bridge is one of the longest bridges in Cambodia and its maintenance requires maintenance plans and works that handle the special features of long bridges. Moreover, new maintenance methods for long bridges using drones and robots have been developed in recent years and the introduction of new technology is in greatly necessary for the reduction of maintenance costs. At the time of ex-post evaluation, periodic maintenance of Neak Loeung

Bridge is to be conducted within a few years and a significant amount of expenditure is expected accordingly for the maintenance cost. It is desirable for MPWT to improve the technical level of the department in charge of bridge maintenance, and to enhance the maintenance equipment by the time of the implementation of periodic maintenance.

Formulation of a Plan for Periodic Maintenance

Neak Loeung Bridge requires periodic maintenance every 10 years after completion, and at the time of ex-post evaluation the periodic maintenance was to be performed in a few years. Considering the amount of the annual budget for periodic maintenance at MPWT, it is presumably difficult to finance the estimated cost for periodic maintenance in a single year. In order that the delay of budget allocation does not cause a delay in maintenance, it is desirable that MPWT specifies the activities required for periodic maintenance immediately and formulates a maintenance program for multiple years.

4.2.2 Recommendations to JICA

Monitoring of Periodic Maintenance

Neak Loeung Bridge was opened in 2015 and the first periodic maintenance is to occur within a few years. By that time, MPWT needs to have improved technical skills for maintenance further and to have obtained the budget required for the maintenance works. Therefore, it is desirable to routinely monitor the periodic maintenance of MPWT and, if required, provide technical advice.

4.3 Lessons Learned

Flexible Modification of RAP for Fairness

The resettlement action plan (RAP) was formulated for the project in accordance with the *JICA Guidelines for Environmental and Social Considerations* (2004) or the *JICA Guidelines for Environmental and Social Considerations* (2010), which were not applied at the time of the request from the Government of Cambodia. This project compensated affected residents on the same basis of replacement costs as the ADB-funded project, which supported the neighboring section, and provided additional compensation to the affected residents of Phases 1 and 2. At the time of the request for this project, no guidelines for social consideration were established, and RAP did not rely on certain guidelines. Moreover, the contents of the guidelines were revised with more consideration for the livelihoods and living environment of the affected residents during project implementation. It was also necessary to consider the compensation level of ADB for fair treatment of the affected residents. Thus, it is concluded that this flexible management of this project was appropriate. When there is a lack of fairness among the affected residents under the existing RAP due to major change in JICA's policy on social consideration and differences

from the policy on social consideration of adjacent sections supported by other donors, it is desirable that the contents of RAP are reassessed in accordance with more recent guidelines.