Ex-Post Project Evaluation 2021

Package IV- 1 (Cambodia, Vietnam)

Evaluation Reports

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Mitsubishi UFJ Research & Consulting Co., Ltd.

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Kingdom of Cambodia

FY2021 Ex-Post Evaluation Report of Japanese Grant Aid Project

"The Project for Development of Traffic Management System in Phnom Penh"

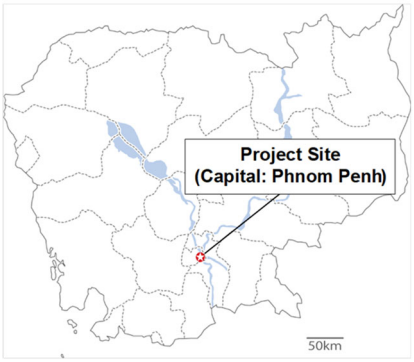
External Evaluator: Masumi Shimamura, Mitsubishi UFJ Research and Consulting Co., Ltd.

0. Summary

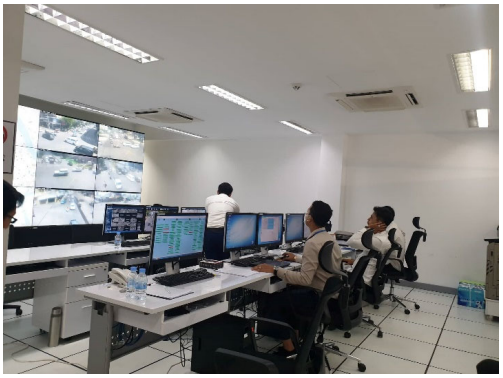
This project developed traffic signals at intersections and a Traffic Control Center (hereinafter referred to as "TCC"), etc. to improve traffic conditions in Phnom Penh Capital City. This project, which aims to promote traffic improvement measures such as improvement of intersections and installation of traffic signals, is consistent with Cambodia's development policy, development needs and project plan and approach were appropriate. The project is also consistent with Japan's assistance policy and concrete results can be confirmed through collaboration with other JICA projects. Therefore, relevance and coherence of the project are high. In terms of project implementation, although the project cost was within the plan, the project period significantly exceeded the plan. Therefore, efficiency of the project is moderately low. Regarding project effects, of the indicators of quantitative effects set at the time of planning, "average travel speed" and "travel time cost" have mostly achieved as planned, but "average ratios of traffic demand/traffic capacity at 10 major locations" and "traffic police needed in traffic control" have not achieved. Regarding impacts, the results of interviews with local residents and public bus and truck drivers indicate that, overall, the project has contributed to the improvement of traffic flow, local residents' lives and traffic safety. Regarding impacts on stimulation of economic activities in Phnom Penh Capital City, it was not possible to clearly confirm the contribution of this project from the interview results. This project also takes into consideration vulnerable road users. Regarding social systems and norms, the project has indirectly contributed to raising people's awareness of traffic safety, however, there are still many traffic violators even after the project, and it is still necessary to continue to raise people's awareness of traffic rules and manners. Therefore, this project has mostly achieved its objectives and thus, effectiveness and impacts of the project are high. No negative impacts on natural environment have been reported. Land acquisition and resettlement did not take place. Regarding operation and maintenance, slight issues have been observed in the technical, financial, and the current status, however, there are good prospects for improvement/resolution. Therefore, sustainability of the project effects is high.

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

1. Project Description



Project Location



TCC Control Room

1.1 Background

The number of registered vehicles in Phnom Penh Capital City has continued to increase due to recent economic development, resulting in lower average travel speed and more serious traffic congestion. Phnom Penh Capital City had been working on traffic improvement measures such as maintenance of traffic signals, improvement of intersections, and construction of grade separated crossing, etc., mainly with its own budget. However, the number of vehicles was increasing due to population and income growth, and the number of fatalities in traffic accidents was becoming serious, making it necessary to consider and implement drastic traffic improvement measures.

There were 69 existing signalized intersections in Phnom Penh Capital City, but the signal equipment and control systems at each intersection were not unified, and signals were displayed irrespective of traffic volume and flow. This has become serious problems, resulting in vehicle stagnation between the intersections, worsening traffic congestion, and increase in traffic fatalities. Thus, updating intersection equipment and improving control systems were urgently needed.

1.2 Project Outline

The objective of this project is to improve traffic conditions in Phnom Penh, where traffic congestion was becoming serious by installing 115 traffic signals (including replacement of 64 signals out of the total of 69 existing signalized intersections) and developing a TCC, etc., thereby contributing to the activation of economic activities in Phnom Penh.

Grant Limit / Actual Grant Amount	1,727 million yen / 1,591 million yen
Exchange of Notes Date /Grant Agreement Date	March 2015 / March 2015
Executing Agency	Department of Public Works and Transport: DPWT of Phnom Penh Capital Administration: PPCA
Project Completion	December 2018
Target Area	Phnom Penh Capital City
Main Contractors	Mitsubishi Corporation / Sumitomo Electric Industries, Ltd. (JV)
Main Consultants	Mets Research & Planning Inc. / CTI Engineering International Co., Ltd. (JV)
Preparatory Survey	May 2014–February 2015
Related Projects	[Technical Cooperation] ・ Project for Capacity Development on Comprehensive Traffic Management Planning and Traffic Control Center Operation and Maintenance in Phnom Penh Capital City (January 2022–2024, on-going) ・ Phnom Penh City Comprehensive Urban Transport Planning Project (March 2012–December 2014) ・ The Project for Improvement of Public Bus Operation in Phnom Penh (January 2017–February 2022) [Grant Aid] ・ The Project for Improvement of Transportation Capacity of Public Bus in Phnom Penh (2016–2018) ・ The Project for Improvement of National Road No.1 (Phase 4) (2014–2017) [Asian Development Bank] ・ Supporting Sustainable Integrated Urban Public Transport Development (2018–present)

2. Outline of the Evaluation Study

2.1 External Evaluator

Masumi Shimamura, 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: November 2021–February 2023

Duration of the Field Study: May 9–28, 2022, September 6–18, 2022

2.3 Constraints during the Evaluation Study

In this study, due to the global spread of COVID-19, the external evaluator could not travel to Cambodia. Instead, local consultant was utilized remotely to conduct the survey. For this reason, the local consultant collected the answers to the questionnaire and conducted interviews with stakeholders and beneficiaries, etc. The external evaluator conducted evaluation analysis and judgment by closely examining the information and data obtained through the remote surveys and desk research.

3. Results of the Evaluation (Overall Rating: A[1])

3.1 Relevance/Coherence (Rating: ③[2])

3.1.1 Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Cambodia

At the time of planning, Cambodian government's *the Rectangular Strategy Phase III (2013–2018)* set out as one of the pillars to prioritize "infrastructure development." In addition, this project was regarded as one of the top priority projects in the short-term plan until 2016 in *the Comprehensive Urban Transport Master Plan* that had been developed by the Phnom Penh Capital Administration (hereinafter referred to as "PPCA").

At the time of the ex-post evaluation, Cambodian Government's *the Rectangular Strategy Phase IV (2018–2023)* set forth "economic diversification" as one of its key strategies and calls for enhanced connectivity in transportation infrastructure, as well as improved road safety and traffic order. In addition, *the Comprehensive Urban Transport Plan in Phnom Penh Capital City* with a target year of 2035 states that various traffic management plans will be promoted, including intersection improvements, traffic signalization, and introduction of one-way traffic system, together with the basic concept of this project. Thus, the implementation of the project is also consistent with the development policy of Cambodia at the time of the ex-post evaluation.[3]

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

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

[3] As described below in "3.4.1 Policy and System," *the Comprehensive Urban Transport Plan in Phnom Penh Capital City* does not change the policies related to the promotion of various traffic management plans, but it no longer reflects the current situation due to significant changes in traffic flow and road development situations resulting from the rapid development of Phnom Penh Capital City, and thus needs to be updated.

3.1.1.2 Consistency with the Development Needs of Cambodia

At the time of planning, there were 69 existing signalized intersections in Phnom Penh Capital City, but signal equipment and control systems at each intersection were not unified, and independent display pattern at each intersection caused traffic flow between the intersections to stagnate. In some cases, traffic congestion was worsened, making it necessary to upgrade the equipment and control system.

At the time of the ex-post evaluation, traffic congestion and accidents are increasing due to increase in traffic volume in Phnom Penh Capital City, and improvement of traffic situation continues to be an urgent issue. In addition, as urban development progresses and urban areas expand, there is an urgent need to improve intersection signals and traffic management systems in the areas surrounding the project to promote traffic safety and traffic facilitation. Furthermore, traffic flow is changing as well as traffic volumes are increasing, which further increases the importance of improving intersection signals and traffic control systems. Therefore, the importance of this project is still maintained at the time of the ex-post evaluation.

3.1.1.3 Appropriateness of the Project Plan and Approach

The project plan and design were based on the lessons learned from similar projects, and the use of the lessons learned was appropriate and generated the expected effects. Specifically, through the soft component (capacity building program), technology transfer was conducted to the PPCA, the Department of Public Works and Transport (hereinafter referred to as "DPWT") of Phnom Penh Capital City and the Traffic Police, and maintenance manuals, etc. were developed and knowledge training on traffic control systems was conducted. Participants of training program utilize the acquired skills and knowledge in the field by sharing them to new staff and introducing to university intern students.

According to the DPWT, there were no effects on the implementation of soft component due to the project period being significantly longer than planned. The project delayed in civil works and procurement of equipment for the TCC, and equipment such as signal controllers and intersection signals, but the technology transfer was carried out without any particular problems due to proper scheduling of the soft component.

From the standpoint of equity, possible actions have been taken within the budget of this project. According to the DPWT, partial road pavement was carried out at the intersection along Norodom Boulevard and Russian Boulevard, where vehicle and pedestrian congestion is particularly heavy, and slope for wheelchair was developed.

3.1.2 Coherence(Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

At the time of planning, Japanese government placed "development of economic

infrastructure" as one of the development issues in its *Country Assistance Program for Cambodia*. In addition, JICA supported the creation of a master plan in the "Phnom Penh City Comprehensive Urban Transport Planning Project," that included traffic management such as expansion and improvement of the urban road network, introduction of public transportation, and traffic signals and traffic control systems. This project aimed to improve traffic conditions in Phnom Penh, where traffic congestion was becoming serious, by installing intersection signals and developing a TCC, etc. The project was consistent with Japan's development cooperation policy at the time of planning.

3.1.2.2 Internal Coherence

This project is internally coherent with a technical cooperation for development planning "Phnom Penh City Comprehensive Urban Transport Planning Project" (March 2012–December 2014), a technical cooperation project "The Project for Improvement of Public Bus Operation in Phnom Penh" (January 2017–February 2022) and a grant aid project "The Project for Improvement of Transportation Capacity of Public Bus in Phnom Penh" (2016–2018) as concrete synergistic effects have been generated. The basic concept for the development of public bus network in Phnom Penh is set forth in *the Comprehensive Urban Transport Plan in Phnom Penh Capital City* prepared by the "Phnom Penh City Comprehensive Urban Transport Planning Project," and "The Project for Improvement of Public Bus Operation in Phnom Penh" to improve capacity of bus operators and "The Project for Improvement of Transportation Capacity of Public Bus in Phnom Penh" to procure bus were implemented with the aim of developing 10 routes by 2020 as proposed in the Master Plan. (Refer to Impacts for specific synergistic effects.)

Collaboration with a grant aid project "The Project for Improvement of National Road No.1 (Phase 4)" (2014–2017) took place which was not anticipated at the time of planning. Project scope was added as a result of collaboration. Specifically, road rehabilitation and widening were carried out from the Monivong Bridge to the 4 km point in the project phase 4, and at the request of Cambodian government, additional traffic signals were installed at six intersections where traffic congestion was expected in this section of the road. However, as discussed later in the Impacts, the traffic signals at the six locations are not connected to the optic fiber network and thus not yet integrated into the traffic control systems at the time of the ex-post evaluation.

3.1.2.3 External Coherence

Collaboration with "Supporting Sustainable Integrated Urban Public Transport Development" (2018–present) implemented by the Asian Development Bank (hereinafter referred to as "ADB") took place which was not anticipated at the time of planning. According to the DPWT, the ADB project is going to develop public transportation policy guides and planning toolkit

based on the results of this project. However, the ADB project is delayed due to the spread of COVID-19, and the project is still under implementation at the time of the ex-post evaluation.

Regarding consistency with the international frameworks, the DPWT confirmed that this project contributes to target 3.6 of the SDGs (halve the number of deaths and injuries from road traffic accidents by 2020). The number of traffic accidents and casualties in Phnom Penh Capital City from 2019 to 2021 are shown in Table 1. There is an overall downward trend, although there are likely to be some effects of lockdowns and travel restrictions (external factors) due to the spread of COVID-19 in 2020 and 2021.

Table 1: Number of Traffic Accidents and Casualties in Phnom Penh Capital City

(Unit: person)

	2019	2020	2021
Number of traffic accidents	1,862	950	537
Number of casualties	333	301	176
Number of serious injuries	1,216	947	488
Number of minor injuries	664	352	170

Source: The DPWT and Phnom Penh Traffic Police

The project is consistent with Cambodia's development policy and development needs, and the project plan and approach were appropriate. The project is also consistent with Japan's development cooperation policy, and concrete synergistic effects can be seen through coordination with other projects within JICA. Furthermore, collaborations with other donors, which was not anticipated at the time of planning took place. Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

This project aims to improve traffic conditions in Phnom Penh by installing intersection signals and developing a TCC, etc. Equipment at intersections and the TCC installed by the project is listed in Tables 2 and 3.

Table 2: Equipment at Intersections

Equipment	Function
Signal controller (centralized type, with sensing function)	Signal control in remote or isolated mode
Layer 2 switch	Network switch
Media converter	Electronic – optical conversion
Signal lights	Lights for various vehicles and pedestrians
Vehicle detector	Detection and counting of vehicles and speed measurement
Traffic monitoring video camera	Traffic monitoring camera and controller

Source: Preparatory Survey Report

Table 3: Equipment at the TCC

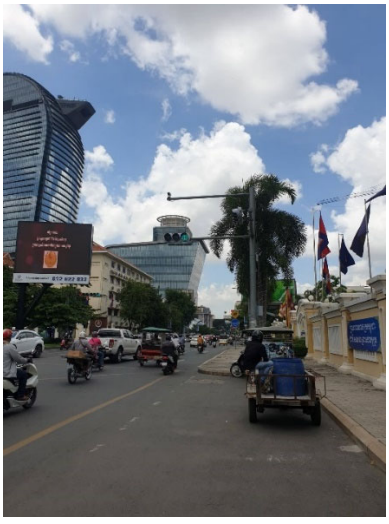
Equipment	Function
Network management server	Network monitoring
Signal control server	Signal control at higher level, equipment monitoring
Signal control workstation	Signal monitoring and control operation by operator
Network attached storage	Network equipment
Front-end processor	Signal control/vehicle detector data processing at real-time level
Network printer	System printer
Video wall	Display of traffic condition, system monitoring, etc.
Video wall controller	Control of video wall
Traffic monitoring workstation with console	Monitoring of traffic conditions
Vehicle detector data processing software	Row vehicle detector data are processed into traffic flow data
Signal control software	Monitoring and control of signal
Equipment operation monitoring software	Monitoring of system equipment
Human-machine interface software	Display to operator and processing of input by operator
Statistics software	Statistical processing of traffic data and system operation data
Database software	Database management
Parameter setting for vehicle detector	Vehicle detector ID, location, adjustment factor, etc.
Signal control parameter setting	Controller ID, phase, step setting, etc.
Uninterruptible power supply (UPS)	Supply of interruptible power
Controller for traffic monitoring video camera	Control of traffic in remote or isolated mode
Layer 3 switch	Network switch
Layer 2 switch	Network switch
Media converter	Electronic – optical conversion

Source: Preparatory Survey Report

Major changes from the plan include changes in the quantities of equipment items, preparation of drawings and implementation of exploratory surveys of underground buried structures, addition of traffic signals at 15 intersections, reconstruction of new fiber optic cable network, and change in the site of the TCC. In addition, open-cut method of daytime construction was changed to night-time construction, and overhead wiring was buried underground. All of these changes were necessary and appropriate according to the actual conditions at the site, such as traffic volume.

Of the 15 intersections where traffic signals were added, six intersections are along National Road which has been improved by "The Project for Improvement of National Road No.1 (Phase 4)," as described earlier in Section 3.1.2.2 Internal Coherence. The TCC site was originally planned to be located within the DPWT, but the new PPCA building was constructed within the traffic control zone, and thus location was changed because it will reduce travel time from the new building to the site in the event of an accident or system failure. The change of open-cut method of daytime construction to night-time construction was due to adjustments and changes made as a result of development progress in the project area. Specifically, since large-scale construction work was taking place in the center of Phnom Penh Capital City, including the high-rise Vattanac Capital Tower, underground parking, and the Olympic Stadium, and traffic congestion was occurring during the daytime, installation of traffic signals and road signs, etc. was changed to night-time construction. The change to undergrounding of overhead wiring was also due to an instruction issued by the PPCA in 2016 regarding city planning. Specifically, instructions were issued to bury overhead lines along major roads from the perspective of urban landscape and safety and thus the project's overhead wiring was buried underground.

Vattanac Capital Tower, Intersection Near Underground Parking



Intersection Near the PPCA

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost was initially planned to be 1,731 million yen (1,727 million yen on the Japanese side, 4 million yen on the Cambodian side). In actuality, the total project cost was 1,595 million yen (1,591 million yen on the Japanese side, 4 million yen on the Cambodian side), which is within the plan (92% of the planned amount).

3.2.2.2 Project Period

The overall project period was planned as 24 months, from April 2015 (start of the detailed design) to March 2017 (completion of construction) as opposed to 45 months in actuality, from April 2015 (start of the detailed design) to December 2018 (completion of construction), which significantly exceeded the plan (188% of the initial plan). Table 4 summarizes the comparison of planned and actual project period.

Table 4: Comparison of Planned and Actual Project Period

Plan	Actual
April 2015–March 2017 (24 months)	April 2015–December 2018 (45 months)
Breakdown: Detailed Design and Tendering Period	
Detailed design: 4.5 months Tendering period: 5.5 months	April 2015–December 2015 (9 months)
Breakdown: Construction and Procurement Period	
Construction and Procurement Period: 16.5 months	December 2015–December 2018 (37 months)

Source: Information provided by JICA and results from questionnaire survey of the DPWT

Note 1: The starting point of the project period is the start of the detailed design, and the definition of project completion is the date of completion of construction (the date of completion of removal work). The project period does not include the defect liability period for both planned and actual.

The reason for the significant increase over the plan was due to the combination of factors mentioned above in "3.2.1 Project Outputs." Specifically, it was due to a combination of (1) installation of additional traffic signals at 15 intersections, (2) reconstruction of a new optical cable network, (3) change of the TCC location, (4) change of open-cut method of daytime construction to night-time construction, and (5) change from overhead wiring to underground installation. They are extensions of the project period due to changes in outputs. In addition, (4) change to night-time construction and (5) undergrounding of overhead wiring were due to the rapid urban development in the project area and the instruction regarding city planning

issued by the PPCA in 2016, and it would have been difficult to foresee these changes at the time of planning.

Therefore, efficiency of the project is moderately low.

3.3 Effectiveness and Impacts[4] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

At the time of planning, "average travel speed," "travel time cost," "average ratios of traffic demand/traffic capacity at 10 major locations," and "traffic police needed in traffic control" were set as quantitative effects of the project. Table 5 summarizes baseline, target and actual figures between 2017 and 2021 for each indicator. As the project completion is December 2018, the target year to be compared is 2021, three years after completion. The target achievement rates are shown in parentheses in the table.

According to the DPWT, due to the spread of COVID-19, they were unable to measure and calculate "average travel speed," "travel time cost" and "average ratios of traffic demand/traffic capacity at 10 major locations" for 2021, and thus actual values for that year were not available. In addition, according to the DPWT, the actual figures for 2020 were affected by the lockdown and travel restrictions due to COVID-19, and the figures do not exclude these effects. For this reason, instead of looking at the achievement status of the actual values for a single year, 2021, analysis was made on the overall changes in the actual values that were available. As regards "traffic police needed in traffic control," analysis was conducted by comparing the actual results for 2021 with the target values, since the actual values for 2021 were available from the Phnom Penh Traffic Police. (Actual values for other years were regarded as reference values.)

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

Table 5: Quantitative Effects of the Project

Indicators	Baseline value 2014 Actual value	Target value 2020 3 Years After Completion	Actual value (Percentages in parentheses indicate achievement rates)				
			2017	2018 Project completion	2019	2020	2021
Average travel speed (km/hr) (average values of speed on major radial roads)	12.5 (Note 1)	14.2 (Note 2)	11.34	15.23 (107%)	13.72 (97%)	16.44 (116%)	N.A.
Travel time cost (million JPY) (Note 3)	14,742 (Note 4)	12,978	13,638	13,361 (97%)	13,453 (96%)	13,313 (97%)	N.A.
Average ratios of traffic demand/traffic capacity at 10 major locations (vehicles)	Morning Peak 1.18 Evening Peak 1.37	Morning Peak 1.13 Evening Peak 1.33	Morning 1.37 Evening 1.59	Morning 1.43 (79%) Evening 1.67 (80%)	Morning 1.51 (75%) Evening 1.75 (76%)	Morning 1.14 (99%) Evening 1.33 (100%)	Morning N.A. Evening N.A.
Traffic police needed in traffic control (person)	About 400 (Note 5)	About 320	N.A.	N.A.	552 (58%)	252 (127%) (Note 6)	478 (67%) (Note 7)

Source: Ex-ante evaluation report and results from questionnaire survey of the DPWT. "Traffic police needed in traffic control" data is from the Phnom Penh Traffic Police.

Note 1: Data from the travel speed results in the study.

Note 2: Based on examples of travel speed improvements effects of traffic control systems installation and intersection improvements in other countries (assuming 14% speed improvement effect).

Note 3: Travel time cost means a monetary value a person is willing to pay for a change in his/her travel time (JPY equivalent figure). For the actual, figures in USD were provided from the DPWT and converted to JPY by the evaluator using the average IMF rate (IFS) for each year.

Note 4: Average travel speed was used to calculate the total travel time cost for seven major routes (Monivong Blvd., Norodom Blvd., Charles de Gaulle Blvd., Russian Blvd., Sihanouk Blvd., Mou Tse Tong Blvd. and Inner Ring Road) in Phnom Penh Capital City.

Note 5: At the time, 64 locations with heavy traffic (inclusive of non signalized intersections) were staffed with two to four traffic police, or approximately 400 traffic police in two shifts. It was estimated that a reduction of 20% of traffic police can be achieved as non signalized intersections are signalized and signalized intersections with high traffic volume are facilitated.

Note 6: The sharp decrease in the number of traffic police in 2020 is due to the lockdown and travel restrictions caused by the COVID-19 pandemic, which also restricted traffic and reduced the deployment of traffic police.

Note 7: As of June 2022, the following year, the number of traffic police for traffic control is 586.

Looking at the trends in "average travel speed" and "travel time cost," the target achievement rates were 97–116% and 96–97%, respectively, indicating that the targets were generally achieved as planned. On the other hand, although the achievement rates for the actual value in 2020 for "average ratios of traffic demand/traffic capacity at 10 major locations" are almost achieved at 99% for the morning peak and 100% for the evening peak, it cannot be said that the indicator is generally achieved as planned, considering that the impacts of lockdowns and travel restrictions due to the spread of COVID-19 are included, and that the achievement rates

in 2018 and 2019 have remained below 80% due to increase in traffic volume. The number of "traffic police needed in traffic control" has not achieved the target. At the time of planning, it was assumed that the number of traffic police on duty would be reduced by the project but the actual number in 2021 has increased to 478, which is 1.5 times the target, and the achievement rate is 67%. In 2020, it can be considered that the target was temporarily achieved due to an external factor, COVID-19. It was assumed that the actual value would be lower than the baseline value for this indicator, but it is conceivable that there was an assumption that road users will observe traffic rules and manners such as traffic signals and road signs (or that this project will promote such observance). However, since there are still traffic violators, traffic police should continue to be deployed at signalized intersections to control traffic. The actual values have increased and the target has not been achieved because increase in the number of traffic police is necessary to deter traffic violations, prevent accidents, and improve traffic flow. This is consistent with the results of the interviews with local residents discussed below in Section "3.3.2.2 Other Positive and Negative Impacts," 5) Social Systems and Norms, Human Well-being and Human Rights.

3.3.1.2 Qualitative Effects (Other Effects)

Qualitative effects were classified as impacts.

3.3.2 Impacts

3.3.2.1 Intended Impacts

As impacts of this project, state of generation of "improvement of traffic flow in Phnom Penh Capital City," "improvement of local residents' lives," "realization of safe and secure road traffic" and "stimulation of economic activities in Phnom Penh" were evaluated.

1) Improvement of traffic flow in Phnom Penh Capital City

The DPWT explained that after the project, traffic signals have been operating under a unified control system, monitored and controlled from the TCC, and thus traffic flow has improved.

Interviews were conducted with 20[5] local residents of Phnom Penh Capital City (users of vehicles, motorcycles, etc. and pedestrians) and drivers of public buses and trucks. 19 respondents (95%) said that overall, traffic flow has improved as a result of the project, and one respondent did not know. However, public bus drivers (5), tuk-tuk driver (1), and

[5] The 20 interviewees consisted of 14 men (one teenager, two in 20s, five in 30s, five in 40s and one in 70s) and six women (one teenager, two in 30s, one in 40s, one in 50s, and one in 60s).
They include seven public bus drivers, one light truck driver, one tuk-tuk driver, one food delivery person, six clerks/salespeople, one security guard at university, one primary school teacher, one university student, and one junior high school student.
One elderly person (a 73-year-old man) was interviewed for vulnerable road users (children, people requiring nursing care, the elderly, and people with disabilities), but the interviewees included local residents with small children and elderly family members.

salesperson (1) answered that traffic flow has not improved in some areas even after the project, and they expect that it will improve in the future.

2) Improvement of local residents' lives

The DPWT explained that after the project, traffic flow was improved, and complaints about traffic congestion from local residents decreased.

The results of interviews with local residents and drivers of public buses and trucks in Phnom Penh Capital City showed that 18 respondents (90%) answered that their lives had improved due to improved traffic flow after the project, one respondent said there was no change, and one respondent did not know. Specifically, following responses were obtained: "We can now go to work and school on time and do not have to leave home early in the morning," "Ambulances can pass through with priority," "I have less frustration due to traffic jams," "I can pick up and drop off my children more smoothly and have better time management," "I can move smoothly during delivery work and have lesser customer complaints." Some respondents also noted that "traffic congestion has eased, saving money on gasoline." Public bus drivers answered that "the overall delay time has been reduced (delays were 15 to 20 minutes before the project, but delays were limited to five to 10 minutes in most cases after the project)."

3) Realization of safe and secure road traffic

The DPWT explained that after the project, number of traffic accidents decreased due to improved traffic flow. (See Table 1)

The results of interviews with local residents of Phnom Penh Capital City and drivers of public buses and trucks showed that 19 respondents (95%) answered that the project has contributed to traffic safety, while one respondent answered no change. Specifically, a respondent answered that "Before the project, there were many accidents due to vehicles forcing their way into the road, but after the project, pedestrians can cross the road safely because they have to stop at red lights" and "Before the project, there were no traffic signals at the Neang Kung Hing Roundabout, causing traffic jams and accidents. After installation of traffic signals in this project, traffic jams have been eliminated and accidents are rarely heard of." On the other hand, it was pointed out that "In the evening, roads are congested and many drivers ignore red lights on Russian Boulevard, which is scary. The passing time for pedestrian signals should be longer than the current set time (15 seconds)" and "This project has contributed to the reduction of traffic accidents, but vehicle drivers need to have better understanding of how to use the lanes and the dedicated public bus lane."

4) Stimulation of economic activities in Phnom Penh

The DPWT explained that after the project, waiting time at intersections has decreased and travel time has been reduced, leading to increased number of truck trips.

The results of interviews with local residents of Phnom Penh Capital City and drivers of public buses and trucks showed that five respondents (25%) (all public bus drivers) answered that the project has contributed to the increase in the number of truck trips and public bus services, three (15%) (two public bus drivers and one salesperson) answered other, and 12 (60%) did not answer or did not know. A public bus driver pointed out that although increase in the number of truck trips and the number of public buses operated may be due in part to the contribution of this project, it is more likely that increase in demand is the main factor. For example, rapid development of Phnom Penh Capital City has increased the demand for truck transportation due to increased business activities, and low-income people living far from the city center are increasingly using public buses for economic reasons, such as using public buses because they cannot afford to pay for gasoline. For this question, 60% of the respondents did not answer or did not know. Various factors other than the project have influenced stimulation of economic activities, and as far as reviewing the answers to the questions, which were given due consideration of causal relationship with this project, the contribution of this project could not be confirmed clearly.

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Natural Environment

The project was classified as Category C based on the *JICA Guidelines for Confirmation of Environmental and Social Considerations* (April 2010) since the project was considered to have minimal undesirable effects on environment.

According to the DPWT, no specific negative impacts on the natural environment were identified. During construction, open-cut daytime work was changed to night-time to avoid road closures and effects on traffic flow. The DPWT also explained that large construction equipment was not used to reduce noise, vibration, and other environmental impacts. The results of interviews with local residents of Phnom Penh Capital City and drivers of public buses and trucks indicate that there were no major problems with the natural environment during construction and after completion.

2) Resettlement and Land Acquisition

Resettlement and land acquisition did not take place for this project.

3) Gender Equality

As a result of interviews with the DPWT and local residents and public bus and truck

drivers in Phnom Penh Capital City, no particular impacts on gender was observed.

4) Marginalized People

The DPWT explained that the project has installed pedestrian signals, making crossing the street more convenient for all pedestrians. As mentioned earlier in "3.1.1.3 Appropriateness of the Project Plan and Approach," road pavement was carried out at the intersection along Norodom Boulevard and Russian Boulevard and slope for wheelchair was developed. During planning, installation of audible pedestrian signals for the visually impaired was discussed, but it was not realized due to budget constraints.

The results of interviews with local residents of Phnom Penh Capital City and drivers of public buses and trucks showed that 19 respondents (95%) answered that the project takes vulnerable road users into consideration, while one respondent answered that it does not. Specifically, there were responses such as "The project helps children, pregnant women, and the elderly to cross intersections. Traffic signals and signs are easy to see," "The pedestrian signal passing times are appropriate, and consideration is being given to vulnerable road users. I have seen elderly people, women pushing baby carriage, and people in wheelchairs crossing the road and they were crossing safely." On the other hand, some respondents pointed out that "It would be better if pedestrian signals could be set longer for children crossing the street during evening school dismissal and for poor people pushing carts to sell general goods," and "Although there are some intersections where pedestrian signal passing time is sufficient, the Petchen Intersection (intersection of Preah Sihanouk Boulevard and Preah Monivong Boulevard) is not sufficient for vulnerable pedestrians to safely cross the street because the green light is too short for the wide road and they have to run."

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

The DPWT explained that, overall, number of vehicles and pedestrians who follow basic traffic rules and manners has increased after the project, for example, vehicles now follow basic rules such as when turning left at an intersection, they must move into the left turn lane. The DPWT mentioned that after project completion, they have installed road signs to guide and disperse traffic flow to improve project effectiveness. On the other hand, the DPWT pointed out that the target area of the project is the central area of Phnom Penh Capital City, and as urban development of Phnom Penh Capital City is progressing rapidly and the urban area is expanding, it is necessary to install traffic signals and deploy traffic police at intersections in the surrounding areas.

As a result of interviews with local residents and drivers of public buses and trucks of Phnom Penh Capital City, all 20 respondents answered that people's awareness of traffic safety has improved compared to before the project. Of these, three respondents (two public

bus drivers and one salesperson) provided answers that were relevant to this project. However, it was pointed out that there are still many traffic violators and that it is necessary to inform the public about traffic rules and manners. Specifically, it was pointed out as follows. “After the project, some drivers began to obey traffic rules such as traffic signals when entering intersections, but some drivers still disregard road signs (turn right, turn left, go straight, white and yellow marks on the road, pedestrian marks),” “Public bus drivers are well aware of changes in traffic laws and regulations, but general drivers are not well aware of them. There are many drivers who do not follow lane rules, such as driving in the right turn lane when they want to turn left, driving in the left turn lane when they want to go straight, and not giving priority to pedestrians when the pedestrian signals are green. So, it is necessary to make people aware of traffic rules and manners.” “At intersections not monitored by traffic police, there are drivers who do not obey traffic rules and ignore traffic signals and signs. Traffic police needs to be deployed at these intersections.” As the reasons for not achieving the target of “traffic police needed in traffic control” is explained in “3.3.1.1 Quantitative Effects,” the interview survey results also suggest that the deployment of traffic police is still necessary to improve traffic flow and make road traffic safer and more secure.

6) Unintended Positive/Negative Impacts

<Synergies with other projects in JICA>

As mentioned above in “3.1.2.2 Internal Coherence,” this project has generated concrete synergistic effects with “Phnom Penh City Comprehensive Urban Transport Planning Project,” “The Project for Improvement of Public Bus Operation in Phnom Penh” and “The Project for Improvement of Transportation Capacity of Public Bus in Phnom Penh.”

This project was implemented based on *the Comprehensive Urban Transport Plan in Phnom Penh Capital City* formulated in the “Phnom Penh City Comprehensive Urban Transport Planning Project,” and the concrete effects shown in the above Effectiveness and Impacts are all collaborative effects.

Regarding collaboration with “The Project for Improvement of Public Bus Operation in Phnom Penh” and “The Project for Improvement of Transportation Capacity of Public Bus in Phnom Penh,” according to the DPWT, a technical team of the technical cooperation project, in order to introduce a priority signalling system for public buses, is undertaking pilot survey on Charles de Gaulle Boulevard and Monireth Boulevard respectively in collaboration with the staff of the TCC developed by the project. In the signal control pattern experiment, the TCC staff have shared data such as public bus travel speed data with the technical team, and operations such as increasing the timing of green lights when public buses pass through intersections are being coordinated between the two parties to ensure that the bus priority signal system works well. As a result, improvements in public bus service

delays have been observed. According to the TCC, the pilot survey showed an increase in green light timing at intersections of approximately 2–4%, which converts to travel time savings of 4–7 seconds, depending on the intersection conditions. Buses provided under the grant aid project are being used.

As a collaboration that was not anticipated at the time of planning, as mentioned above in "3.1.2.2 Internal Coherence," collaboration with "The Project for Improvement of National Road No.1 (Phase 4)" took place. However, the additional traffic signals installed at six intersections are not currently connected to the fiber optic network and have not yet been integrated into the traffic control systems. According to the DPWT, installation of the fiber optic network is costly and need to secure budget. Connection costs would need to be budgeted as a new investment project rather than in the maintenance budget.

<Synergies with organizations outside of JICA>

As mentioned earlier in "3.1.2.3 External Coherence," collaboration with ADB project has taken place. According to the DPWT, public transportation policy guides and planning toolkit will be developed under the ADB project based on the results of this project, but the ADB project has been delayed due to the spread of COVID-19 and is still under implementation at the time of the ex-post evaluation, so concrete results have not yet been realized.

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

3.4 Sustainability (Rating: ③)

3.4.1 Policy and System

According to the DPWT, there is no change in the policies of *the Comprehensive Urban Transport Plan in Phnom Penh Capital City* with a target year of 2035, traffic signals and traffic control systems at intersections will continue to improve. However, it was pointed out that the Master Plan no longer reflects the current situation due to the rapid development of Phnom Penh Capital City, which has drastically changed traffic flow and road development situation etc., and that it needs to be updated.

From the above, sustainability of policy and system of the project is assured.

3.4.2 Institutional/Organizational Aspect

After project completion, operation and maintenance of the project is carried out by the DPWT under the supervision of PPCA. Although the TCC is located in the PPCA building, it is an organization under the DPWT and is under the reporting line to the DPWT. Roles and responsibilities of the DPWT and the TCC are as follows.

- DPWT: Responsible for technical supervision on the operation and maintenance of

traffic control system

- TCC: Responsible for operation and maintenance of traffic control systems

According to the DPWT, the DPWT and the TCC directly carry out maintenance work of the traffic control systems because they can handle themselves, and they do not outsource the work to maintenance contractors. In addition, remote maintenance has not been implemented through direct access to the TCC's servers from Japan.

The DPWT prepares and submits operation and maintenance plan and budget plan to the PPCA every year and undertakes operation and maintenance work upon approval by the PPCA. The DPWT/the TCC is in constant communication with the PPCA and there is a system in which they can collaborate.

The TCC has 13 staff members. It consists of one TCC Chief, one Deputy Chief and 11 technical staff. According to the DPWT and the TCC, currently necessary personnel are secured to operate and maintain the traffic control systems. In the future, if the traffic control area is going to be expanded, the number of staff needs to be increased, but at present, 13 staff members are sufficient, and there are no particular problems.

At the time of the ex-post evaluation, a technical cooperation project "Project for Capacity Development on Comprehensive Traffic Management Planning and TCC Operation and Maintenance in Phnom Penh Capital City" (scheduled from January 2022 to December 2024) has been implemented for the PPCA, the DPWT, the TCC, and Phnom Penh Traffic Police, and one of its outputs is "establishment of a maintenance management system for traffic control systems." In view of expansion of the urban area due to the rapid urban development in Phnom Penh Capital City, there are plans to expand the development of intersection signals and traffic control systems to the surrounding areas of the project. With the expansion of operations, it is necessary to establish a more appropriate maintenance management system, and the following activities are planned for this technical cooperation project.

- Activity 1-1: Review the TCC's current organization and management structures
- Activity 1-2: Identify operation and maintenance management problems that have occurred since the start of operation of the traffic control systems and develop improvement measures
- Activity 1-3: Review existing system operation manuals, maintenance management manuals, and other manuals to make them suitable for the situation in Phnom Penh
- Activity 1-4: Investigate maintenance management organization (including possibility of outsourcing) and propose an appropriate maintenance management system

From the above, no particular problem has been identified regarding the Institutional/Organizational aspect of operation and maintenance.

3.4.3 Technical Aspect

According to the DPWT and the TCC, the TCC staff have basic knowledge and skills to carryout day-to-day operations and maintenance work. However, traffic signal operation techniques need to be strengthened so that traffic flow can be controlled at appropriate times, especially during peak hours and in response to traffic conditions, and it is expected that the capacity of TCC staff will be enhanced through the on-going technical cooperation project.

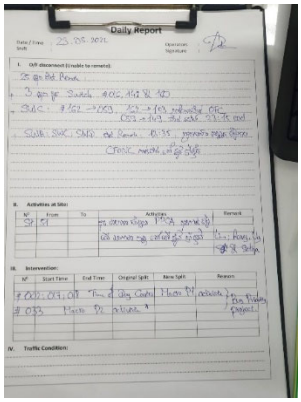
According to the DPWT and the TCC, the soft component (capacity building program) of the project provided training and hands-on work related to basic knowledge and operation and maintenance of the traffic control systems. According to interviews with training participants, they found the training content easy to understand and comprehend. Although no training has been provided after completion of the project, the TCC staff are improving their skills through daily on-the-job training.

The manuals prepared under the soft component have not been updated, but updates to the manuals are planned through on-going technical cooperation project. The current manual is always available at the TCC and is referred to and utilized in daily operations.

From the above, the TCC staff in charge of operation and maintenance has the basic technical skills necessary to undertake usual operation and maintenance work. More advanced technologies, such as controlling traffic flow in a timely manner during peak hours, will be transferred in an on-going technical cooperation project, and concrete prospects are in place. Therefore, although there are some minor problems with the technical aspects of operation and maintenance, prospects for improvement and resolution are high.

Monitoring Screen at the TCC

TCC Server



Daily Monitoring Records by the TCC Staff

3.4.4 Financial Aspect

As regards operation and maintenance costs of the project, necessary amounts are estimated by the DPWT annually, and budget request will be made to the PPCA where it is scrutinized.

Then, after approval by the PPCA, budget will be allocated to the DPWT. For urgent and high priority repairs, such as damage to traffic signal poles due to traffic accidents, the DPWT requests a budget each time, which will be approved by the PPCA.

Table 6 shows the budget (requested amount), actual allocation and actual expenditure of operation and maintenance cost of the project.

Table 6: Operation and Maintenance Cost for the Project

(Unit: USD)

	2019	2020	2021
Budget (Requested Amount)	74,700	74,700	74,700
Actual Allocation	22,250	21,070	5,640
Actual Expenditure	14,940	19,890	5,640

Source: Results of questionnaire survey of the DPWT

Note 1: According to the DPWT, budget request is made excessively (requested more than the expected expenditure) because full amount requested is not approved and allocated in a timely manner.

Note 2: Actual expenditures in 2019 and 2020 are lower than actual allocations because the cost of spare parts not procured in those years was carried over to the following year.

Note 3: The significant decrease in actual allocation and actual expenditure in 2021 is due to the effects of COVID-19. (Cambodian government prioritized its budget on COVID-19 countermeasures.)

According to the DPWT, budged request for operation and maintenance cost is made excessively because full amount requested is not approved. In addition, budget is not allocated in a timely manner. Actual expenditures are within the allocation. The reason for significant decrease in actual allocations and expenditures in 2021 is due to the fact that the government budget was prioritized for expenditures for COVID-19 countermeasures. The projected budget allocations for 2022 is unknown at the time of the ex-post evaluation.

From the above, there are some minor problems with financial aspect of operation and maintenance, but no substantial problems have occurred.

3.4.5 Environmental and Social Aspect

As a result of confirming with the DPWT and the TCC, there were no unexpected environmental and social considerations.

3.4.6 Preventative Measures to Risks

According to the DPWT and the TCC, traffic control systems are based on advanced technology of Japan. If there is anything unclear in the system maintenance, they consult with the Japanese contractors for this project via e-mail, etc., and can receive useful advice. However, a more detailed manual is necessary for the TCC to carry it out on its own. There are no software

compatibility issues.

According to the DPWT and the TCC, they do not have the tools and equipment to repair fiber optic cables in the event of a physical disconnection or other failures. Thus, the DPWT has plans to rent the equipment from private entities and have the TCC staff conduct repairs.

3.4.7 Status of Operation and Maintenance

Condition of signals and fiber optic network is monitored on a daily basis and repaired by the TCC staff when problems occur. Physical damage to traffic signal poles and other equipment caused by traffic accidents, etc. is repaired by the DPWT after the TCC staff obtain information at the site in cooperation with the Traffic Police.

According to the DPWT and the TCC, frequent malfunction of Layer 2 switches is taking place and they are not available in a timely manner since suppliers do not have spare parts in stock. As a result, traffic signals at four intersections are not connected to the traffic control systems and currently have independent display patterns. In addition, the additional traffic signals installed at six intersections along National Road No.1 are not connected to the fiber optic network and have not yet been integrated into the traffic control systems. According to the TCC, these intersections are not major intersections and the independent traffic signals have no effects on traffic.

Spare parts are stored in the DPWT warehouse. Fiber optic cable and control power unit would be procured from Japan, and it would take about one to three months. Layer 2 switches that have been causing frequent malfunctions can be procured in Cambodia but are currently not available due to lack of stock.

From the above, there are some problems in the operation and maintenance status at the time of the ex-post evaluation, but as a whole, there is no problem because facilities are properly operated and maintained.

Slight issues have been observed in the technical, financial, and the current status of operation and maintenance, however, there are good prospects for improvement/resolution. Therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project developed traffic signals at intersections and a TCC, etc. to improve traffic conditions in Phnom Penh Capital City. This project, which aims to promote traffic improvement measures such as improvement of intersections and installation of traffic signals, is consistent with Cambodia's development policy, development needs and project plan and approach were appropriate. The project is also consistent with Japan's assistance policy and concrete results can

be confirmed through collaboration with other JICA projects. Therefore, relevance and coherence of the project are high. In terms of project implementation, although the project cost was within the plan, the project period significantly exceeded the plan. Therefore, efficiency of the project is moderately low. Regarding project effects, of the indicators of quantitative effects set at the time of planning, "average travel speed" and "travel time cost" have mostly achieved as planned, but "average ratios of traffic demand/traffic capacity at 10 major locations" and "traffic police needed in traffic control" have not achieved. Regarding impacts, the results of interviews with local residents and public bus and truck drivers indicate that, overall, the project has contributed to the improvement of traffic flow, local residents' lives and traffic safety. Regarding impacts on stimulation of economic activities in Phnom Penh Capital City, it was not possible to clearly confirm the contribution of this project from the interview results. This project also takes into consideration vulnerable road users. Regarding social systems and norms, the project has indirectly contributed to raising people's awareness of traffic safety, however, there are still many traffic violators even after the project, and it is still necessary to continue to raise people's awareness of traffic rules and manners. Therefore, this project has mostly achieved its objectives and thus, effectiveness and impacts of the project are high. No negative impacts on natural environment have been reported. Land acquisition and resettlement did not take place. Regarding operation and maintenance, slight issues have been observed in the technical, financial, and the current status, however, there are good prospects for improvement/resolution. Therefore, sustainability of the project effects is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Due to malfunction of Layer 2 switches, traffic signals at four intersections are not connected to the traffic control systems, resulting in independent display patterns. According to the TCC, these intersections are not major intersections, and the independent signals are not affecting traffic. However, in order for the project to generate effects, the entire project area needs to be integrated into the traffic control systems. Therefore, it is important for the DPWT to replace Layer 2 switches and integrate them into the system as soon as possible.

Traffic signals at six intersections along National Road No.1, which were installed as additional scope of the project, have not been integrated into the traffic control systems, resulting in independent display patterns. It is important for the PPCA and the DPWT to secure budgets for the installation of optic fiber network, etc. and integrate them into the system as soon as possible so as not to cause stagnation of traffic flow between intersections and worsening of traffic congestion.

Since the DPWT does not have equipment to repair when problems such as fiber optic cable

disconnections occur, it has been relying on the private sector to do the repair. In the future, the DPWT plans to rent repair equipment from the private sector and repair it by TCC itself and is currently preparing for it. Thus, it is important for the DPWT to secure budget for rental costs and establish a system to repair by itself.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

<u>When providing support for the development of traffic control systems in urban transport sector, project effectiveness and sustainability can be enhanced by providing complementary support seamlessly, from a comprehensive perspective for overall urban transportation issues</u>

The project was implemented based on *the Comprehensive Urban Transport Plan in Phnom Penh Capital City* formulated by the technical cooperation for development planning "Phnom Penh City Comprehensive Urban Transport Planning Project." Based on the basic concept of *the Comprehensive Urban Transport Plan in Phnom Penh Capital City* , a technical cooperation project "The Project for Improvement of Public Bus Operation in Phnom Penh" and a grant aid project "The Project for Improvement of Transportation Capacity of Public Bus in Phnom Penh" were implemented at about the same time and collaboration among these projects took place. These collaborations have resulted in the development of concrete synergies to improve the urban transportation situation, such as addressing traffic congestion issues and improving bus service delays. In addition, synergistic effects with an ongoing technical cooperation project "Project for Capacity Development on Comprehensive Traffic Management Planning and TCC Operation and Maintenance in Phnom Penh Capital City" is expected. The project will address traffic rules and manners pointed out in interviews with local residents and drivers of public buses and trucks, and further strengthen the capacity of the TCC staff to operate and maintain traffic control systems introduced by the project. This suggests that when providing support for the development of traffic control systems in urban transport sector, project effectiveness and sustainability can be enhanced by seamlessly implementing complementary supports for overall urban transportation issues from a comprehensive perspective, both before and after the project.

End

Kingdom of Cambodia

FY2021 Ex-Post Evaluation Report of Japanese Grant Aid Project

"The Project for Expansion of Water Supply System in Kampot"

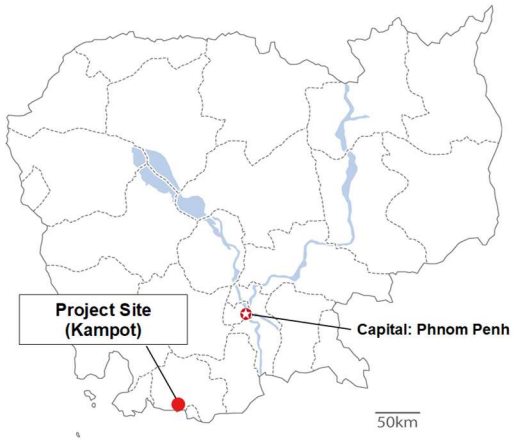
External Evaluator: Masumi Shimamura, Mitsubishi UFJ Research and Consulting Co., Ltd.

0. Summary

This project expanded and improved water supply facilities in Kampot City to improve access to safe water and stable water supply services for the local residents. This project, which aims to improve water supply capacity, is consistent with Cambodia's development policy, development needs, and project plan and approach were appropriate. The project is also consistent with Japan's development cooperation policy, and collaboration with other projects within JICA and organizations outside of JICA has taken place as well and concrete results have been generated. Therefore, relevance and coherence of the project are high. In terms of project implementation, both project cost and project period were within the plan and thus efficiency of the project is very high. As for project effects, quantitative indicators set at the time of planning have all far exceeded the target values. Regarding impacts, interviews with local residents in the surrounding area indicate that improved access to safe water and stable water supply services have improved the living environment of the residents. In addition, the project has contributed to the promotion of water supply connections for poor households, and with the expansion of water supply area, it is expected to have further positive impacts on the society as well. Therefore, the project has generated more effects than planned, and effectiveness and impacts of the project are very high. No negative impacts on natural environment and land acquisition have been reported. Resettlement did not take place. Regarding operation and maintenance, slight issues have been observed in the current status, however, there are good prospects for improvement/resolution. Therefore, sustainability of the project effects is high.

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

1. Project Description



Project Location

Sedimentation Basin at the Water Treatment Plant

1.1 Background

In Cambodia, after the civil war, with the support of Japan and other donors, development support of water supply facilities in the capital city of Phnom Penh and development support of human resources for operation and maintenance have been provided to improve water supply capacity. On the other hand, water supply capacity in local cities other than the capital was still low, and safe water supply to the entire population was not realized. In Kampot City, the capital of Kampot Province, the existing water treatment plant was fully rehabilitated and reconstructed in 2006 with the support of the Asian Development Bank (hereinafter referred to as "ADB"). JICA also implemented a technical cooperation project "The Project on Capacity Building for Water Supply System in Cambodia (Phase 2)" (May 2007–April 2011) with the aim of improving capacity of the staff of the waterworks in eight local cities including Kampot City. In this way, in Cambodia, both in terms of hard measures and soft measures, water supply capacity of local cities was being improved, however, there was an urgent need to expand water supply facilities to further improve water supply capacity.

1.2 Project Outline

The objective of this project is to improve access rate to safe water and provide stable water supply services by expanding and upgrading water supply facility systems in Kampot City, thereby contributing to the improvement of living environment of local residents.

Grant Limit / Actual Grant Amount	2,985 million yen / 2,408 million yen
Exchange of Notes Date /Grant Agreement Date	June 2015 / June 2015
Executing Agency	Ministry of Industry, Science, Technology &Innovation: MISTI
Project Completion	August 2018
Target Area	Kampot City
Main Contractors	Sumitomo Mitsui Construction Co., Ltd. / Swing Corporation (JV)
Main Consultants	Nihon Suido Consultants Co., Ltd. / Kitakyushu City Water and Sewer Bureau (JV)
Preparatory Survey	May 2014–March 2015
Related Projects	[Technical Cooperation] ・ The Project on Capacity Building for Water Supply System (Phase 1) (2003–2006) ・ The Project on Capacity Building for Water Supply System in Cambodia (Phase 2) (2007–2011) ・ The Project on Capacity Building for Urban Water Supply System in Cambodia (Phase 3) (2012–2017) [ADB] ・ Urban Water Supply Project (2014–present) [GRET] (NGO in France) ・ Urban Water Supply Project

2. Outline of the Evaluation Study

2.1 External Evaluator

Masumi Shimamura, 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: November 2021–February 2023

Duration of the Field Study: May 9–28, 2022, September 6–18, 2022

3. Results of the Evaluation (Overall Rating: A[1])

3.1 Relevance/Coherence (Rating: ③[2])

3.1.1 Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Cambodia

At the time of planning, Cambodian government's *the Rectangular Strategy Phase III (2013–2018)* and *the National Strategic Development Plan (2009–2013)* set out its goal to achieve 80% access to safe drinking water in urban areas by 2015. The government also aimed to increase its ratio to 100% by 2025 in its *the National Strategic Development Plan (2014–2018)*, and the then Ministry of Industry & Handicraft (hereinafter referred to as "MIH") was taking the lead in promoting the development of water supply facilities in local cities as an important issue.

At the time of the ex-post evaluation, Cambodian Government's *the Rectangular Strategy Phase IV (2019–2023)* points out the importance of further investment in water supply infrastructure development and rehabilitation. Furthermore, *the National Strategic Development Plan (2019–2023)* states the target to realize 100% access to safe water in urban areas by 2025. Cambodian government also aims to provide affordable water supply services, ensuring quality, safety and sustainability. Thus, the implementation of the project is also consistent with the development policy of Cambodia at the time of the ex-post evaluation.

3.1.1.2 Consistency with the Development Needs of Cambodia

At the time of planning, Kampot City's water supply rate was only 47% due to lack of supply capacity of water treatment plants, inadequate maintenance of distribution pipe network, and aging of some distribution pipes, making it urgent to improve water supply facilities.

At the time of ex-post evaluation, the importance of safe and stable water supply is also high, and further strengthening the water supply capacity of Kampot Waterworks remains a challenge. Specifically, demands for water have increased significantly due to development of resorts, hotels, and villas in the areas served by Kampot Waterworks. In addition, water supply area has expanded in 2021 to include Boeung Touk commune adjacent to Kampot City. Furthermore, construction of a multipurpose port has begun in May 2022, and a distribution center is scheduled to be developed, which is expected to continue to generate strong demand for water in the future.

3.1.1.3 Appropriateness of the Project Plan and Approach

One of the major changes since the time of planning is the strong and growing demand for

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[2] ④: Very High, ③: High, ②: Moderately Low, ①: Low

water in the areas served, as described above. Water supply capacity of Kampot Waterworks has been increased by a local private company to meet the increasing water demand year by year after project completion. Specifically, a new water treatment facility with water supply capacity of 5,000 m^3 per day has been constructed (the facility has begun supplying water in April 2022). This is due to the expansion of Kampot water supply area and the rapid development of the existing water supply area, which could not have been anticipated at the time of planning. Therefore, project plan and approach were considered to be appropriate.

In terms of equity, consideration is given to the poor. Specifically, in order to ensure that the poor have equitable access to safe and affordable water, consideration is given to allow households holding "ID Poor cards" issued by the Ministry of Planning to connect to water pipes free of charge during project formulation and implementation. In addition, water tariff structure is also designed to take into account the poor.

3.1.2 Coherence(Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

At the time of planning, Project Development Plan of Japan's *the Country Assistance Program for Cambodia* placed "development of water supply and sewage infrastructure" as one of the important development issues. In addition, JICA identified "promotion of social development" as a priority area in its *the Country Analysis Paper to Cambodia*, and analyzed the high needs for water and sewage infrastructure in particular. The project aims to improve access rate to safe water and provide stable water supply services through expansion and improvement of the water supply facility system, which was consistent with Japan's development cooperation policy at the time of planning.

3.1.2.2 Internal Coherence

This project has collaborated with technical cooperation projects "The Project on Capacity Building for Water Supply System in Cambodia (Phase 2)" (May 2007–April 2011) and "The Project on Capacity Building for Urban Water Supply System in Cambodia (Phase 3)" (November 2012–November 2017) for operation and maintenance of water supply facilities and water service operations, and concrete synergistic effects have been generated. (See Impacts for concrete synergistic effects.)

In addition, the Cambodian side has established a system for Cambodia's own human resource development of waterworks staff in local cities based on Japan's cooperation to date, and ripple effects can be confirmed. Specifically, staff of Phnom Penh Water Supply Authority (hereinafter referred to as "PPWSA"), whose capacity for water service operation management, and operation and maintenance, etc. was strengthened through the "The Project on Capacity

Building for Water Supply System (Phase 1)" (2003–2006), etc. have served as lecturers to conduct technology transfer in the soft component (capacity development component) of the project, contributing to the capacity building of Kampot Waterworks staff. (See BOX 1.)

3.1.2.3 External Coherence

This project has collaborated with the support by the ADB and the GRET, a French NGO, and has generated concrete synergistic effects. Rehabilitation and expansion of water supply facilities was conducted by the ADB's Urban Water Supply Project,[3] and it was expected that maintenance costs of Kampot Waterworks would be reduced through collaboration with the project. In addition, the GRET's support included construction of distribution pipes, and it was anticipated that the number of people supplied with water would increase and non-revenue water volume would decrease in collaboration with this project. JICA has confirmed the specifics of the supports provided by these organizations and the areas to be supported during project formulation stage, and developed a project plan to avoid overlap with these projects and to generate synergies, and thus generation of long-term effects has been confirmed. (See Impacts for specific synergistic effects.)

In terms of consistency with international frameworks, Cambodian government is committed to achieving SDG Goal 6 by 2030. It states that water tariff is set with consideration for the poor so that all people can access to safe water supply, sanitation facilities, and enjoy a safe, hygienic, and environmentally friendly living conditions. This project is part of efforts to achieve this goal.

The project is consistent with Cambodia's development policy and development needs, and the project plan and approach were appropriate. The project is also consistent with Japan's development cooperation policy, and coordination with other projects within JICA has taken place, and concrete results can be confirmed. Furthermore, with regard to collaboration with organizations outside of JICA and consistency with international framework, collaboration with organizations outside JICA has taken place and concrete results can be confirmed. Therefore, relevance and coherence of the project are high.

3.2 Efficiency (Rating: ④)

3.2.1 Project Outputs

This project expanded and upgraded water supply facilities in Kampot City to improve access rate to safe water for local residents. Tables 1, 2 and 3 compare the planned and actual outputs

[3] The size of ADB's support is 22,848,000 SDRs (SDR stands for Special Drawing Rights, an international reserve asset created by the International Monetary Fund (IMF)).

of major outputs.

Table 1: Comparison of Major Planned and Actual Outputs (Construction of Facilities)

Plan		Actual/ Comparison
Category	Facility Size	
Intake Facility	8,250 m^3/day, Intake Pump Station, Intake Pump Facility	As Planned
Raw Water Transmission	Raw Water Transmission Pipeline Diameter 400 mm, Raw Water Transmission Pipeline Length 5.4 km	Raw Water Transmission Pipeline Diameter 400 mm, Raw Water Transmission Pipeline Length 5.3 km
Water Treatment Facility	7,500 m^3/day, Coagulation-Sedimentation Rapid Sand Filtration	As Planned
Transmission and Distribution Facilities	Transmission and Distribution Pump Station/Facility, Distribution Pipe diameter 63 mm–400 mm, Distribution Pipe Length 88.7 km, Elevated Water Tank 300 m^3	Transmission and Distribution Pump Station/Facility, Distribution Pipe Diameter 63 mm–400 mm (Changes in the Breakdown of Diameter and Length), Distribution Pipe Length 88.9 km, Elevated Water Tank 300 m^3

Source: Results from questionnaire survey of Kampot Waterworks

Table 2: Comparison of Major Planned and Actual Outputs (Installation of Facilities)

Plan			Actual/ Comparison
Category	Equipment	Quantity	
Quality Analysis	Jar Tester	One set	As Planned
	Distillation Apparatus	One set	As Planned
	Turbidity Meter	One set	As Planned
	Turbidity Continuous Monitoring Meter	One set	As Planned
	Laboratory Table	One set	As Planned
	Residual Chlorine Analyzer	One set	As Planned
	Uninterruptible Power System	One set	As Planned
	pH Meter (glass electrode)	One set	As Planned
	pH Meter (BTB)	One set	As Planned

	Portable Conductivity Meter	One set	As Planned
	Conductivity Meter	One set	As Planned
	Spectrophotometer	One set	As Planned
	Reagents	One set	As Planned
	Glassware	One set	As Planned
	Microbiological Measurement Equipment	One set	Added
Mechanical Equipment	Vibration Checker	One set	As Planned
Water Supply Equipment	HDPE Pipes Socket Fusion Equipment	One set	As Planned
	Equipment and Materials for Water Service Connections for Poor Households	900 sets	As Planned

Source: Results from questionnaire survey of Kampot Waterworks

Table 3: Comparison of Major Planned and Actual Outputs (Consulting Services)

Item	Actual/ Comparison
Detailed Design, Tendering Assistance, Construction Supervision	As Planned
Capacity Building Program (Soft Component) • Operation and Maintenance of Water Treatment Facility • Operation and Maintenance of Transmission and Distribution Facility • Production Management	As Planned

Source: Results from questionnaire survey of Kampot Waterworks

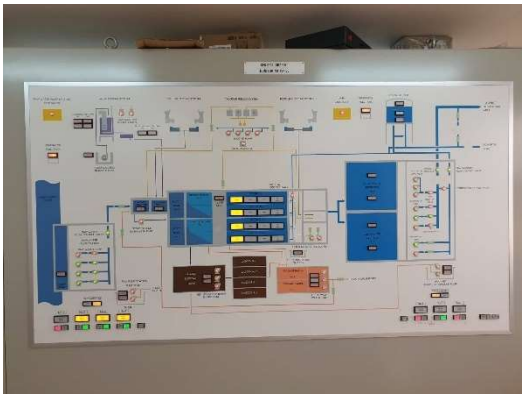
There were some changes from the original plan regarding construction of the facility. Transmission pipeline length and distribution pipe length were modified based on the findings of accurate extensions from field survey and measurement survey during detailed design. Distribution pipe diameters were revised to appropriate sizes based on a review of the pipe network calculations. All of these changes were based on accurate survey results after the preparatory survey and were appropriate changes.

A set of microbiological measurement equipment was added to the procurement equipment. The equipment is a very effective way for Kampot Waterworks to properly monitor water quality and provide clean water that complies with Cambodia's water quality standards, and its addition to the project scope was appropriate.

Regarding other project scopes, it was confirmed through interviews with the executing agency, Ministry of Industry, Science, Technology & Innovation (hereinafter referred to as "MISTI,") and Kampot Waterworks that there were no major changes.

Concerning the work to be undertaken by the Cambodian side, installation of materials and equipment for service connections and water meters for poor households has been completed for 416 (46%) of the 900 sets of materials and equipment provided as of the time of the ex-post evaluation[4]. There is a time lag between the 2008 survey by the Ministry of Planning, which was the basis for the figure of 900 sets, and this figure does not necessarily reflect the number of poor households when the project was implemented. In other words, subsequent economic and social development of the project area may have improved the overall living conditions of local residents and has reduced the number of poor households. In fact, it is unlikely that the poor are being left behind, as Kampot Waterworks has been continuing its efforts to connect water pipes by conducting promotional and awareness-raising activities to promote connection to local residents, including poor households. At the time of planning, it would have been difficult to foresee a decrease in number of poor households.

Office Building and Elevated Water Tank



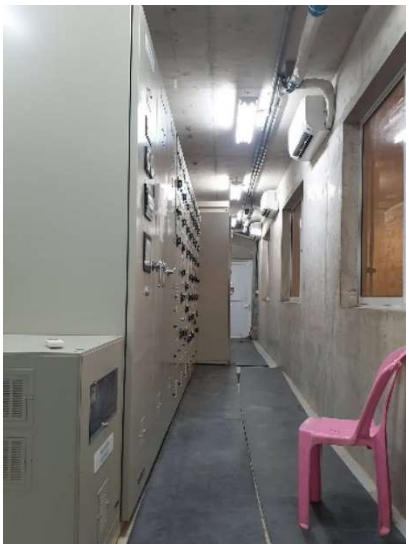
Water Distribution Flow Monitoring Panel

[4] The remaining materials and equipment will continue to be used to connect poor households in the existing water supply area of Kampot Waterworks, and with the expansion of water supply area, the plan is to use them when poor households in the new water supply area apply for connection work.

Water Quality Testing Equipment

Chemical Feeding Facility

Distribution Pump



Distribution Pump Station Control Room

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost was initially planned to be 3,005 million yen (2,985 million yen on the Japanese side, 20 million yen on the Cambodian side). In actuality, the total project cost was 2,428 million yen[5] (2,408 million yen on the Japanese side, 20.7 million yen on the Cambodian side), which is within the plan (81% of the planned amount). The costs borne by the Cambodian side include the costs of land acquisition, installation of electricity to the new intake and water treatment facilities, and conducting surveys and removing unexploded ordnance.

[5] Amounts less than one million yen were rounded down.

3.2.2.2 Project Period

The overall project period was planned as 38 months, from July 2015 (start of the detailed design) to August 2018 (completion of construction/procurement) as opposed to 36 months in actuality, from September 2015 (start of the detailed design) to August 2018 (completion of construction/procurement), which is within the plan (95% of the planned period). Table 4 summarizes the comparison of planned and actual project period.

Table 4: Comparison of Planned and Actual Project Period

Plan	Actual
July 2015–August 2018 (38 months)	September 2015–August 2018 (36 months)
Breakdown: Detailed Design and Tendering Period	
Detailed design: 7.5 months Tendering period: 3.5 months	September 2015–April 2016 (8 months)
Breakdown: Construction and Procurement Period	
Construction and Procurement Period: 27 months	April 2016–August 2018 (29 months)

Source: Information provided by JICA and results from questionnaire survey of Ministry of Industry, Science, Technology and Innovation

Note 1: The starting point of the project period is the start of the detailed design, and the definition of project completion is the date of completion of construction/procurement. The project period does not include the defect liability period for both planned and actual.

Therefore, efficiency of the project is very high.

3.3 Effectiveness and Impacts[6] (Rating: ④)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

At the time of planning, "served population," "daily average water supply volume" and "number of domestic service connections" were set as quantitative effects of the project. Table 5 summarizes baseline, target and actual values between 2019 and 2021 for each indicator. As the project completion is August 2018, the target year to be compared is 2021, three years after completion. The target achievement rates are shown in parentheses in the table.

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

Table 5: Quantitative Effects of the Project

Indicators	Baseline Value 2013 Actual Value	Target Value 2021 3 Years After Completion	Actual Value		
			2019	2020	2021 (Note 3)
Served Population (person) (Note 1)	23,657	55,874	52,840	61,610	67,875 (121%)
Daily Average Water Supply Volume (m^3/day)	4,252	10,339	10,426	12,839	13,147 (127%)
Number of Domestic Service Connections (Note 2)	4,834	11,417	10,568	12,322	13,575 (119%)
Reference Value (Note 4)					
Number Connected to the Poor Households out of Total Number of Domestic Service Connections	—	—	239	324	416
Non-Revenue Water Rate (%)	17.78	—	8.90	8.65	8.45

Source: Information provided by JICA and results from questionnaire survey of Kampot Waterworks
Note 1: If population growth within the water supply area continued as projected, the water supply rate is expected to reach 92% in 2021, up from 47% in 2013.
Note 2: The target value includes the number of households that can be newly connected to the water supply pipeline network as a result of the construction of new water treatment facilities (6,014 households), as well as the use of excess capacity in existing facilities (569 households).
Note 3: The water supply to the Boeung Touk commune adjacent to the project area started in 2022; therefore, it is not included in the actual figures for 2021.
Note 4: Indicators that were not included in the original plan but were added at the time of the ex-post evaluation.

The actual values for each of the indicators set at the time of planning have increased every year since the project was completed, and all have far exceeded the target values. The achievement rates for the actual values in 2021 are 121%, 127%, and 119% for "served population," "daily average water supply volume," and "number of domestic service connections," respectively, far exceeding the targets. As mentioned above in "3.1.1.3 Appropriateness of the Project Plan and Approach," the large increase in water demand was due to the rapid development of Kampot City, which was not anticipated at the time of planning. For this reason, after project completion, a new water treatment facility with water supply capacity of 5,000 m^3 per day was constructed by a local private company, and its water supply was started in April 2022. The water supply capacity of Kampot Waterworks is being further enhanced to meet the further increase in water demand and the expansion of the water supply area.

As mentioned in "3.2.1 Project Outputs," "number connected to the poor households out of total number of domestic service connections," which is mentioned as a reference value, is 416 in 2021 (46% of 900 sets of materials and equipment provided). In addition, as a reference value, "non-revenue water rate" obtained from Kampot Waterworks is on a downward trend,

and the actual value in 2021 is 8.45%, which suggests that its water service operations are in very good condition.

3.3.1.2 Qualitative Effects (Other Effects)

Qualitative effects were classified as impacts.

3.3.2 Impacts

3.3.2.1 Intended Impacts

As impacts of this project, state of generation of "improvement of insufficient water pressure from water taps," "improvement of sanitation environment and alleviation of water shortage concerns for local residents who have been using rainwater, etc.," "improvement of water leakage in the existing water supply areas" and "promotion of water connections to the poor" were evaluated.

1) Improvement of insufficient water pressure from water taps

According to Kampot Waterworks, water pressure before the project was 0.1 bar,[7] but after the project, water pressure was increased to 1 bar. Water supply time before the project was about 18 hours a day, but after the project, 24 hours water supply has been realized.

In addition, as a result of interview survey conducted with 14 local residents[8] in the water supply service area, all the respondents who use water from Kampot Waterworks indicated that they are satisfied with water supply service, as water volume and water pressure are sufficient and water supply is stable 24 hours a day, 365 days a year, without any difference between rainy and dry seasons. When asked the residents who were not connected to water pipes the reasons, three residents (all of whom were not "ID Poor card" holders) said that they were not connected because the initial cost[9] for connection was high.

2) Improvement of sanitation environment and alleviation of water shortage concerns for local residents who have been using rainwater, etc.

Results of interviews with local residents in the water supply service area confirmed that

[7] 1bar is the force that can push water up to a height of 10m.

[8] The 14 local residents consisted of three men (one in 30s, one in 50s and one in 60s) and 11 women (two in 30s, one in 40s, five in 50s and three in 60s). Interviews were conducted to the following four categories of residents.

- Residents who have been connected to the water pipe before the project and can compare the differences before and after the project. (three residents: one woman in 30s, one woman in 50s and one woman in 60s.)
- Residents who have newly connected to the water pipe after the project. (three residents: one woman in 30s, one man in 50s and one woman in 50s.)
- Target residents of the connection support system for the poor. (four residents: one man in 30s, two women in 50s and one woman in 60s.)
- Residents who are unconnected. (four residents: one woman in 40s, one woman in 50s, one man in 60s and one woman in 60s.)

[9] Initial fee of 356,800 Riel (about USD89) is charged, consisting of a connection fee of 319,000 Riel and a deposit of 37,800 Riel.

sanitary conditions of the residents have improved after the project. Following responses were obtained: “after connecting to the water pipe after the project, frequency of showering, washing hands, and washing has increased,” “because tap water is clean, it does not make my hair sticky or skin itchy after showering, so I can use water with peace of mind,” “because tap water is clean, I drink it without boiling it,” “since I started using tap water, I no longer have diarrhea,”[10] “after connecting to the water pipe after the project, water is available 24 hours a day, and there is no need to worry about water shortage.”

3) Improvement of water leakage in the existing water supply areas

According to Kampot Waterworks, it is monitoring water flow data using the water distribution flow monitoring system installed by the project. Staff in charge are appointed to each water distribution block to check and manage water distribution pressure and flow volume. In addition, water distribution maps, piping history, customer information, etc., have been prepared to reduce non-revenue water rate and improve water leakage based on the past history. The trend of non-revenue water rate has been decreasing year by year as shown in Table 5, indicating that the situation is improving.

Kampot Waterworks plans to continue the following efforts to keep the non-revenue water rate below 8%.

- Strengthen water distribution block management
- Replace water meters in each distribution block
- Replace existing old water pipes with new pipes
- Install water distribution pipes with the same diameter as the replacement mentioned above when connecting to a new water supply area

4) Promotion of water connections to the poor

Kampot Waterworks has introduced preferential treatment for the poor by installing water supply connection equipment and water meters free of charge for poor households.[11] As mentioned earlier in “3.2.1 Project Outputs,” Kampot Waterworks has been carrying out promotion and awareness-raising activities by holding public forums and other briefings for local residents to promote water connection among the poor, and plans to continue these activities in the future.

Through interviews with local residents in the water supply service area, it is confirmed that living conditions have improved after the project from those eligible for the connection

[10] It should be noted that it is difficult to prove a causal relationship between the project and improvement of waterborne diseases such as diarrhea.

[11] Normally, a connection fee of 319,000 Riel and a deposit of 37,800 Riel, for a total of 356,800 Riel (about USD89), are charged, but the poor can connect to the water pipes with only a deposit (about USD9).

support program for the poor (households holding the "ID Poor card"). Following responses were obtained: Before the project, fetching water (drawing water from wells or purchasing water) was time-consuming and labor intensive (time required per fetch varied from about 30 minutes to about three hours,[12] depending on the respondent), and children also had to fetch water. However, after the project, they were able to spend more time on housework and taking care of their children and grandchildren (two respondents), work full time (one respondent), sell their harvested crops and food (one respondent), and earn extra income by selling fish caught in the river (two respondents).

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Natural Environment

The project was classified as Category B based on the *JICA Guidelines for Confirmation of Environmental and Social Considerations* (April 2010) since it does not fall under any sensitive sectors/characteristics or sensitive areas, and its undesirable effects on the environment were considered to be not significant. According to MISTI, the Initial Environmental Impact Assessment (IEIA) report was prepared and submitted to the Ministry of Environment on November 1, 2016, and was approved by the Ministry on November 11, 2016.

According to Kampot Waterworks, water quality, air quality, noise and vibration, waste, safety management, and sanitation management were monitored in accordance with the environmental monitoring plan, and there were no major problems, such as exceeding the standards. In addition, environmental mitigation measures including cleaning up public roads and work areas after daily construction work, separating waste, assigning traffic control personnel at the construction site, and instructing workers on handling hazardous chemicals were conducted, and facilities were constructed in an environmentally friendly manner.

As a result of environmental monitoring, no negative impacts on the natural environment have been reported, and no complaints have been received from local residents. Based on interviews with local residents in the water supply service area and the results of the project site inspection, it can be considered that there were no major problems with the natural environment.

[12] Respondents varied in the time it took to fetch water. Residents who had gone to the pond to fetch water said it took them about 30 minutes. Residents who purchased water from neighbors connected to the water supply pipes said that it took them about 10 minutes to get to their homes, but sometimes water pressure was so low that only a little water came out of the faucet, and sometimes they had to wait for two to three hours until the container became full.

2) Resettlement and Land Acquisition

According to Kampot Waterworks, land acquisition has occurred from one landowner for a site (9,656m^2) for the construction of a new water treatment plant. The construction site was vacant, there were no one making a living or informal residents on the construction site, and the land was purchased from the landowner at market price. According to Kampot Waterworks, land acquisition process was carried out smoothly in accordance with Cambodia's domestic procedures and the *JICA Guidelines for Confirmation of Environmental and Social Considerations*, and there were no complaints from the landowner, including the purchase price, and there were no problems. Resettlement did not occur.

3) Gender Equality

As a result of questionnaire survey of Kampot Waterworks and interviews with local residents in the water supply service area, it was confirmed that women's employment has been promoted after the project. Female residents responded "by reducing the time spent fetching water, women are now able to sell their harvested crops and food products," and "women can earn additional income by selling fish caught in the river."

4) Marginalized People

It was confirmed that poor households are connected to the water supply system, and their access to safe and affordable water has been realized. As mentioned earlier in "3.3.2.1 Intended Impacts" under "4) Promotion of water connections to the poor," the project has installed water supply connection equipment and water meters to the poor free of charge, and has introduced preferential treatment for the poor. In interviews with residents in the water supply service area, residents eligible for the connection support system for the poor (households with "ID Poor cards") responded that they were very satisfied with the water service, and water tariff was reasonable, and that they were able to pay it without delay.

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

The project has enabled the poor to access safe and affordable water. Interviews with residents eligible for the connection support system (households with "ID Poor cards") indicated that they are satisfied with being able to use clean water anytime without worrying about water tariff.

6) Unintended Positive/Negative Impacts

<Synergies with other projects in JICA>

Questionnaire survey and interviews with MISTI and Kampot Waterworks have confirmed that through collaboration with other projects within JICA,[13] Kampot Waterworks has gained high customer satisfaction for its water supply services, improved water leakage situation, reduced non-revenue water rate, and operated water services in net positive. Results of interviews with local residents in the water supply service area indicated a high level of satisfaction with the service provided by Kampot Waterworks from all respondents who use the waterworks' tap water. In addition, as shown in Table 5, non-revenue water rates have been decreasing year by year, and as mentioned later in "3.4.4 Financial Aspect," Kampot Waterworks' water service operations have been running profits and is financially sound.

Various Standard Operating Procedures (herein after referred to as "SOPs") developed under the soft component of the project were coordinated with "The Project on Capacity Building for Water Supply System in Cambodia (Phase 2)" regarding SOP creation, improvement, and guidance, and Kampot Waterworks is now able to update its customer ledgers, asset ledgers, and financial statements based on the SOPs. (See "3.4.3 Technical Aspect" and "3.4.4 Financial Aspect" below.)

Kampot Waterworks has introduced a Systematic Utility Management System, hereinafter referred to as "SUMS" in "The Project on Capacity Building for Urban Water Supply System in Cambodia (Phase 3)." Its water service operations can now be managed by utilizing SUMS, and MISTI is strengthening its monitoring system. (See "3.4.2 Institutional/Organizational Aspect" below.)

<Synergies with organizations outside of JICA>

According to Kampot Waterworks, its maintenance costs have reduced through collaboration with the ADB's Urban Water Supply Project. For example, it explained that reduction in power consumption volume has been realized – before collaboration, power consumption volume in the maximum month had been 54,440kw/month, whereas it was reduced by about 25% to 40,609kw/month. In addition, one flowmeter installed in the project had failed due to a lightning strike, and Kampot Waterworks is planning to replace it with a flowmeter procured under the ADB project. (See "3.4.7 Status of Operation and Maintenance" below.)

Kampot Waterworks also explained that the number of people supplied with water has increased in collaboration with the assistance provided by GRET. In addition, flowmeters

[13] "The Project on Capacity Building for Water Supply System in Cambodia (Phase 2)" and "The Project on Capacity Building for Urban Water Supply System in Cambodia (Phase 3)"

installed in the project enabled leak detection in GRET-supported areas and existing water supply areas, leading to decrease in non-revenue water rate for Kampot Waterworks.

This project has achieved its objectives more than planned. Therefore, effectiveness and impacts of the project are very high.

3.4 Sustainability (Rating: ③)

3.4.1 Policy and System

MIH, which at the time of planning had jurisdiction over water service operations, was renamed MISTI in April 2020 and continues to be responsible for the oversight of water service operations. According to MISTI, *the National Strategic Development Plan (2019–2023)* goal of 100% access to safe water in urban areas by 2025 is maintained. There is also no change in the policy of taking care to ensure that the poor have equitable access to safe and affordable water.

From the above, sustainability of policy and system of the project is assured.

3.4.2 Institutional/Organizational Aspect

Operation and maintenance of the project after completion is undertaken by Kampot Waterworks under the supervision of MISTI and Department of Industry, Science, Technology & Innovation (hereinafter referred to as "DISTI") in Kampot Province, which is a sub-national organization of MISTI in Kampot Province.

MISTI, Kampot DISTI, and Kampot Waterworks are in constant communication and working closely together. For example, Kampot Waterworks prepares an annual operation and maintenance plan and submits it to DISTI and MISTI for final approval before conducting operation and maintenance work. In addition, DISTI is informed in advance of any extension of water distribution pipes or new connections. Furthermore, Kampot Waterworks reports its financial status, including revenues and expenses, to DISTI and MISTI every three months.

SUMS, which was introduced in "The Project on Capacity Building for Urban Water Supply System in Cambodia (Phase 3)" is now being utilized by public water utilities, including Kampot Waterworks, for customer information management, finance, accounting, etc., and MISTI has established a system to monitor the public water utilities.

Kampot Waterworks has 56 staff members. It consists of one Director, one Deputy Director, four members in Administration Section, 16 members in Business Section, four members in Finance Section, 16 members in Production Section and 14 members in Connection Section. Its work allocation and number of staff are shown in Table 6. According to Kampot Waterworks, they currently have necessary personnel to operate and maintain the water supply facilities. It

was pointed out that in light of vigorous increase in water demand, number of staff will need to be increased in the future.

Table 6: Work Allocation and Number of Staff of Kampot Waterworks

Position/Section	Work Allocation	Number of Staff (Person)
Director	General Management	1
Deputy Director	Assistant to the Director	1
Administration Section	General Affairs, Human Resources Management, Planning and Administration	4
Finance Section	Tariff Collection, Accounting and Finance	4
Business Section	Customer Management, Water Meter Reading, Billing	16
Production Section	Water Treatment Plant Operation and Maintenance, Water Quality Control	16
Connection Section	Leakage Investigation and Repair, Pipe Network Management, Pipe Extension, Renewal	14
Total		56

Source: Results from questionnaire survey of Kampot Waterworks

From the above, no particular problems have been identified regarding the institutional/organizational aspect of operation and maintenance.

3.4.3 Technical Aspect

According to Kampot Waterworks, there is limited qualification for water service operators in Cambodia, and at the Waterworks, there is no technical qualification holders for the operation and maintenance staff with the exception of one Production Manager, who majored in electrical engineering. However, staff in charge of operation and maintenance have accumulated necessary experiences and knowledge through the soft component of this project, training by the JICA technical cooperation projects as well as guidance through on-the-job-training. Thus, they are improving their technical level sufficient to carry out daily operation and maintenance work.

Training record in the soft component of the project (capacity strengthening related to operation and maintenance of water treatment facilities and water distribution facilities, and production management) is shown in Table 7. According to Kampot Waterworks, in addition to

the project consultant and Kitakyushu City staff, PPWSA staff accompanied the project and participated as instructors. The training participants explained that "PPWSA staff explained effectively with their own experiences and the participants were able to deepen their understanding" and "participation of PPWSA staff made the training more contextualized in Cambodia," indicating that technology transfer was effectively conducted.

[BOX 1: Developing Effective Support Based on a Long-Standing Relationship of Trust with JICA]

In this project, PPWSA staff have participated in the training of staff of Kampot Waterworks. PPWSA has enhanced its capacity by receiving technology transfers from Kitakyushu City related to water service operation and maintenance through past JICA projects and cooperation, and PPWSA staff members are now in a position to provide technology transfers to local waterworks as trainers. In other words, PPWSA is disseminating its own good practices to local public waterworks. PPWSA's technical capabilities and know-how have been developed through past JICA projects, etc. The longstanding relationship of trust and cooperation between JICA and PPWSA has extended to support for local public waterworks. Through capacity development, Kampot Waterworks has solidified its appropriate management foundation of the water service operations, reduced non-revenue water rate, and ensured good operation and maintenance, thereby improving access to safe water. It is expected that further collaboration and cooperation beyond the framework of individual projects like this project will continue based on the longstanding relationship of trust and cooperation between JICA and the Cambodian side.

According to Kampot Waterworks, lecture contents and materials from the soft component are shared with all operation and maintenance staff, including newly hired staff. However, it was pointed out that the water distribution flow monitoring system introduced in this project is a Japanese system newly introduced to the Waterworks, and since the understanding of the Waterworks staff is still at a general level, it sometimes takes time to respond to system malfunctions, etc., and further capacity building is needed.

As mentioned earlier in "3.3.2.2 Other Positive and Negative Impacts" for the various SOPs[14] developed under the project, the project has collaborated with "The Project on Capacity Building for Water Supply System in Cambodia (Phase 2)," which enabled the Waterworks to

[14] SOPs related to water treatment and quantity control, facilities management, water quality inspection, distribution facilities management, distribution flow monitoring system, and production management were created under the project.

update its customer ledgers, asset ledgers, and financial statements based on the SOPs. SOPs are always available at the site of the Waterworks and are utilized as reference in their daily operations.

Table 7: Training Record

	Course		Number of Participants
Primary	Operation and Maintenance of Water Treatment Facilities		12
	Operation and Maintenance of Water Distribution Facilities		4
Secondary	Operation and Maintenance of Water Treatment Facilities	Water Treatment	13 (4)
		Water Quality	2
	Operation and Maintenance of Water Distribution Facilities		4
	Production Management		4

Source: Information provided by JICA and results from questionnaire survey of Kampot Waterworks

Note: The numbers in parentheses indicate the number of participants who also attended the production management course. Training was conducted in February 2018 (primary) and July–August 2018 (secondary).

From the above, technical staff in charge of operation and maintenance appear to have sufficient technical capacity to conduct usual operation and maintenance tasks, and there are no particular problems.

3.4.4 Financial Aspect

Operation and maintenance costs of the project are covered by the revenues of the Kampot Waterworks, but approval from MISTI must be obtained each year in order to be expended. Therefore, after estimating the amount required each year, Kampot Waterworks requests to MISTI through DISTI, the sub-national organization of MISTI in Kampot Province, for approval after scrutiny by MISTI. The amounts requested and approved by MISTI and actual expenditures for maintenance and management costs related to Kampot Waterworks' operating system and water distribution facilities are shown in Table 8.

Table 8: Maintenance Cost of Operating Systems and Water Distribution Facilities for Kampot Waterworks

(Unit: million Riel)

	2018	2019	2020	2021
Amount Requested to MISTI	288.3	388.4	452.3	730.6
Approved Amount	288.3	388.4	452.3	730.6
Actual Expenditure	351.8	420.2	659.8	759.0

Source: Results from questionnaire survey of Kampot Waterworks

Note 1: Personnel costs are not included in the operation and maintenance costs.

Note 2: Actual expenditures exceeded the approved amount due to emergency expenditures that were not anticipated at the time of planning.

Kampot Waterworks' water tariff revenues are shown in Table 9.

Table 9: Water Tariff Revenue of Kampot Waterworks

(Unit: million Riel)

2018	2019	2020	2021
3,204.4	4,995.7	6,172.6	6,286.8

Source: Results from questionnaire survey of Kampot Waterworks

According to Kampot Waterworks, water tariff collection rate is 98%. Water users can pay at the counter located in the same Waterworks building or make a transfer through mobile banking system.

Water tariff structure of Kampot Waterworks is shown in Table 10. Water tariffs are regulated by the MISTI Ministerial Decree. The tariff structure is designed to be accessible to the poor, taking into consideration customers with low water volume usage fees.

Table 10: Water Tariff Structure of Kampot Waterworks

(Unit: Riel/m^3)

Amount Used (m^3)	0–3	4–7	8–15	16–50	51–
Tariff	1,100	1,200	1,300	1,400	1,500

Source: Results from questionnaire survey of Kampot Waterworks (MISTI Ministerial Decree 154/2020)

Financial data for Kampot Waterworks are shown in Table 11. Its water service operations have been running profits and it is financially sound.

Table 11: Financial Data for Kampot Waterworks

(Unit: million Riel)

	2018	2019	2020	2021
Income from Selling Water	3,204.4	4,995.7	6,172.6	6,286.8
Income from Water Connection	408.5	988.3	581.0	367.7
Other Income	113.7	114.1	133.5	126.7
Total Income	**3,726.6**	**6,098.1**	**6,887.1**	**6,781.3**
Salary and Other Allowances	642.5	1,405.5	1,091.3	1,155.6
Repair and Maintenance (Operating System)	75.3	106.7	157.0	166.4
Repair and Maintenance (Distributing System)	276.5	313.5	502.8	592.6
Repair and Maintenance Vehicles	35.8	38.2	36.0	56.2
Diesel for Business	27.4	46.1	56.0	65.0
Raw Material for Water Treatment	227.4	337.8	419.1	471.9
Electric Power	766.2	793.6	944.4	953.3
Diesel for Production	37.0	65.8	61.4	72.6
Printing	10.5	14.2	15.3	18.4
Administrational Expense	333.5	364.0	413.3	371.3
Training	6.4	6.9	3.2	0
Other Expenses	0	1.7	0.9	26.4
Total Operation Expense	**2,438.5**	**3,493.9**	**3,700.4**	**3,949.7**
Household Connection Equipment	351.4	850.6	499.9	334.8
Other Expense	7.7	7.9	17.5	6.6
Expense Other than Business Operation	8.0	8.0	8.0	8.0
Sub Total	2,805.6	4,360.4	4,255.9	4,299.1
Profit Before Depreciation	**920.9**	**1,737.7**	**2,631.1**	**2,482.2**
Depreciation, Interest	467.0	568.5	608.7	610.6
Grand Total Expense	**3,272.6**	**4,928.9**	**4,864.6**	**4,909.7**
Profit Before Tax	**454.0**	**1,169.2**	**2,022.5**	**1,871.6**
Tax on Profit	37.3	61.0	68.8	67.8
Net Profit	**416.7**	**1,108.2**	**1,953.7**	**1,803.8**

Source: Prepared based on the results from questionnaire survey of Kampot Waterworks

Note 1: Some figures do not match due to rounding.

From the above, there are no particular problems with financial aspect of operation and maintenance.

3.4.5 Environmental and Social Aspect

As a result of confirming with MISTI and Kampot Waterworks, there were no unexpected environmental and social considerations.

3.4.6 Preventative Measures to Risks

According to MISTI and Kampot Waterworks, as mentioned earlier in "3.1.1.2 Consistency with the Development Needs of Cambodia," water demand is increasing rapidly due to rapid

development in the supply area, and water demand is expected to increase significantly in the future due to construction of a multipurpose port and development of distribution centers. For this reason, a contract with a local private company has been concluded to build a new water treatment facility with water supply capacity of 5,000 m^3/day. It is expected to reach its maximum production capacity (18,800 m^3/day) by 2025, and studies are underway to further increase production capacity.

3.4.7 Status of Operation and Maintenance

Facilities developed by the project are in normal operation, and both water pipes to the elevated water tank and distribution pipe network are fully functional and well utilized. Based on the maintenance and inspection guideline, Kampot Waterworks conducts daily patrols and inspections of facilities and equipment, implements periodic maintenance, and keeps records.

According to Kampot Waterworks, two of the flowmeters installed in this project are out of order. The flowmeter at the S1 location was damaged by a lightning and the flowmeter at the S6 location was disconnected. According to Kampot Waterworks, the flowmeter at the S1 location will be replaced by the on-going ADB's Urban Water Supply Project. The flowmeter at the S6 location is under consideration for a measure to deal with the situation, depending on the budget. Kampot Waterworks pointed out that since the other flowmeters are functioning properly, it is possible to calculate water volume to the block of failed flowmeters and no real problems have occurred.

Spare parts are stored at Kampot Waterworks' warehouse and inventory lists are being updated. There are no particular problems with procurement of spare parts, and there are sufficient stocks of important spare parts.

From the above, there are small problems in the operation and maintenance status at the time of the ex-post evaluation, but as a whole, there is no problem because facilities are properly operated and maintained.

Slight issues have been observed in the current status of operation and maintenance, however, there are good prospects for improvement/resolution. Therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project expanded and improved water supply facilities in Kampot City to improve access to safe water and stable water supply services for the local residents. This project, which aims to improve water supply capacity, is consistent with Cambodia's development policy, development

needs, and project plan and approach were appropriate. The project is also consistent with Japan's development cooperation policy, and collaboration with other projects within JICA and organizations outside of JICA has taken place as well and concrete results have been generated. Therefore, relevance and coherence of the project are high. In terms of project implementation, both project cost and project period were within the plan and thus efficiency of the project is very high. As for project effects, quantitative indicators set at the time of planning have all far exceeded the target values. Regarding impacts, interviews with local residents in the surrounding area indicate that improved access to safe water and stable water supply services have improved the living environment of the residents. In addition, the project has contributed to the promotion of water supply connections for poor households, and with the expansion of water supply area, it is expected to have further positive impacts on the society as well. Therefore, the project has generated more effects than planned, and effectiveness and impacts of the project are very high. No negative impacts on natural environment and land acquisition have been reported. Resettlement did not take place. Regarding operation and maintenance, slight issues have been observed in the current status, however, there are good prospects for improvement/resolution. Therefore, sustainability of the project effects is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Two of the flowmeters installed by the project are out of order. One of these is scheduled to be replaced under ADB's on-going Urban Water Supply Project, while the other is being discussed at Kampot Waterworks, depending on how the budget fits into the project. Therefore, it is important for Kampot Waterworks to promptly coordinate with MISTI to secure budget and replace the flowmeter as soon as possible.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

<u>Consideration and Efforts to Ensure Access to Safe and Affordable Water for the Poor</u>

In the project formulation and implementation, consideration is given to ensure that the holders of the "ID Poor card" issued by the Ministry of Planning (the poor) can connect to the water pipes free of charge and water tariff is set at a level that the poor can afford. In addition, Kampot Waterworks has been conducting promotional and awareness-raising activities to encourage local residents, including poor households, to connect to water pipes. Combination of these

considerations and efforts has resulted in access to safe and affordable water for the poor, and Kampot Waterworks' services are highly supported by the poor. In order to promote water service connection for the poor in urban water supply projects, it would be effective to include equipment and materials for water service connections for poor households in the project scope so that connection fee for the poor can be reduced or exempted, as in this project. It is also considered effective for water utilities to include poverty considerations in their water tariff structure and to conduct promotional and awareness-raising activities.

Expansion of Development Effects Through Synergies with Other Donor Support and JICA Technical Cooperation, etc.

Through collaboration with the ADB project, French NGO support, and JICA technical cooperation projects, this project has generated concrete synergistic effects, such as reduction of maintenance costs, increase in served population, enhanced water leak detection, and reduction of non-revenue water rates. All of these have led to the realization of sound management of Kampot Waterworks. Regarding collaboration with other donors, at the project formulation stage (during the preparatory survey), contents of other donors' support and their target support areas were specifically confirmed. The fact that the project plan was prepared in such a way as to avoid overlap with these projects and to create synergies was a factor in increasing effectiveness of collaboration. In addition, participation of Kitakyushu City Water and Sewer Bureau, which has more than 20-year history of cooperation with Cambodia in both this project and technical cooperation projects and is familiar with the local situation, enabled JICA to strengthen consistent program management. The project has been implemented in the following sequence: "The Project on Capacity Building for Water Supply System in Cambodia (Phase 2)" (2007–2011) and "The Project on Capacity Building for Urban Water Supply System in Cambodia (Phase 3)" (2012–2017) and this project (September 2015–August 2018), with Kitakyushu City Water and Sewer Bureau participating in all projects on the technology transfer side. Furthermore, some of the technical staff received training in all or several of these technical cooperation projects and this project (soft component), and follow-up and aftercare was provided across projects, which increased collaboration among JICA projects. In addition, the project has also contributed to utilization of private sector in water service operations, as water supply capacity was increased in cooperation with a private company to meet further increases in water demand after project completion. This suggests that a program approach utilizing various actors is effective as a strategic support approach in the water supply sector.

[BOX 2: Cambodia's Continuous Efforts in the Water Supply Sector]

One of the major success factors of this project is the collaboration with other donors and JICA technical cooperation projects. In addition, Cambodia's own efforts to strengthen the base of local public waterworks are considered to have been largely contributed to the success. Looking back at efforts in water supply sector in Cambodia, H.E. Ek Sonn Chan, former PPWSA Director General, who restructured water service operations in Phnom Penh Capital City through the reform of PPWSA, strengthened local public waterworks including Kampot Waterworks when he was a Secretary of State of MIH (2013–2018), the predecessor of MISTI, and the mechanism established through these efforts is considered to have been carried forward today. At that time, H.E. Ek Sonn Chan, together with MIH, PPWSA staff members and JICA experts for the Project on Capacity Building for Urban Water Supply System in Cambodia (Phase 3) visited local public waterworks as part of a "Provincial Tour" (2014–2016) to diagnose the management situation, operation and maintenance status, and direct and supervise immediate actions. The local public waterworks have also noted increased momentum and further commitment to improve their management. In 2016, MIH's Department of Potable Water Supply was upgraded to the General Department of Potable Water. Furthermore, Department of Technics and Project Management, which comprehensively oversees all water service operations (technical aspect) and project implementation including this project, was newly established, and successive staff assigned to this department have worked enthusiastically to achieve good results. In addition, during project implementation, MIH's Department of Potable Water Supply / General Department of Potable Water visited the project site every month to check the progress of the project and to further strengthen commitment of contractor, consultant, and Kampot Waterworks. The "Provincial Tour" resumed in 2022, and MISTI, which oversees the provincial public waterworks, keeps track of quantitative and qualitative performance of each public waterworks and provides guidance and advice, etc. in a timely manner. Such a system has led to competition among public waterworks in order to improve performance, and is considered to be a factor in achieving high results in this project as well.

End

Socialist Republic of Viet Nam

FY2021 Ex-Post Evaluation Report of Technical Cooperation Project

"The Project for Capacity Enhancement in Road Maintenance/The Project for Capacity Enhancement in Road Maintenance Phase II"

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

0. Summary

The objective of this project[1] was to strengthen the implementation capacity of the implementing agency for road maintenance of the national roads network through two phases of technical cooperation projects. It was envisioned that the objective was achieved by developing a pavement management system (hereinafter referred to as "PMS[2]") specially adapted to Viet Nam's operation method, by improving and applying it, and by supporting the construction of a system for improvement, formulation, and implementation of technical standards and institution. As a result, based on the medium-term maintenance plan, it was expected that appropriate road maintenance would be implemented along with the PDCA cycle management[3]. The objective of the project was consistent with the development policies and needs of the country and the project plan and approach was appropriate. The project was consistent with the development cooperation policy of Japan. It also collaborated with other projects of JICA and with other organizations such as the World Bank (hereinafter referred to as "WB"), and concrete results have been confirmed. Therefore, relevance and coherence are high. Through implementation of the project, improvement of the implementing capacity of the implementing agency for road maintenance, which was set as the project purpose, was achieved. In addition, the project has contributed to the overall goal of maintenance work based on the PDCA cycle to a certain extent. The project results have been largely achieved as planned, therefore, the effectiveness and impacts of the project are high. Efficiency is high as the project cost and period slightly exceeded the plan. Sustainability of the effects of the project is moderately low since there are some minor financial issues and they are not expected to be improved/resolved in the near future.

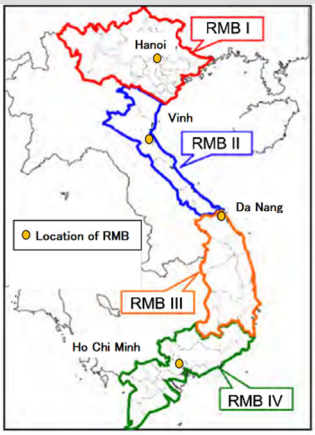
In light of the above, this project is evaluated to be satisfactory.

[1] Phase I and Phase II are collectively referred to as "this project."

[2] PMS is one of the tools for accurately grasping and predicting pavement conditions, and accurately judging what kind of management action to implement at what timing within budget constraints for systematic and efficient pavement management. (Japan Road Association website (in Japanese): https://www.road.or.jp/technique/pavement.html)

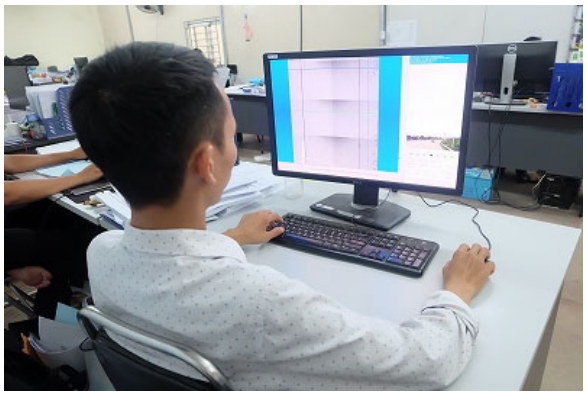
[3] It is a management method to enhance work efficiency by repeating Plan (P), Do (D), Check (C) and Action (A).

1. Project Description



Project Location

Source: Modified from Information provided by JICA



RMB officer analyzing pavement condition data

Source: Taken by local consultant at the time of ex-post evaluation survey

1.1 Background

National road network of Viet Nam has been improved with the support from Japan, WB, the Asian Development Bank (ADB) and others in addition to its own budget, which has contributed to its strong economic development. On the other hand, since the priority was set for the construction and major rehabilitation in road sector, the sufficient budget was not allocated to the road maintenance. Thus, the adequate maintenance was not implemented. In the field of road maintenance, the Directorate for Roads of Viet Nam under the Ministry of Transport (hereinafter referred to as "DRVN"), which is in charge of the maintenance of the national roads, has been provided with PMS and databases as software for formulating medium-term plans for national roads by WB and ADB. However, they were not actually put into operation due to problems such as the low reliability of the original data and the complexity of the data input. Furthermore, the actual road maintenance work was outsourced to the private sector or government joint ventures by the Road Management Bureau (hereinafter referred to as "RMB"[4]) under DRVN and Road Department of the People's Committee, but it was not functioning sufficiently either. This was because problems such as inadequate guidelines for inspection and repair, inconsistency in technical standards, and insufficient technical levels of local engineers had become apparent.

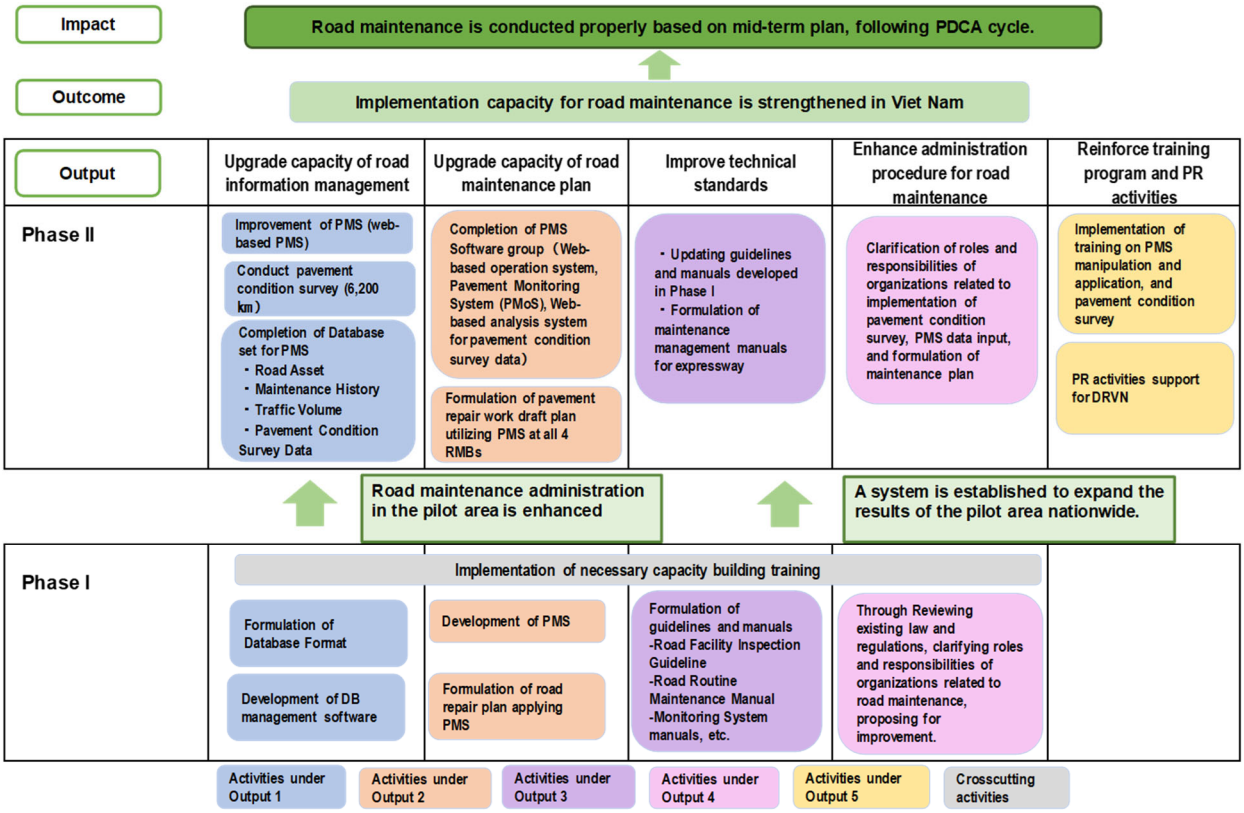
Under these circumstances, the Government of Viet Nam requested to the Government of Japan to improve the capacity to formulate maintenance plans and to strengthen the capacity for routine maintenance.

[4] The country is divided into four districts and Road Management Bureaus (RMBs) are allocated at each regional base (Hanoi, Vinh, Da Nang and Ho Chi Minh). At the time of Phase I, the same organization was called Regional Road Management Unit (RRMU), but RMB is used in this evaluation report.

1.2 Project Outline

		Phase I	Phase II
Overall Goal		1. Road facilities are properly maintained in the target region. 2. Outputs of the project are disseminated across the country.	Road maintenance is conducted properly based on medium-term plan, following PDCA cycle.
Project Purpose		1. Road maintenance institution in the target region is enhanced. 2. Dissemination system of the output of the project across the country is developed.	Implementation capacity for road maintenance is strengthened in Viet Nam.
Output	Output 1	Enhancement of capacity for road information management	PMS data development technology is improved.
	Output 2	Enhancement of planning capacity for road maintenance	PMS is upgraded and applied to the planning of trial pavement repair works.
	Output 3	Enhancement of road maintenance technologies	Technical specifications for inspecting road facility and selecting repair work are developed.
	Output 4	Reinforcement of DRVN institutional issues on road maintenance management	Responsibility assignment and administration procedure are clarified for road maintenance.
	Output 5	-	Training implementation and public relations are reinforced.
Total Cost (Japanese Side)		465 million yen	605 million yen
Period of Cooperation		July 2011 - April 2014 (Extension period: February 2014 - April 2014)	February 2015 - April 2018 (Extension period: One month in April 2018)
Target Area		Road Management Bureau I (RMB I)	Viet Nam Nationwide
Implementing Agency		Directorate for Roads of Viet Nam, Ministry of Transport (DRVN/MoT)	
Other Relevant Agencies /Organization		None	
Consultant/ Organization in Japan		None	
Related Projects		<Technical Cooperation> ・The Comprehensive Study on the Sustainable Development of Transport System in Vietnam (2007-2013) ・The Project for Strengthening Operation and Maintenance System for Expressway in Vietnam (2012-2013) 【International Organization】 ・World Bank, “Vietnam Road Asset Management Project (VRAMP)” (2015-2022)	

Below is a conceptual diagram showing the relationship between Phase I and Phase II. In Phase I, a new database system and PMS were developed and applied to the RMB I jurisdiction area as a pilot area to strengthen the implementation system. In Phase II, the results of Phase I were utilized and improved and were rolled out nationwide. Therefore, the direction of the two projects to be evaluated is common, and the two projects were evaluated as one project in the ex-post evaluation.



Source: Formulated by the external evaluator

Figure 1: Relations between Phase I and Phase II

1.3 Outline of the Terminal Evaluation

Although the terminal evaluation was not implemented in Phase II, the relevant parts from the completion report are quoted as below.

1.3.1 Achievement Status of Project Purpose at the Terminal Evaluation

At the time of terminal evaluation of Phase I, although an initial base of the new road database and new PMS, and the manual for routine maintenance were developed, the OJT period leading up to actual operation could not be secured sufficiently. Furthermore, the procured new pavement condition survey vehicle was expected to arrive in the original project completion month. It was necessary to have an opportunity to implement OJT for on-site data collection by

this vehicle, analysis, PMS operation, and medium-term plan formulation. Therefore, the project purpose was likely to be achieved if the OJT period was secured, and an extension of the practical training period was proposed in the terminal evaluation.

At the time of completion of Phase II, all expected outputs were achieved and it was judged that the project purpose was achieved through effective technical transfer by training session, OJT, and involvement in the project for the officers of implementing agency and related local agencies.

1.3.2 Achievement Status of Overall Goal at the Terminal Evaluation (Including Other impacts)

The prospect to achieve overall goal could not be judged since the project purpose had not been achieved at the time of terminal evaluation of Phase I. On the other hand, the existing laws and regulations reviewed in Output 4 served as an important input, and institutional impacts were seen, such as the formulation of decree to clarify regulations on road maintenance[5].

At the time of completion of Phase II, the implementing agency had started preparing an action plan to achieve the overall goal. In the action plan, it was planned that pavement condition surveys would be regular surveys, and that the annual and medium-term plans formulated using PMS would be the official plans for DRVN in consultation with the Ministry of Transport. In addition, based on the results of this project, DRVN developed a road maintenance manual by themselves adding the contract procedure information. The manual has become a regular manual of DRVN after the legal procedure. Therefore, the overall goal was considered highly likely to be achieved.

1.3.3 Recommendations from the Terminal Evaluation

(1) A few months' extension of the project period was required for operation training of a new PMS and for conducting OJT on a series of tasks from data collection, analysis, PMS operation and medium-term plan formulation. The data would be collected using pavement condition survey vehicle that was delayed in procurement.

(2) Recommendation during the project period: ①Completion of input of necessary data in the database with strong support from DRVN, ②Completion of PMS development by adding improvements based on operations, and ③Conducting training on formulation of medium-term plans

(3) Recommendation after the project completion: ① Dissemination of project outputs nationwide, ②Completion of the national road database, ③Improvement and update of road database, PMS and pavement monitoring System (PMoS), and ④ Utilization of routine maintenance manual

[5] In No.538/QD-BGTVT "Comprehensive innovation for management and maintenance of national highway network" issued as a Decision in March 2013, a decree was proposed to clarify the regulations on road maintenance.

(4) Implementation of further coordination with related organizations led by the Project Management Unit until project completion

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: November 2021 - February 2023

Duration of the Field Study: May 23, 2022 - June 3, 2022, October 28, 2022 - November 25, 2022 (By local consultant)

2.3 Constraints during the Evaluation Study

Due to global spread of the coronavirus infection (COVID-19) pandemic, the external evaluator was unable to travel to Viet Nam and instead, conducted the field survey remotely using a local consultant. Since the external evaluator was not able to directly collect responses to the questionnaires, interview the stakeholders and beneficiaries, and conduct field surveys of the project sites, there were restrictions on the information and data necessary for evaluation analysis. For this reason, the external evaluator conducted evaluation analysis and judgment through careful examination of the information and data obtained from the remote and desktop surveys.

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

3.1 Relevance/Coherence (Rating: ③[7])

3.1.1 Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Viet Nam

In the Five-Year development plans that were valid at the time of planning of Phase I and Phase II, respectively (*8th Social and Economic Development Plan (SEDP)* (2006-2010) for Phase I and *9th SEDP* (2011-2015) for Phase II), transportation infrastructure development is the most important issue for promoting industrialization and economic growth. The road maintenance is important factor that is indispensable for the development of transportation infrastructure system.

The policy at the time of completion of Phase I is the same as at the time of planning of Phase II above (2014). *The 10th SEDP* (2016-2020), which is effective at the time of completion of Phase II, lists infrastructure construction as one of the three breakthroughs for

[6] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[7] ④: Very High、③: High, ②: Moderately Low, ①: Low

economic and social development, and emphasizes the importance of transportation infrastructure development in particular.

Therefore, the objectives of both phases are consistent with Viet Nam's development policy at the time of planning and completion.

3.1.1.2 Consistency with the Development Needs of Viet Nam

At the time of planning for Phase I, it was stipulated that the implementing agency would utilize the database (RosyBASE) introduced for formulation of medium-term maintenance plans with assistance from ADB, and formulate a nationwide maintenance plan through the PMS (HDM-4) introduced by WB. However, due to the inadequacies in the creation of datasets, the necessity of the large number of input data for using PMS, and the complexity of the software themselves for both RosyBASE and HDM-4, the implementing agency was unable to operate them. Therefore, there was an urgent need to improve the road database and PMS to be simpler and easier to maintain. In Phase I, the format of the road database and PMS adapted to the operation method in Viet Nam were developed, and the road maintenance manual and other documents were created. Phase I was targeted at the pilot area in northern Viet Nam (RMB I jurisdiction area) and it was necessary to expand this outcome nationwide and ensure its establishment.

At the time of completion for Phase II, the importance of infrastructure development was high for the national goal of becoming an industrialized country by 2020, and the need for efficient road maintenance was high.

From the above, it was confirmed that the development needs from the time of project planning to the time of completion are consistent with this project, which aims to improve road maintenance capabilities.

3.1.1.3 Appropriateness of the Project Plan and Approach

In Phase I, utilizing the lessons pointed out in the ex-ante evaluation paper, "Apply simpler technology for the introduction of the planning system and the operation of the database, build a post-project management system, and ensure technology transfer," Simple and easy-to-maintain software tailored to the operational situation of Vietnamese side was developed for the new PMS[8]. In Phase II, based on the lessons learned from Phase I that "the implementing agency should sustain project activities and outcomes with ownership," working

[8] For example, while the PMS dataset requires a minimum of 159 data entries in WB's HDM-4, the data required for new PMS dataset has become simplified to 61 items mainly from four types of data: 1) road inventory data, 2) pavement condition data, 3) traffic volume data, and 4) road maintenance history data. It reduced the burden on road administrators. In addition, Kono (2012) pointed out that the new PMS has been customized to enable budget plans, annual repair plans, deterioration predictions, and ex-post evaluations of repairs as outputs. (Kono Hirotaka, "De fact standardization strategy for social capital asset management for Asian countries" (Asiashokoku wo taisho toshita shakai shihon asset management no de-facto hyojunka senryaku), paper presented in Japanese at the 2012 National Land Technology Study Group.

groups were established for each output, and Japanese experts and Vietnamese counterparts co-worked closely. It fostered ownership and led to the establishment of outcomes.

On the other hand, the setting of indicators was not appropriate, such as setting indicators for the project purpose that would produce effects after the project completion[9], or proceeding the project without setting target value for overall goal. However, it cannot be said that there was a serious problem.

Therefore, it can be said that the project plan and approach were appropriate.

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

The Country Assistance Program (2009) at the time of planning of Phase I listed promotion of economic growth and enhancement of international competitiveness as one of priority issues. In order to deal with this issue, it was stated that assistance would be provided for the development of transportation infrastructure and strengthening capacity of operation and maintenance. In the Country Assistance Policy (December 2012) at the time of planning of Phase II, "human resource development and quality assurance related to the operation and maintenance of increasing transportation infrastructure assets" was listed as one of the issues to be addressed to the priority area of "growth and strengthening competitiveness." JICA Country Analytical Paper for Viet Nam (March 2014) stipulates that the basic policy of the "main transport infrastructure development" program is to integrally implement operation and maintenance and soft aspects of cooperation such as institutional development.

Therefore, the project was consistent with Japan's development cooperation policy at the time of planning.

3.1.2.2 Internal Coherence

There was a collaboration with the "Project for Strengthening Operation and Maintenance System for Expressway in Vietnam" (2012-2013). In response to a request from the implementing agency during Phase II, the manual formulated by that project was modified into a PMS-compatible manual. As a result, a concrete collaborative effect was confirmed, in which maintenance plans can be formulated using PMS not only for national roads but also for expressways.

3.1.2.3 External Coherence

The PMS developed in the project is based on the pavement deterioration prediction model developed by Kyoto University (hereinafter referrer do as "Kyoto Model"), and was developed in collaboration with Kyoto University, University of Transport and

[9] For details, refer to "3.2.1.2 Achievement of Project Purpose."

Communications (UTC) in Viet Nam and this project. Kyoto University has been cooperating with UTC to conduct educational and research activities related to road asset management since before the planning of Phase I. The Kyoto Model was introduced to the implementing agency, Viet Nam's Ministry of Transport, engineers of private companies, etc. through such as summer schools and seminars. In collaboration with the JICA Viet Nam Office, Kyoto University conducted a trial operation of the Kyoto Model using 2007 road data. After that, repeated technical discussions with JICA led to the development of a Vietnamese version of the PMS using the Kyoto Model in this project, confirming the concrete effects of collaboration.

In addition, prior to the commencement of Phase II, the efforts were made to coordinate with the WB supported VRAMP[10], which aims to build a comprehensive road asset management system[11], so that there would be no overlap in the contents of the two projects. During the project period, close cooperation and coordination were carried out such as by setting up a working group and sharing information. Support for road maintenance and management was implemented in a mutually complementary manner and concrete collaborative effects were confirmed. Thus, external coherence was recognized. (see "3.2.2.2 Other Positive and Negative Impacts").

The implementation of this project is consistent with Viet Nam'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 Effectiveness and Impacts[12] (Rating: ③)

3.2.1 Effectiveness

3.2.1.1 Project Output

(1) Phase I

Table 1 shows the achievement of outputs at the time of completion of Phase I. Among four outputs, Output 1 was mostly achieved but other outputs were achieved. Regarding Output 1, after developing the new database system, existing data was supposed to be utilized. However, there was a lot of missing or inconsistent data and the project had to re-acquire new data. It was not possible to sufficiently acquire technical skills related to operation using actual data.

[10] VRAMP consists of four components (A: Road Asset Management, B: Road Network Maintenance, C: Road Asset Improvement, D: Institutional Strengthening). Especially for Component A "Road Asset Management," the road database developed in Phase I of this project was utilized to collect and input road data.

[11] To achieve the maintenance plan for the purpose of extending the life of assets and minimizing life cycle costs by properly grasping the current status of road assets, predicting asset deterioration and damage, and carrying out repairs and reinforcements at the appropriate time. (https://www.jica.go.jp/activities/issues/transport/ramp/index.html)

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

Table 1: Achievement of Project Outputs (Phase I)

Output	Actual
Output 1: Enhancement of capacity for road information management	**Mostly Achieved** 1) A new database system was developed and started operation. 2) Although the skills were acquired on how to input the data and manipulation of database, due to the problem of data inadequacy, the database had not yet been used for routine maintenance. 3) Relevant guidelines were formulated and the trainings were carried out as planned. 4) At least one employee who can be a training instructor was developed.
Output 2: Enhancement of planning capacity for road maintenance	**Achieved** 1) A new PMS was developed. Annual and Medium-term maintenance plans utilizing PMS were developed in the pilot area. 2) Seven training courses were conducted on pavement condition survey, PMS data, and road maintenance plan. A total of 117 people attended the courses.
Output 3: Enhancement of road maintenance technologies	**Achieved** 1) OJT was conducted using the developed Road Facility Inspection Guideline and Road Routine Maintenance Manual. They were used for daily activities. 2) Pavement Monitoring System (PMoS) was developed and its operation method was learned through training. 3) Relevant training courses were conducted for a total of 222 people. 4) At least one employee who can be a training instructor was developed.
Output 4: Reinforcement of DRVN institutional issues on road maintenance management	**Achieved** 1) Roles of relevant departments of DRVN HQs and RMB were clarified. 2) Recommendations were made to strengthen the maintenance system based on review of existing relevant laws and regulations.

Source: Information provided by JICA, Questionnaire results from the implementing agency and implementing consultant

(2) Phase II

Table 2 shows the achievement of outputs at the completion time of Phase II. All five outputs were achieved.

Table 2: Achievement of Project Outputs (Phase II)

Output	Actual
Output 1: PMS data development technology is improved.	**Achieved** 1) Road database set required for PMS[13] was completed and became available for utilization for officers at the regional level.
Output 2: PMS is upgraded and applied to the planning of trial pavement repair works.	**Achieved** 1) PMS developed in Phase I was improved by being online. 2) Annual and Medium-term plans were developed in all four RMBs.
Output 3: Technical specifications for inspecting road facility and selecting repair work are developed.	**Achieved** 1) A guideline and manuals[14] were prepared to provide local engineers with basic techniques for road maintenance.

[13] Road inventory database, Maintenance history database, Traffic volume database and Road administration database

[14] Road Facility Inspection Guideline, Road Routine maintenance Manual and Expressway Maintenance Manual

Output 4: Responsibility assignment and administration procedure are clarified for road maintenance.	**Achieved** 1) Recommendations were made regarding the methods of implementing, sharing of responsibilities, and the improvement of administrative procedures of Output 1 to 3 of this project. DRVN formulated an action plan based on the recommendations.
Output 5: Training implementation and public relations are reinforced.	**Achieved** 1) PMS training was conducted five times each at the four RMBs. 2) An annual road maintenance plan was prepared. A system was developed for private companies to register their road maintenance technologies on the DRVN web page.

Source: Information provided by JICA, Questionnaire results from the implementing agency and implementing consultant

3.2.1.2 Achievement of Project Purpose

(1) Achievement of Project Purpose of Phase I

The set indicators (1) and (2) were indicators for effects that would emerge after the completion of the project, not indicators for measuring the degree of achievement of the project purpose. Therefore, for indicator (1), whether a new PMS and a new road database have been developed and whether actual data has been input; for indicator (2), whether road maintenance skills had improved through OJT using developed manuals on road maintenance management skills, were confirmed through questionnaires to the implementing agency and interviews with the implementing consultant.

As a result, except indicator (1), other indicators were achieved as shown in Table 3. Thus, it can be judged that the project purpose of Phase I was mostly achieved.

Table 3: Achievement of Project Purpose (Phase I)

Project Purpose	Indicator	Actual
1. Road maintenance institution in the target region is enhanced. 2. Dissemination system of the output of the project across the country is developed.	(1) New PMS and new road database are continuously operated and updated after the project completion. → New PMS and new road database are developed and actual data is entered into them. (Alternative)	**Mostly Achieved** It took longer than expected to enter the data into the database required to operate the new PMS. It was, therefore, not possible to spend enough time on the operation using the actual data. However, the initial base of new road database and the new PMS have been developed. It can be said that certain outcomes have been achieved.
	(2) Standard of road maintenance technology enhanced by OJTs is maintained. → Technical capacity on road maintenance is enhanced through OJTs utilizing developed manuals of road maintenance. (Alternative)	**Achieved** Training and OJT were conducted using the guideline and manuals for road maintenance developed in Output 3, including the PMS user manual. It can be said from the achievement status of Outputs 1 to 3 that road maintenance technology has improved.
	(3) Staff allocation and training program are established for nationwide deployment of project output under the pilot area.	**Achieved** Through this project, staff who can develop training programs and become instructors for nationwide expansion were fostered.

Source: Information provided by JICA, Questionnaire results from the implementing agency and interview results from the implementing consultant

(2) Achievement of Project Purpose of Phase II

In Phase II, three indicators of project purpose were achieved as shown in Table 4. Five outputs were also achieved. Therefore, it can be said that project purpose of Phase II was achieved.

Table 4: Achievement of Project Purpose (Phase II)

Project Purpose	Indicator	Actual
Implementation capacity for road maintenance is strengthened in Viet Nam	(1) Trial pavement repair work plan using PMS is formulated in RMB I, II, III and IV.	**Achieved** Draft road maintenance plans using PMS were formulated in each RMB during the project period. Through this exercise, it can be thought that RMB engineers understood the formulation method and meaning of the plans.
	(2) Primary rules for road facility inspection, maintenance and repair work are formulated (target facilities, frequency, methods, diagnosis, selection method for repair works, repair wok and construction management).	**Achieved** Based on the developed "Road Facility Inspection Guideline" and "Road Maintenance Manual," DRVN itself clarified the fundamental but important rules and created a new "Procedure Manual of Road Management, Operation and Maintenance." The created manual was officially issued by DRVN Decision in December 2017.
	(3) Implementation structure for road maintenance is established.	**Achieved** Based on the recommendations made in Output 4, DRVN reviewed organizational responsibility sharing and maintenance procedures.

Source: Information provided by JICA, Questionnaire results from the implementing agency and interview results from the implementing consultant

Through Phase I activities, a road database format and input system were constructed (Output 1), and a Vietnamese version of the PMS adapted to the actual situation in Viet Nam was developed (Output 2). In addition, technical standards such as road facility inspection guideline and road routine maintenance manual were prepared (Output 3), and by reviewing existing laws and regulations, roles and responsibilities of maintenance-related organizations were clarified (Output 4). For each output, training was conducted for the staff of the implementing agency to strengthen their capacity. Of the four outputs, Output 1 was mostly achieved and the rest were achieved. The four outputs formed the initial basis for the new road database and new PMS system, improved the road maintenance system in the pilot area, and contributed to the establishment of a system to deploy the results of the pilot area nationwide (Project purpose of Phase I).

In Phase II, through activities to establish the developed PMS nationwide, improvements were made such as making the PMS online so that it can be used by all RMBs (Output 1), the annual and medium-term maintenance plans utilizing PMS were drafted by each RMB (Output 2). In addition, the technical standards formulated in Phase I were improved (Output 3), and the rules and regulations related to the implementation of Outputs 1 to 3 were reviewed and an

improvement plan was proposed (Output 4). Furthermore, training and public relations functions were strengthened (Output 5). As a result, the project contributed to improving the road maintenance capacity of the implementing agency (Project purpose of Phase II).

The project purpose of Phase I was mostly achieved, and that of Phase II was achieved. Therefore, the project purpose was achieved.

3.2.2 Impacts

3.2.2.1 Achievement of Overall Goal

As shown in Figure 1, Phase I is the basis for the achievement of Phase II. Since the direction of the two projects is the same, the overall goal was evaluated using the overall goal of Phase II. However, the target values were not set in the indicator and the implementing agency has not obtained the data for the indicator. Therefore, the situation at the time of the ex-post evaluation was confirmed from the three perspectives in Table 5 as alternative indicators.

Table 5: Achievement of Overall Goal

Overall Goal	Indicator	Actual
Road maintenance is conducted properly based on medium-term plan, following PDCA cycle. Original Indicator: The indicators for pavement damage (IRI, cracks, rutting, etc.) will be improved X%.	(1) Utilization status of PMS and road database, and update status of data (Alternative)	**Mostly Achieved** ・ Some of the data collection and data update required for PMS have been taken over by VRAMP, and the road database has been updated. However, due to the limitation of budget, not all national roads have been covered. However, the collected data has been input into the PMS by each RMB, and been shared between the headquarters and the RMB using the online PMS.
	(2) Implementation status of pavement condition survey (Alternative)	**Mostly Achieved** ・ Pavement condition surveys were conducted on approximately 25,000 km of national roads under the jurisdiction of RMB in four regions and part of expressways. ・ Conducting pavement condition surveys has become an official task of DRVN, but it cannot be done every year due to the enormous cost and time involved in carrying out 25,000 km with two vehicles. It is scheduled to be implemented once every 3 to 5 years. ・ After this project, it was updated once by VRAMP in December 2020.
	(3) Formulation status of annual and medium-term maintenance plans utilizing PMS (Alternative)	**Partially Achieved** ・ The annual maintenance plan has been prepared almost from the expert point of view of engineers. ・ In the medium-term maintenance plan, the PMS data was treated as a reference value, and the final adjustment and formulation were made from the expert point of view of the engineers.

Source: Questionnaire results from the implementing agency and interview results from the implementing consultant

WB supported VRAMP has taken over the results of this project, partially updating the road data, and inputting the data into the PMS developed by this project by each RMB (Indicator (1)). Pavement condition surveys were also conducted by VRAMP recently in December 2020 on approximately 25,000 km of national roads under the jurisdiction of four RMBs and part of expressways. It was confirmed that the online PMS has been used to grasp road conditions and utilized for road maintenance (Indicator (2)). On the other hand, although PMS data was referred to in formulating medium-term maintenance plans, the plans were actually formulated from a technical point of view by engineers. The reason is that due to the limited budget for pavement condition surveys, it is not possible to conduct them frequently, and some of the data in the PMS has not been updated or is incomplete due to missing data. However, the implementing agency pointed out that data inputted into the PMS such as pavement conditions, repair history, traffic volume, etc., were very effective in formulating plans. In addition, they stressed that the accuracy of the medium-term maintenance plan was significantly improved compared to before the project by referring to the data calculated from the PMS, combined with the technical perspective.

Thus, the project has achieved its overall goal only to a certain extent compared to the plan.

3.2.2.2 Other Positive and Negative Impacts

1) Impacts on the Natural Environment

This project was classified as Category C based on the JICA Guidelines for the Confirmation of Environmental and Social Considerations (April 2010) as it was judged to have minimal negative impacts on the environment. No negative impacts were confirmed by the implementing agency and implementing consultant.

2) Resettlement and Land Acquisition

There was no resettlement or land acquisition for this project.

3) Gender Equality, Marginalized People, Social Systems and Norms, Human Well-being and Human Rights, and Unintended Positive/Negative Impacts

<Coordination Effects with VRAMP>

As described in “3.1.2.3 External Coherence,” the project has been collaborating with VRAMP since the planning of Phase II and clarified the division of roles for each other. During the project implementation, a coordination committee and working groups were established for each related field to share information. Through such collaboration, for example, one pavement condition survey vehicle was purchased with the VRAMP budget after the

completion of Phase II, contributing to the efficient implementation of pavement condition surveys. In order to update the PMS data set, VRAMP has collected road information, input data as well as conducted training on road maintenance including PMS. In the training, training materials were prepared based on the manuals on road maintenance developed by this project. Therefore, synergistic effects were confirmed, such as the effect of this project being passed on to VRAMP, and the increasing opportunities to implement the effect of this project, which has become established in the implementing agency.

<Establishment of human network with Kyoto University and UTC>

The cooperative relationship with Kyoto University and UTC, which collaborated in PMS development, was maintained even at the time of the ex-post evaluation. A system was established to receive support in case of technical problems or consultations. It can be said that this project established a strong human network to ensure the sustainability of PMS.

<Institutional Impacts>

According to the questionnaire results of the implementing agency, it was confirmed that the results of the review in this project (Output 4 of Phase I and Phase II) became important inputs and references when formulating and revising important laws and regulations related to road maintenance. For example, the results of review were utilized when formulating a decision on Comprehensive innovation for management and maintenance of national highway network to clarify the rules on road maintenance (Decision No.538/QD-BGTVT (2013)), and when revising Quality control and maintenance of construction works (Decree No.46/2015/ND-CP (2015)), Regulations on the management, use and exploitation of road traffic infrastructure assets (Decree No.33/2019/ND -CP (2019)) and others.

Through the implementation of this project, the implementation capacity of the implementing agency for road maintenance has been improved, which was set as the project purpose. Although it has not reached the stage of formulating a medium-term plan that fully utilizes the PMS, road information collection and inputting them into the PMS have been carried out in order to utilize the PMS to a certain extent. It was confirmed that the project contributed to the maintenance work based on the PDCA cycle, which is the overall goal, to a certain extent, and the effects were largely realized as planned. In addition, the collaboration effects with VRAMP, Kyoto University, and UTC and the institutional impacts were also observed. No negative impacts were observed. In light of the above, the effectiveness and impacts of the project are high.

3.3 Efficiency (Rating: ③)

3.3.1 Inputs

Table 6: Plan and Actual of Inputs

	Phase I		Phase II	
Inputs	**Plan**	**Actual (Completion time)**	**Plan**	**Actual (Completion time)**
(1) Experts	Long-term: 1 expert (36 MM) Short-Term (110 MM)	Long-term: 1 expert (36 MM) Short-Term: 13 experts (100 MM)	Long-term: 1 expert (36 MM) Short-Term: 13 experts (138 MM)	Long-term: 1 expert (36 MM) Short-Term: 14 experts (138 MM)
(2) Trainees received	Not mentioned	13 persons (2 times)	3 times	25 persons (3 times)
(3) Equipment	Equipment for pavement condition survey, PC	Pavement condition survey with equipment, PC, Copy machine	Equipment and materials for pavement repair works, PC	Equipment and materials for pavement repair works, PC, Application server, Database server, Training equipment
(4) Local Expenses	Not mentioned	12 million yen	Not mentioned	6 million yen
Japanese Side Total Project Cost	415 million yen	465 million yen	470 million yen	605 million yen
Vietnamese Side Total Project Cost	Project operation costs	843 million VND (About 3.6 million yen[15]) Costs for consultant, pilot repair works, and pavement condition survey	Costs for pilot repair works and pavement condition survey	Costs for pilot repair works, pavement condition survey, and training participation

*MM stands for man months
Source: Information provided by JICA

3.3.1.1 Elements of Inputs

Table 6 above shows the inputs of the project. In Phase I, the plan was to provide pavement condition survey equipment, but in actuality it was provided together with the vehicle. In Phase II, based on the lessons learned in Phase I, the implementing agency secured a project office space near the DRVN headquarters, allocated counterpart officers, formed working groups for each outcome, and maintained close communication with Japanese experts. Especially, regarding PMS a system was established to act proactively by allocating staff in charge of PMS system to each RMB, Road Technical Center (RTC), and Sub-Bureau. Efficient input was also made. According to the implementing consultant, prompt arrangements by the implementing agency for importing equipment and machinery for Phase II pilot construction shortened the period by two months, contributing to the smooth implementation of the pilot construction.

[15] The exchange rate is calculated from the IMF/IFS average from 2012 to 2013 (1 VND = 0.0043 yen).

3.3.1.2 Project Costs

In Phase I, the actual project cost was 465 million yen compared to the planned cost of 415 million yen, slightly exceeding the plan (112% of the plan.) The increase in the amount was due to the increase in expenses for OJT and long-term expert because of the extension of the period, and the addition of a training in Japan. To the planned value for Phase I, the following costs were added before the comparison: the cost of the pavement condition vehicle with necessary equipment, which was re-estimated during the project period after the specifications were finalized in consideration of the road conditions in Viet Nam; and the country specific training costs, which could not be estimated due to lack of data at the planning. In Phase II, the actual cost was 605 million yen compared to the planned cost of 470 million yen, exceeding the plan (128% of the plan).

The total project cost for both phases was 121% of the plan, slightly exceeding the plan.

3.3.1.3 Project Period

The project period of Phase I was 34 months compared to the planned period of 31 months, slightly exceeding the plan (109% of the plan). Due to the inadequacy of existing data, the development of database and PMS was delayed and the OJT period could not be secured sufficiently. The project responded by implementing a three-month extension. The project period of Phase II was 39 months compared to the planned period of 38 months, slightly exceeding the plan (102% of the plan).

Combining the two phases, the project period was 73 months compared to the planed period of 69 months, slightly exceeding the plan (106% of the plan).

Therefore, although both the project cost and project period slightly exceeded the plan, efficiency of the project is high.

3.4 Sustainability (Rating: ②)

3.4.1 Policy and System

In the *Socio-Economic Development Strategy* (2021-2030) that was effective at the time of the ex-post evaluation, comprehensive infrastructure development is positioned as one of the three strategic breakthroughs for economic development. It also emphasizes the importance of infrastructure development as the most effective means of stimulating post-pandemic economic recovery and economic growth[16], and among other things, advocates the promotion of transport infrastructure construction[17]. The master plan on the road network

[16] Strategic breakthroughs indicate the three directions of "socialist-oriented market economy," "development of human capital," and "infrastructure construction," which will be emphasized in order to innovate the growth model. (IDE-JETRO Web page (in Japanese): https://www.ide.go.jp/Japanese/IDEsquare/Eyes/2021/ISQ202120_019.html)

[17] VIETO JO Web page: https://www.viet-jo.com/news/economy/210723081844.html

(2021-2030) places emphasis on improving road database and upgrading and using software to help formulate road maintenance plans. In regard to the pavement condition survey, it is positioned as an official task of DRVN. Based on the above, no major problems were found in the policy and systems related to this project.

3.4.2 Institutional/Organizational Aspect

There have been no major changes in the roles of road maintenance from the time of planning. The Planning and Investment Department of DRVN is in charge of general management of PMS, formulation of annual and medium-term maintenance plans, and support for formulation of plans by RMB. The Maintenance Department is in charge of collecting and updating road data. The Science, Technology, Environment and International Cooperation Department is in charge of managing PMS software development through outsourcing. The implementation of the pavement condition survey and the management of the pavement condition survey vehicle are carried out by the RTC and supervised by the responsible RMB. RMB formulates annual and medium-term maintenance plans for the areas under its jurisdiction and reports them to the Planning and Investment Department.

According to the questionnaire responses from the implementing agency, there were 22 engineers in charge of maintenance at the DRVN headquarters, and about 100 of the 120-130 staff at each RMB are engineers. The required number of staff was generally filled, and there have been no problems related to operation and maintenance due to staff shortages.

In light of the above, no major problems were found in terms of the institutional/organizational aspect.

3.4.3 Technical Aspect

It was confirmed that the technical outputs of this project, such as collection of road data related to maintenance, input to the database, operation of PMS, and implementation of inspections and repairs using guidelines and manuals on road maintenance, were maintained. It was also confirmed that each RMB was conducting maintenance in accordance with the guidelines and manuals formulated in this project. In addition, as mentioned above, the training materials of the VRAMP's training were developed based on the manuals of this project, which ensures the sustainability of the technology of this project. Furthermore, if a problem arises, technical advice can be obtained from the human network built by this project with Kyoto University, UTC, and the implementing consultant. The pavement condition survey was conducted using the vehicle procured under this project, and it was confirmed that there were no technical problems with the survey.

In light of the above, no major problems were found in the technical aspects of maintenance.

3.4.4 Financial Aspect

In order to implement the PDCA cycle of maintenance and ensure the sustainability of the project, mainly 1) expenses for collecting and updating road information including implementation of pavement condition surveys, 2) maintenance costs for PMS system and pavement condition survey vehicles, 3) road repair and maintenance costs, and 4) training costs are required.

1) Expenses for collecting and updating road information

It is planned to conduct pavement condition survey by every 3 to 5 years because it requires a large amount of money. In fact, according to the implementing agency, it was confirmed that a certain amount of budget has been secured since they are planning to conduct the survey with existing two vehicles in FY2003 after the implementation by VRAMP in FY2020. However, according to the results of questionnaires and interviews with the implementing agency, in order to maximize the operation of PMS and formulate annual and medium-term plans, it is necessary to collect the latest data including new routes by conducting a pavement condition survey once a year, screen and input data. In addition to the collection of road data through such periodic pavement condition surveys, there remains the issue of survey costs for collecting repair history and traffic volume data.

2) Maintenance costs for PMS system and pavement condition survey vehicle

The operating and maintenance costs for the PMS and pavement condition survey vehicle were secured by the implementing agency. There were no problems due to insufficient funds.

3) Road repair and maintenance costs

Overall, the budget for the repairs and maintenance carried out by the RMB was not sufficiently secured. According to the implementing agency, maintenance costs to the RMB are distributed according to the distance of the roads under their jurisdiction[18]. Each RMB places priority on ensuring safety and smooth pavement, and carries out maintenance work within a limited budget. As shown in Table 7, the budget remains at 40% to 60% of the requested amount, except for RMB I. Insufficient budget for repair and maintenance costs leads to the inability to ensure the effectiveness of the plan using PMS, which did not lead to effective utilization of PMS.

[18] According to the implementing agency, the average repair costs are 230-250 million VND (approximately 1.36 - 1.46 million yen, 1 VND=0.006 yen) per kilometer. The maintenance costs are determined by the specification unit price of each route.

Table 7: Road Maintenance Budget for each RMB (2019 – 2021)

(Unit: billion VND)

RMB I	2019	2020	2021
Budget Request	855	735	607
Allocation	670 (78%)	711 (96%)	607 (100%)
Expenditure	670	711	607

RMB II	2019	2020	2021
Budget Request	2018	2160	2163
Allocation	961 (45%)	700 (32%)	935 (43%)
Expenditure	961	700	607

RMB III	2019	2020	2021
Budget Request	1080	1087	1111
Allocation	660 (61%)	553 (51%)	747 (67%)
Expenditure	660	553	747

RMB IV	2019	2020	2021
Budget Request	1610	1045	1294
Allocation	973 (60%)	611 (58%)	792 (61%)
Expenditure	973	611	792

Source: Questionnaire results from the implementing agency

4) Training costs

Although the training necessary for road maintenance is mainly done by OJT, it was confirmed that a certain amount of training costs was secured.

In light of the above, some issues have been observed in terms of financial aspect.

3.4.5 Environmental and Social Aspect

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

3.4.6 Preventative Measures to Risks

Due to the influence of the coronavirus, measures were taken to minimize the impacts, such as conducting some training online and adjusting the timing of the pavement condition survey.

3.4.7 Status of Operation and Maintenance

The PMS system was properly maintained and operated without any problems at the time of the ex-post evaluation. There were no major problems with maintenance for the pavement condition survey vehicle.

In light of the above, some minor issues have been observed in terms of the financial aspects in order to sustain the effects of this project. They are not expected to be improved/resolved in the near future. Therefore, sustainability of the project effects is moderately low.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project was to strengthen the implementation capacity of the implementing agency for road maintenance of the national roads network through two phases of technical cooperation projects. It was envisioned that the objective was achieved by developing a PMS specially adapted to Viet Nam's operation method, by improving and applying it, and by supporting the construction of a system for improvement, formulation, and implementation of technical standards and institution. As a result, based on the medium-term maintenance plan, it was expected that appropriate road maintenance would be implemented along with the PDCA cycle management. The objective of the project was consistent with the development policies and needs of the country and the project plan and approach was appropriate. The project was consistent with the development cooperation policy of Japan. It also collaborated with other projects of JICA and with other organizations such as WB, and concrete results have been confirmed. Therefore, relevance and coherence are high. Through implementation of the project, improvement of the implementing capacity of the implementing agency for road maintenance, which was set as the project purpose, was achieved. In addition, the project has contributed to the overall goal of maintenance work based on the PDCA cycle to a certain extent. The project results have been largely achieved as planned, therefore, the effectiveness and impacts of the project are high. Efficiency is high as the project cost and period slightly exceeded the plan. Sustainability of the effects of the project is moderately low since there are some minor financial issues and they are not expected to be improved/resolved in the near future.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

The main reason why PMS was not fully utilized when formulating annual and medium-term maintenance plans was that the budget for collecting data to be input into PMS was not sufficiently allocated. To make PMS a more effective tool for planning, it is recommended to devote resources to survey.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

In order to realize appropriate road maintenance, it is essential to cooperate with other related donors and to continuously encourage the implementing agency and relevant ministries even after the project is completed.

The project dealt with the development of PMS, a system necessary for formulating plans for efficient and effective road maintenance, and provision of technical assistance to utilize it, as well as institutional building. A certain level of effect was confirmed through this project, such as the accuracy of the maintenance plans being improved compared to before the project. This is partly due to the fact that strategic cooperation with VRAMP has increased opportunities to put the results of this project into practice even after the project, and the effects of the project have been established to a certain extent. However, due to the lack of frequent data collection and updates because of limited finances, it is not possible to formulate a plan that makes the most use of PMS. Therefore, the ultimate goal of proper maintenance work has not been achieved. Appropriate implementation of the PDCA cycle for road maintenance cannot be accomplished solely through the implementation of this project, which mainly supported the development of systems such as PMS. Based on a comprehensive strategy for implementing appropriate road maintenance, it is important to clarify the roles of individual projects, cooperate with other related donors and to continuously encourage the implementing agency and related ministries to consider the need for securing finance and merits of using the system (implementation of maintenance based on a highly accurate plan is economical as a result) not only during the project period but also after the project. In cases where the implementing agency has formulated the action plans after the completion of the project, as in this project, follow-up by the JICA office with the implementing agency will serve as a tool for such encouragement.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

None.

5.2 Additionality

As additionality of this project, it can be raised that improvement of human resources, equipment, technology, and capacity was promoted through industry-government-academia collaboration, including related projects and exchanges between universities.

As for PMS, HDM-4 and RosyBASE have been established as international standard systems. According to Han et al. (2009) [19], many developing countries have introduced HDM-4 as a condition for receiving infrastructure loans from WB. In fact, various versions have been used in more than 100 countries and regions[20]. However, there have been few reports of successful

[19] HAN, Daeseok, Kiyoshi Kobayshi, and Myungsik Do. “Improved Calibration for HDM-4 Implementation: A Lesson from Korean Experience,” Journal of JSCE, Vol 4, 2009 (http://library.jsce.or.jp/jsce/open/00039/200911_no40/pdf/84.pdf)

[20] Fujiwara Eigo, et al. “Issues of Pavement Management System and Measures to Improve Practicality” (Hoso

operation[21]. According to THAO et al. (2015) [22], since HDM-4 was first introduced as a PMS in Viet Nam in 1988, by 2006, six trials were conducted by WB and ADB. However, due to the large amount of data required (for example, 159 data items for one road section must be manually entered into the dataset) and the high skills required to use the software, it was not possible for DRVN staff to manipulate them themselves. Under such circumstances, DRVN requested JICA to develop PMS software that can be used relatively easily by their staff. Then, this project was realized.

On the other hand, the international standard system was a "black box" (the internal structure is unknown and cannot be improved), and the inability to adjust according to the circumstances of each country has been viewed as a problem [23]. At the international seminar on the implementation of road asset management in Asia held in Malaysia in 2009, it was emphasized that the standard system could not respond to the circumstances of each country because the method of asset management is completely different depending on the situation of each country[24]. Many participating countries agreed that future road asset management systems should be developed to be user-friendly, practical and effective. Against this background, in Japan, Kyoto University has conducted research on new PMS, and the "Kyoto Model" has been developed. The reason why this project has successfully developed the PMS customized for Viet Nam based on the "Kyoto Model" was because there were voluntary efforts of Japanese researchers to develop human resources on the Vietnamese side as an added value. Kyoto University and UTC had an agreement even before Phase I of this project was planned, and Kyoto University has been conducting annual training on road maintenance and asset management for UTC staff and students. Among participants, there were DRVN staff as well in the training. In addition, during the project period, Japanese researchers participated in the project's training as instructors, and continued to develop human resources for roads in Viet Nam. Such industry-government-academia collaboration between Japanese researchers, JICA, and the implementing consultant contributed to the smooth implementation of this project. As mentioned above, the relationship with these research institutes and the implementing consultant has continued even at the time of the ex-post evaluation. The introduction of locally customized PMS in Viet Nam has become a pioneering example for the introduction of PMS in other developing countries in the future.

END

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[21] THAO, Nguyen Dinh, Kazuya AOKI, Tsuneo KATO, To Nam TOAN, Kiyoshi KOBAYASHI, Kiyoyuki KAITO "A Practical Process to Introduce a Customized Pavement Management System in Vietnam," Journal of JSCE, Vol.3, 246-258, 2015 (https://www.jstage.jst.go.jp/article/journalofjsce/3/1/3_246/_pdf)

[22] THAO et al. (2015), op. cit.

[23] For example, pointed out in Han et al. (2009), op. cit. and THAO et al. (2015), op. cit.

[24] THAO et al. (2015), op. cit.