Internal Ex-Post Evaluation for Technical Cooperation Project

conducted by Pakistan Office: 11, 2024

Country Name	**The Project for Technical Assistance on Implementation of Bridge Management System in NHA***
Islamic Republic of Pakistan	*National Highway Authority

I. Project Outline

Background	Approximately 80% of road users in Pakistan relied on national highways, including about 5,000 bridges and about 16,000 culverts[1], so their importance in the road network was very high. However, bridges/culverts were at high risk of premature deterioration and damage due to increased traffic volume, unchecked overloading, poor design, and construction, etc. Although Bridge Maintenance System (BMS), a tool to gather bridge data for bridge maintenance management and repair planning, had been formulated as a component of the Road Asset Management System, no maintenance plans had been formulated and periodic inspections had never been carried out. As a result, repair works were carried out when damage was found based on the concept of post-damage maintenance. By the time damage was found, it was already difficult for repair works to be effective, so there were cases in which a bridge had to be replaced even though its design life was not reached. In order to keep bridges in good condition for a longer period of time, it was urgently needed to enhance the bridge maintenance and management system using BMS. (Figures at the time of ex-ante evaluation.)
Objectives of the Project	The project aims at preparing annual bridge maintenance plan on the basis of the latest bridge inspection data of the model area[2] in Pakistan through (i) developing manuals, a database, and Bridge Management System (BMS)[3] for bridge inspection and repair, (ii) implementing bridge/culvert inspection in the model area after BMS training[4], and (iii) having it available bridge data of the model area with Bridge Management Unit (BMU) at National Highway Authority (NHA) headquarters (HQ) and preparing bridge maintenance plan according to the data[5], thereby improving bridge inspection and maintenance status improved on the bridges of National Highways in the model area[6]. 1. Overall Goal: Bridge inspection and maintenance status improved on the bridges of National Highways in the model area. 2. Project Purpose: Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of the model area.
Activities of the Project	1. Project site[7]: In/around Islamabad and the model area i.e., the jurisdiction of the Rawalpindi Maintenance Unit (MU) and the Wazirabad MU in the Punjab North Regional Office (RO) of the NHA. 2. Main activities: (i) Development of manuals, Bridge Inspection Database (BIDB), BMS software, and training materials for bridge inspection and repair; (ii) implementation of BMS training (training for inventory survey and inspection) for Trainee Engineers (TEs) and the relevant MU staff by the BMU, implementation of inventory survey and inspection of the representative 41 bridges /culverts (36 bridges and 5 culverts) in the model area and registration of the data in BIDB by the BMU and the TEs; (iii) analysis of the inspection data included in BIDB using the BMS software and preparation of annual bridge/culvert maintenance plan for the 41 bridge/culverts in the model area by the BMU.

[1] Structures built into embankments or the ground to create space for roads, waterways, etc. that cross under a road (Source: https://www.pref.saitama.lg.jp/documents/51755/001kyouryoutebik1hen.pdf (translated by ex-post evaluator)).

[2] The Project Purpose was modified twice. In the first year of the project, the initial Project Purpose ("Cost estimate necessary for bridge maintenance every fiscal year implemented on the basis of bridge inspection results of the bridges on National Highways in Pakistan") was changed to "Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of entire NHA Network" through the 1st amendment of the Record of Discussion (R/D) described in the Minutes of the Meeting (M/M) (February 2017). The reason was "Because bridge inspection data has not been carried out regularly since the existing BMS (Smart Bridge) was developed, NHA's bridge maintenance plan including all the procedures must be prepared as priority". Then, in the third year of the project, the target area of the Project Purpose was scaled down from "entire NHA network" to "the model area" through the 2nd amendment of the R/D described in the M/M (October 2018) because "Considering number of bridges of entire NHA network, inspection of the nation-wide bridges during the project period is too ambitious".

[3] Development of BMS was added to the contents of Output 1 when the Project Purpose was changed for the 1st time. The reason was "Because bridge inspection data has not been carried out regularly since the existing BMS (Smart Bridge) was developed, BMS with the prioritization function is newly made in this project" as per the M/M (February 2017).

[4] When the Project Purpose was modified for the 2nd time, the approach for Output 2 was also changed from training and mobilizing Master Trainers in the whole country to establishing the Bridge Management Unit (BMU) at the NHA HQ and involving Trainee Engineers (TEs) in the model area (the BMU consisted of 3 civil engineers selected from the excellent candidates in the Master Trainer Training and an IT engineer). Accordingly, Output 2 was modified from "Trainers of bridge inspection and bridge repair method selection trained at the NHA's HQ and Regional Offices (ROs), and bridge inspection and bridge repair method selection of uniformed contents implemented on all the bridges of National Highways in Pakistan" to "Bridge/culvert inspection in the model area is implemented after BMS training". The reason for deleting the bridge repair method selection is not clear in the available documents related to this project.)

[5] The initial Output 3 was "Data on all the bridges of National Highways in Pakistan input by MUs to existing BMS available to NHA's HQ and ROs". When the Project Purpose was modified for the 1st time, the term "existing BMS" was changed to "database" because "MUs will input data to Bridge Inspection Database, not Smart Bridge (correction of improper usage)" as per the M/M (February 2017). When the Project Purpose was modified for the 2nd time, Output 3 was further modified to "Bridge data of the model area is available with BMU at NHA HQ, and bridge maintenance plan is prepared according to the data" mainly because "Database will be available only in HQ for the time being" as per the M/M (October 2018).

[6] When the Project Purpose was modified for the 2nd time, the initial Overall Goal ("Bridge maintenance status improved on the bridges of National Highways in Pakistan") was also changed to the current one because "Considering the number of bridges of entire NHA network, repair of the nation-wide bridges before ex-post evaluation (3 years after the project completion) are too ambitious. The Overall goal should be scaled down to a realistic scope" as per the M/M (October 2018).

[7] See footnote 2 for the change of the project site.

	3. Inputs (to carry out the above activities) Japanese Side 1) Experts: 9 persons 2) Trainees received: 2 persons 3) Equipment: Carbonation test equipment, crack scales, test hammers, helmets, etc. 4) Local cost Pakistani Side 1) Staff allocated: 6 persons[8] 2) Room and facilities for the project 3) Local cost[9]		
Project Period	(ex-ante) July 2016-January 2019 [30 months][10] (actual) July 2016-April 2019 [33 months]	Project Cost (Japanese side only)	(ex-ante)197 million yen, (actual) 214 million yen
Implementing Agency	National Highway Authority (NHA), Ministry of Communications		
Cooperation Agency in Japan	Pacific Consultants Co., Ltd.		

II. Result of the Evaluation

< Special Perspectives Considered in the Ex-Post Evaluation >

- "Bridge maintenance plan…for the model area" mentioned in the Project Purpose Indicator was interpreted to be "Bridge maintenance plan for the 41 representative bridges/culverts in the model area" based on the understanding of the internal terminal evaluation/joint review of the project stated in the Project Completion Report (PCR).

-The continuation status of the effects of the Project Purpose Indicator was confirmed by checking the implementation status and revision status of the plan. In addition, the continuation status of the activities for the inventory survey in the model area and registration of the inspection data in BIDB were also checked.

- As for the Overall Goal, the target year was set to be Pakistan Fiscal Year (PFY) 2021/22[11] because the ex-post evaluation was planned 3 years after the project completion in the draft Ex-ante Evaluation Sheet. The Overall Goal Indicator 1 reads "The bridges identified in the maintenance plan prepared under the project are maintained and repaired according to the plan". The bridge maintenance plan was to be revised annually based on the inspection results of the other bridges in the model area as per the Overall Goal Indicator 2 ("In the model area, more than 65 bridges are annually inspected, and the bridge maintenance plan is annually revised"). Therefore, "the maintenance plan" in the Overall Goal Indicator 1 was interpreted to be the latest bridge maintenance plan. As for the Overall Goal Indicator 2, it consists of 2 sub-indicators: (a) inspections of more than 65 bridges annually; and (b) revision of the bridge maintenance plan annually. Equal weight was given to each sub-indicator in making the evaluation judgment. The part "more than 65 bridges" in sub-indicator (a) was considered a simple mistake for "at least 65 bridges". It is noted that the target figure of 65 is the average value of the total number of bridge/culverts in the model area then (325 bridges/culverts) divided by 5 years, which was calculated based on an NHA's policy to inspect bridges once in 5 years. The part "the bridge maintenance plan is annually revised" in sub-indicator (b) was interpreted to be "the bridge maintenance plan is annually reviewed and revised based on the inspection results". This includes a case where the plan is reviewed but not revised because it is unnecessary. Since this evaluation was conducted after the target year, the latest status of Overall Goal indicators was also taken into consideration in the evaluation judgement. Equal importance was given to the status in the target year and the latest status.

1 Relevance/Coherence

[Relevance]

<Consistency with the Development Policy of Pakistan at the Time of Ex-Ante Evaluation >

The project was consistent with the development policy of Pakistan, the Pakistan Vision 2025 (2014), at the time of ex-ante evaluation, which sets forth the establishment of an efficient and integrated transportation system that will facilitate the development of a competitive economy under one of its 7 Pillars "Modernizing Transportation Infrastructure and Greater Regional Connectivity".

<Consistency with the Development Needs of Pakistan at the Time of Ex-Ante Evaluation >

The project was consistent with the development needs of Pakistan for enhancing the bridge maintenance and management system using BMS at the time of ex-ante evaluation as mentioned in "Background" above.

<Appropriateness of Project Design/Approach>

The project design/appropriate was appropriate. No problem attributed to the project design/approach was confirmed.

<Evaluation Result>

In light of the above, the relevance of the project is ③[12].

[Coherence]

<Consistency with Japan's ODA Policy at the Time of Ex-Ante Evaluation>

The project was consistent with the Japan's ODA policy to Pakistan at the time of ex-post evaluation. The Country Assistance Policy for the Islamic Republic of Pakistan (2012) included assistance for transportation infrastructure under one of the three priority areas of "Improvement of economic infrastructure".

<Collaboration/Coordination with JICA's other interventions>

[8] Six people (i.e., the Person in Charge, the Project Manager, and 4 main counterpart staff (C/Ps)) were assigned at the time of project completion. (Nine people in total were involved in the project as C/Ps, and 3 of them left the project because of personnel transfer and retirement.) Prior to the project, the NHA had planned to deploy 2 main C/Ps, but it assigned only 1 C/P for the initial 1 and a half years. With the establishment of the BMU in January 2018, the number of main C/Ps was increased from o1 to 4.

[9] Local costs included the salary of TEs. Prior to the establishment of the BMU, the NHA had decided to hire 12 TEs, who had been working as inspectors in other projects in the NHA, on one year-contract basis, because the NHA was not able to hire new officers due to internal legal issues. The NHA could hire 10 TEs in February 2018, but 2 of them left for other jobs in August 2018.

[10] The planned period (July 2016-January 2019) is based on the information provided by the Sectoral Dept. The number of months (30 months) is based on the R/D. The number of months (both ex-ante and actual) is calculated with one-end putting.

[11] PFY is from July to June.

[12] ④ : very high, ③ : high, ② : moderately low, ① : low.

Any collaboration/coordination between the project and other JICA's intervention was not clearly planned at the time of ex-ante evaluation and during the project implementation.

<Cooperation with other institutions/ Coordination with international framework>

Any cooperation/coordination with other institutions was not clearly planned at the time of ex-ante evaluation and during the project implementation.

<Evaluation Result>

In light of the above, the coherence of the project is ②.

[Evaluation Result of Relevance/Coherence]

In the light above, the relevance/coherence of the project is ③.

2 Effectiveness/Impact

<Status of Achievement of the Project Purpose at the Time of Project Completion>

At the time of project completion, the Project Purpose was mostly achieved as planned. Based on the priority analysis of the inspection data of the representative 41 bridges/culverts (hereinafter referred to as "bridges") in the model area that was registered in BIDB, the BMU prepared the draft bridge maintenance plan with breakdowns for the model area and calculated approximate budget for the budgetary request for the following 3 cases in November 2018: 1) repairs of all deteriorated elements (41 bridges in 9 years); 2) repairs of most critical elements (14 bridges in 3 years); and 3) repairs of only elements with severe deterioration (14 bridges in 1 year) (Indicator).

<Continuation Status of Project Effects at the Time of Ex-Post Evaluation>

By the time of the ex-post evaluation, the project effects have been continued. As for the bridge maintenance plan for the model area developed under the project, NHA has selected Case 1. Annual revisions of the Case 1 maintenance plan have not been continued as described in the results of Overall Goal Indicator 2 (b) below. Meanwhile, the maintenance and repair of the bridges in the model area have been continued according to the latest plan as described in the results of Overall Goal Indicator 1 below. In the model area, an inventory survey of remaining bridges was conducted in 2019/20, 2022/23, and completed in 2023/24. The inventory survey in 2019/20 was conducted by the BMU and TEs but the one in 2022/23 and 2023/24 was conducted by local consultants hired by NHA and a TE who remained with NHA, because the rest of trained TEs and all new TEs hired after the project completion had left NHA for stable jobs.(see <Institutional/Organizational Aspects> of "Sustainability"). For reference, the local consultants were hired in April 2022 to complete the inventory survey and 1st cycle of inspections of bridges on the entire NHA network[13] and to register the obtained data in BIDB by December 2024. All inventory and inspection data obtained in the model area has been registered in BIDB (for inspection status, please see the results of Overall Goal Indicator 2(a) below). It is noted that registering the data in BIDB was done by the BMU for the data obtained in 2019/20 and by the abovementioned consultants for the data obtained in 2022/23 and 2023/24[14]. The project has contributed to the inventory survey and data registration by consultants, as the consultants are mandated to use the technical documents developed under the project and have been trained by the NHA bridge engineers who had acquired the skills and knowledge through the project.

<Status of Achievement of the Overall Goal at the Time of Ex-Post Evaluation>

At the time of ex-post evaluation, the Overall Goal has been partially achieved as planned.

By the target year (2021/22), the target of inspecting at least 65 bridges annually in the model area was not achieved. A total of 65 bridges were inspected in 2019/20 by the BMUs and TEs but the inspection was not conducted in 2020/21 and 2021/22 mainly due to deficiency of TEs as stated above and lack of budget for inspection in 2020/21 and 2021/22 (see <Financial Aspect> of "Sustainability"), and delay in the process of hiring the local consultants mentioned earlier. After the target year, inspection by the local consultants and a TE remaining with NHA started. In the model area, 200 bridges and 66 bridges were inspected respectively in 2022/23 and 2023/24. (For reference, the 1st cycle of inspections of bridges in the model area was completed with the inspection of 25 bridges in 2023/24 and, the 2nd cycle of inspections of the 41 bridges inspected under the project was also completed.) As a result, a total of 331 were inspected in the model area by 2023/24. The target of inspecting at least 65 bridges annually in the model area was mostly achieved as planned as of 2023/24 because, while the average number of inspected bridges per year was 66, inspection was not conducted annually as planned. The project has contributed to the inspections by consultants due to the same reasons as in the cases of inventory survey and data registration. Overall, the target of inspecting at least 65 bridges annually in the model area has been partially achieved at the time of ex-post evaluation. As NHA plans to continue to outsource 5-yearly periodic inspections of bridges on the entire NHA network (20% of bridges per year) based on the Long-term Plan from 2025/26 onwards, at least 65 bridges are expected to be inspected annually in the model area in the future. (Indicator 2 (a)). By the target year, the annual review/revision of the bridge maintenance plan for the model area based on the analysis of inspection data was not achieved. The Case 1 plan selected by NHA was reviewed based on the analysis of inspection data of an additional 65 bridges in 2019/20. Although it was determined that there was no need to repair additional bridges, the repair schedule for the existing target bridges was revised based on a review of the repair priorities. The plan was not revised in 2020/21 and 2021/22 as no inspections were conducted as stated above. After the target year, an inspection was conducted in 2022/23, but the plan was not revised because the data obtained was not detailed enough, and additional data collection was required. Overall, the annual review/revision of the bridge maintenance plan for the model area has not been achieved at the time of ex-post evaluation. It is noted that the plan will be revised in 2023/24 based on the analysis of the data obtained in 2022/23 and 2023/24, which will be used for planning the Annual Maintenance Plan (AMP) 2024/25 of NHA (Indicator 2(b)). Taken together, Indicator 2 has not been achieved at the time of ex-post evaluation.

All bridges identified in the latest plan of the bridge maintenance plan for the model area prepared under the project were maintained and repaired according to the latest plan by the target year. A major promoting factor was the inclusion of the latest plan in the AMP and approval of the AMP by NHA. The same applies after the target year. Overall, Indicator 1 has been achieved as planned at the time of ex-

[13] The workforce for bridge inventory/inspection is TEs according to the Short-term (December 2018-February 2020), Mid-term (March 2020-May 2022), and Long-term (June 2022 onwards) Plans for bridge inventory/inspection developed by the BMU during the project implementation with support from the JICA expert team; however, "outsourcing" is planned to be added to the workforce from the Mid-term Plan. NHA started the process of hiring local consultants in 2020 according to the Mid-term Plan, but it only realized in 2022 due to a lacuna in the financial bid of the consultant. For reference, the Short-term Plan targets bridges in 6 ROs, and the Medi-term plan targets the ones in the remaining RO. The Long-term Plan is to inspect bridges on once in 5-year basis (20 % of bridges per year).

[14] It is noted that the BIDB system is only accessible from the NHA HQ. NHA has a plan to upgrade the BIDB system in the future (specific year was not mentioned by NHA) so that consultants and ROs can access the system from their own offices and enter data themselves.

post evaluation. From the past trend, it is likely to continue in the future. (Indicator 1)

<Other Impacts at the Time of Ex-Post Evaluation>

Some positive impacts have been observed. During the project implementation, the Short-term, Mid-term, and Long-term Plan for BMS was developed by the BMU with support from the JICA expert team (see footnote 12), based on which, the BMU started conducting inventory surveys and inspections of the bridges outside the model area. Before the project completion, 4,902 bridges were inspected by the BMU and the TEs and, since the project completion, 2,281 more bridges have been inspected by the BMU and TEs (in 2019/20) and the local consultants hired by NHA and a TE remaining with NHA (in 2022/23 and 2023/24) as of August 2023. Meanwhile, no negative impacts have been observed.

<Evaluation Result>

In light of the above, the effectiveness/impact of the project is ③.

Achievement of Project Purpose and Overall Goal

<table>
<tr><th>Aim</th><th>Indicators</th><th>Results</th><th>Source</th></tr>
<tr><td>(Project Purpose) Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of the model area.</td><td>Indicator: Bridge maintenance plan with breakdowns for the model area prepared by November 2018.</td><td>Status of the Achievement (Status of the Continuation): mostly achieved as planned (partially continued)
(Project Completion)
● In November 2018, the BMU prepared the draft bridge maintenance plan with breakdowns for the model area for the 3 cases.
(Ex-Post Evaluation)
● Of 3 cases proposed in the project, NHA has selected Case 1 (repair of all deteriorated elements of the 41 representative bridges in 9 years) as the bridge maintenance plan for the model area. Annual revisions of the bridge maintenance plan have not continued (see the results of Overall Goal Indicator 2 (b)), but the bridge maintenance has been continuously implemented according to the latest bridge maintenance plan (see the results of Overall Goal Indicator 1)</td><td>Project Completion Report, questionnaire and interview with NHA</td></tr>
<tr><td rowspan="2">(Overall Goal) Bridge inspection and maintenance status improved on the bridges of National Highways in the model area.</td><td>Indicator 1: The bridges identified in the maintenance plan prepared under the project are maintained and repaired according to the plan*.

*See <Special Perspectives considered in Ex-Post Evaluation></td><td>Status of the Achievement: achieved as planned.
(Target Year) (Ex-Post Evaluation)
>Ratio of bridges maintained and repaired according to the latest bridge maintenance plan.
<table>
<tr><th>PFY</th><th>2019/20</th><th>2020/21</th><th>2021/22 (Target Year)</th><th>2022/23</th></tr>
<tr><td>(Ref). No. of initial bridges to be repaired in the initial Case 1 plan selected by NHA</td><td>4</td><td>5</td><td>4</td><td>1</td></tr>
<tr><td>(1) No. of bridges to be repaired according to the latest bridge maintenance plan</td><td>4</td><td>3</td><td>3</td><td>5</td></tr>
<tr><td>(2) No. of bridges included in the approved Annual Maintenance Plan of the NHA</td><td>4</td><td>3</td><td>3</td><td>5</td></tr>
<tr><td>(3) No. of bridges maintained and repaired according to the Annual Maintenance Plan</td><td>4</td><td>3</td><td>3</td><td>5</td></tr>
<tr><td>(4) % of bridges maintained and repaired according to the latest plan = ((3)/(1)) *100</td><td>100%</td><td>100%</td><td>100%</td><td>100%</td></tr>
</table></td><td>Questionnaire and interview with NHA</td></tr>
<tr><td>Indicator 2: In the model area, more than [65] bridges are annually inspected and the bridge maintenance plan is annually revised*

*See <Special Perspectives considered in Ex-Post Evaluation>.</td><td>Status of the Achievement: not achieved.
(Target Year) (Ex-Post Evaluation)
>Implementation status of inspection in the model area and revision status of the bridge maintenance plan for the model area
<table>
<tr><th>PFY</th><th>(Ref) During the project (2017/18)</th><th>2019/20</th><th>2020/21</th><th>2021/22 (Target Year)</th><th>2022/23</th><th>2023/24 (as of Oct 2023)</th></tr>
<tr><td>(a) Number of bridges inspected (1st: 1st cycle of inspection/2nd: 2nd cycle of inspection*)</td><td>41 (1st)</td><td>65 (1st)</td><td>0</td><td>0</td><td>200 (1st)</td><td>25 (1st: completed)
41 (2nd)</td></tr>
<tr><td>(b) Revision status of the bridge maintenance plan (Yes=reviewed/revised, No=not revised)</td><td></td><td>Yes</td><td>No</td><td>No</td><td>No</td><td>(Ref) Plan: Yes</td></tr>
</table>
*NHA has a policy to inspect bridges once in 5 years</td><td>Questionnaire and interview with NHA</td></tr>
</table>

3 Efficiency

	Project Cost (Japanese side only, yen)	Project Period (months)
Plan (ex-ante)	197 million	30[15]

[15] See footnote 10.

Both the project cost and the project period slightly exceeded the plan (the ratio against the plan: 109% and 110%, respectively). The project cost slightly exceeded the plan since the BMS software needed to be newly developed and the number of JICA experts increased from 7 to 9. The project period slightly exceeded the plan as well, because of the relative lack of progress of the project in the initial one and half years. This was caused by several factors including the following: 1) shortage of the C/Ps; 2) shortage of trained manpower in MUs and ROs; 3) the original logical framework that was less than feasible; and 4) much time needed for reaching a mutual understanding between the C/Ps and the JICA expert team.

Actual	214 million	33
Ratio (%)	109	110

Outputs in the original logical framework were not produced as planned due to the addition of the development of BMS to Output 1, the reduction of the scope of Outputs 2 and 3 from bridges on the entire NHA network (around 21,000 bridges in 13 ROs (then)) to the 41 representative bridges in the model area in 1 RO, and the addition of the preparation of bridge maintenance plan to Output 3 (see footnotes 3, 4 and 5). Since, it was difficult to verify whether increases in the project cost and period were commensurate with changes in Outputs, a simple comparison of planned and actual cost/period was applied. In the light above, the efficiency of the project is ③.

4 Sustainability

<Policy Aspect>

The Pakistan Vision 2025 stated in "Relevance" is still effective at the time of ex-post evaluation. In addition, the National Transportation Policy (2018), the Central Asia Regional Cooperation Transport Strategy 2030 (Pillar-VII Modernizing transportation infrastructure and greater regional connectivity), and the Road Maintenance Account (RMA) Rules 2003 promote the system/activities for bridge maintenance introduced/established by the project.

<Institutional/Organizational Aspect>

The organizational system to promote BMS introduced under the project (i.e., the workforce for BMS consisting of the BMU and TEs) has been partly changed. The organizational structure of the BMU has been approved by the then Chairman NHA and later by NHA Executive Board with allocation of 3 posts for NHA officers of engineering cadre. The BMU has been functioning. At the time of ex-post evaluation, the BMU does not have the necessary number of staff as 2 out of 3 posts are vacant due to staff transfer in 2022/23. Its adverse effects on the promotion of BMS are minimized by the effort of the remaining staff, who is the head of the BMU. NHA has a plan to appoint and/ or recruit permanent staff for the vacant posts in the BMU in the next fiscal year (2024/25). Meanwhile, only one TE trained under the project is included in the workforce for BMS as stated earlier. The rest of TEs trained under the project and all new TEs hired and trained after the project completion have left NHA with better job opportunities as their positions at NHA are on a contract basis, and NHA did not recruit new TEs due to budget constraints in 2020/21 and 2021/22 (see <Financial Aspect> below> and difficulty in keeping the TEs in the workforce (TEs just leave NHA when they find more secure jobs even during the middle of the contracts). NHA does not have a plan to recruit new TEs in the future, either. NHA is also facing a shortage of staff at MUs and ROs as staff recruitment has not been carried out last 10 years. Lack of TEs and staff at MUs and ROs negatively affected inspections and inventory surveys in and outside the model area in 2020/21 and 2021/22; however, this has been addressed by hiring local consultants as described in "Effectiveness/Impact". NHA plans to continue outsourcing the inspection and data registration tasks in the future. The BMU has been coordinating with MUs and ROs as well as other departments such as the Computer Bureau. If there is any issue related to IT arises at the BMU, NHA temporarily assigns a specialist from the Computer Bureau to the BMU.

<Technical Aspect> .

The existing staff of the BMU is a well-trained structure engineer with a Ph.D., and the technical skills and knowledge have been continuously enhanced with the experience gained during the ongoing consultancy services contract of inspection of the entire NHA bridges. Once the vacant posts of the BMU are filled, NHA plans to provide training to new staff by the staff trained under the project. The existing TE, who has conducted bridge inspections in and outside the model area after the project completion, is now regarded as experienced and qualified bridge inspector. Training of the relevant staff of NHA, including the BMU, was planned to be conducted annually at the Highway Research Training Center (HRTC) under NHA. It has been suspended due to the COVID-19 pandemic but will be resumed in 2023/24. It is worthwhile mentioning that NHA plans to integrate BMS into the training at the HRTC. A training program for the abovementioned consultants was arranged by the BMU and other NHA staff trained under the project to make sure that inspection and inventory survey be conducted properly, the negative effects on the technical capacity of NHA caused by the turnover of the TEs have been minimized. The manuals and material developed under the project have been used by the BMU, all MUs and ROs as well as the consultants hired by NHA.

<Financial Aspect>

NHA has continuously secured enough budget for the promotion of BMS through its revenue (i.e. RMA from highway tolls, fines, etc.) except for the budget for inventory survey/inspection in 2020/21 and 2021/2022 due to external factors. During this period, the revenue of NHA was reduced due to effects of COVID-19 pandemic and many bridges and roads were damaged by a flood in 2022. As a result, much of the budget was allocated to higher priority works (i.e., repair of bridges and roads) besides emergency budget. It is noted that NHA has secured the budget for outsourcing the inventory survey, inspection, and data registration in BIDB since 2022/23, and has a plan to continue outsourcing these tasks in the future. From the past trend, it is expected that NHA will secure sufficient budget through its revenue in the future.

<Environmental and Social Aspect>

No issue on environmental and social aspect has been observed and it has not been necessary to take any countermeasures.

<Evaluation Result>

In light of the above, slight problems have been observed in terms of the institutional/organizational and technical aspects of the implementing agency. Therefore, the sustainability of the project effects is ③.

5 Summary of the Evaluation

The project mostly achieved as planned the preparation of annual bridge maintenance plan on the basis of the latest bridge inspection data of the model area (Project Purpose) and partially achieved the improvement of Bridge inspection and maintenance status on the bridges of National Highways in the model area (Overall Goal). After the project completion, the effects of the project have been continued. As for Sustainability, no problems have been observed in terms of policy, financial, and environmental and social aspects. Considering all

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

III. Recommendations & Lessons Learned

Recommendations for Implementing Agency:

- NHA is required to make sure to appoint and/or recruit permanent staff for the vacant posts for the BMU at NHA HQ in the next fiscal year (2024/25) and to make efforts to secure necessary budget to continuously hire local consultants to maintain necessary technical human resource to continue inspections in the future.
- Considering the current situation that the BIDB system can only be accessed from the NHA HQ, NHA needs to implement its plan to upgrade the BIDB system as early as possible so that consultants and ROs can access the system from outside the NHA HQ and necessary data registration can easily be done by them. This will make the connection with ROs stronger and the flow of maintenance more efficient and effective. This will be less time-consuming for consultants, too.

Lessons Learned for JICA:

- For new projects that include the development of a bridge information management database, an integrated system that is accessible not only from the HQ of the implementing agency but also the offices of those involved in bridge management such as local offices, consultants (if applicable), etc. should be developed at first place to make maximum use of the system[16].
- Through the project activities, both implementing agency and JICA exchanged views thoroughly on the adequacy of the initial plan, and the activities and target areas were modified twice. The initial plan to target the entire NHA network was unrealistic, and JICA should discuss a specific and realistic plan with the implementing agency during the detailed planning survey.

Example of a bridge inspected and repaired under the last maintenance plan

[16] This lesson was extracted from the fact stated in footnote 14.