

### 3. Project Monitoring Sheet

(1) Version 1 (29 July 2016)

**TO CR of JICA Pakistan OFFICE**

**PROJECT MONITORING SHEET**

**Project Title : The Project for Technical Assistance on Implementation  
of Bridge Management System in NHA**

**Version of the Sheet: Ver.1 (Term: the beginning stage)**

**Name: Kenichi TOMI**

**Title: Project Monitoring**

**Submission Date: 4<sup>th</sup> August, 2016**

**I. Summary**

**1 Progress**

**1-1 Progress of Inputs**

(N/A because of the beginning stage)

**1-2 Progress of Activities**

(N/A because of the beginning stage)

**1-3 Achievement of Output**

(N/A because of the beginning stage)

**1-4 Achievement of the Project Purpose**

(N/A because of the beginning stage)

**1-5 Changes of Risks and Actions for Mitigation**

(N/A because of the beginning stage)

**1-6 Progress of Actions undertaken by JICA**

(N/A because of the beginning stage)

**1-7 Progress of Actions undertaken by Gov. of NHA**

(N/A because of the beginning stage)

**1-8 Progress of Environmental and Social Considerations (if applicable)**

(N/A because of the beginning stage)

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

(N/A because of the beginning stage)

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

Before conducting MT Training, Member (Planning) suggested to dispatch Mr. Ikramus Saqlain Haider, GM (RAMD) and Mr. Muhammad Asif Azam, DD (RAMD) to Japan for approximate two (2) weeks in order to study the overall BMS of Japan and

understand the procedures of inspection, maintenance and operation of bridge structures for appropriately defining NHA's objectives.

## **2 Delay of Work Schedule and/or Problems (if any)**

### **2-1 Detail**

(N/A because of the beginning stage)

### **2-2 Cause**

(N/A because of the beginning stage)

### **2-3 Action to be taken**

(N/A because of the beginning stage)

### **2-4 Roles of Responsible Persons/Organization (JICA, NHA, etc.)**

(N/A because of the beginning stage)

## **3 Modification of the Project Implementation Plan**

### **3-1 PO**

(N/A because of the beginning stage)

### **3-2 Other modifications on detailed implementation plan**

*(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)*

(N/A because of the beginning stage)

## **4 Preparation of NHA toward after completion of the Project**

**II. Project Monitoring Sheet I & II** as Attached



Project Design Matrix

**Project Title: The Project for Technical Assistance on Implementation of Bridge Management System in NHA**

**Implementing Agency: National Highway Authority**

Version 1

Dated 29, July, 2016

**Target Group:**

**Period of Project: July, 2016 – January, 2019 (30 months)**

**Project Site: in/around Islamabad, Pakistan**

**Model Site:**

| Narrative Summary   |  | Objectively Verifiable Indicators  | Means of Verification  | Important Assumption   | Achievement | Remarks |
|---|--|--|--|--|-------------|---------|
| <b>Overall Goal</b><br>Bridge maintenance status improved on the bridges of National Highways in Pakistan.  | Average bridge damage value, calculated by the existing BMS (Smart Bridge), decreased by XX% in [January, 2022] from the start of the  | Average bridge damage value, calculated by the existing BMS (Smart Bridge), decreased by XX% in [January, 2022] from the start of the  | Output data of the existing BMS  |  |             |         |
| <b>Project Purpose</b><br>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. | Bridge maintenance budget document with breakdowns prepared in [November, 2018].   | Bridge maintenance budget document with breakdowns prepared in [November, 2018].   | Analysis on each of input data to the existing BMS (Smart Bridge) and bridge maintenance budget document (with breakdown)                                  | <ul style="list-style-type: none"> <li>· NHA's road maintenance budget does not decrease from the start of the Project.</li> <li>· Natural disasters with the risk of damages on bridges do not occur on National Highways in Pakistan.</li> </ul> |             |         |
| <b>Outputs</b><br>1. 1. Manuals and a database developed for bridge inspection and bridge repair method selection.  | 1-1. 3 types of draft manuals (for (1) bridge inspection, (2) data input to a bridge inspection database, and (3) bridge repair method selection) developed by [November, 2016]<br>1-2. A draft bridge inspection format developed by [November, 2016].<br>1-3. A manual for culvert inspection and a culvert inspection format developed by [November, 2016].<br>1-4. A draft bridge inspection database developed by [November, 2016].<br>1-5. 2 types of draft training materials for the master trainers of NHA's HQ and ROs (for (1) bridge inspection and (2) bridge repair method selection) developed by [November, 2016]<br>1-6. Manuals (1-1 & 1-3), a bridge inspection format (1-2 & 1-3), a database (1-4) and training materials (1-5) finalized by [September, 2018]. | 1-1. 3 types of draft manuals<br>1-2. A draft bridge inspection format<br>1-3. A manual for culvert inspection and a culvert inspection format<br>1-4. A draft bridge inspection database<br>1-5. 2 types of draft training materials<br>1-6. 3 types of manuals, a bridge inspection format, a database and 2 types of training materials | <ul style="list-style-type: none"> <li>· The existing BMS (Smart Bridge) is continuously in use by NHA for cost estimate of bridge maintenance.</li> </ul> |  |             |         |

|   |   |   |  |  |  |
|---|---|---|--|--|--|
| <p>2. Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and bridge repair method selection of uniformed contents implemented on all the bridges of National Highways in Pakistan.</p> | <p>2-1. 3 types of master trainers' training (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database) implemented by [October, 2017]</p> <p>2-2. 3 types of training (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database) implemented by the master trainers (trained in Activity 2-1) at all the 36 MUs by [November, 2017]</p> <p>2-3. Bridge inspection, bridge repair method selection, and data input to a bridge inspection database completed at all the 36 MUs by [June, 2018].</p> <p>2-4. 90% or more results of bridge repair method selection and data input to a bridge inspection database by the staff of MUs evaluated to be accurate by NHA's HQ &amp; JICA Experts by [October, 2018]</p> <p>2-5. 80% or more master trainers of NHA's HQ and ROs scored at the capacity test after the training 80% or higher than that before the training.</p> | <p>2-1. Training records and reports</p> <p>2-2. Training records and reports</p> <p>2-3. Completed bridge inspection formats and input data to a bridge inspection database</p> <p>2-4. Input data to a bridge inspection database and its evaluation</p> <p>2-5. Test records and reports</p> |  |  |  |
| <p>3. 3. Data on all the bridges of National Highways in Pakistan input by MUs to the existing BMS (Smart Bridge) available to NHA's HQ and ROs.</p>  | <p>3-1. Training for management of the existing BMS (Smart Bridge) implemented by [October, 2017].</p> <p>3-2. Data on all the bridges of National Highways in Pakistan input to the existing BMS (Smart Bridge) by [October, 2018].</p> <p>3-3. Cost estimate necessary for bridge maintenance in the fiscal year of 2019 based on the data input to the existing BMS (Smart Bridge).</p>  | <p>3-1. Training records and reports</p> <p>3-2. Input data to the existing BMS (Smart Bridge)</p> <p>3-3. Bridge maintenance budget document with breakdown</p>  |  |  |  |

| Activities  | Inputs<br>The Japanese Side   | The Pakistani Side   | Pre-Conditions  |
|---|---|--|---|
| <p>1-1. Develop 3 types of draft manuals (for (1) bridge inspection, (2) data input to a bridge inspection database, and (3) bridge repair method selection)</p> <p>1-2. Develop a draft bridge inspection format.</p> <p>1-3. Develop a manual for culvert inspection and a culvert inspection format.</p> <p>1-4. Develop a draft bridge inspection database (in Excel/Access).</p> <p>1-5. Develop 2 types of draft training materials for the master trainers of NHA's HQ and ROs (for (1) bridge inspection and (2) bridge repair method selection)</p> <p>1-6. Review and finalize the above 3 types of manuals (Activity 1-1), a format (Activity 1-2), a data base (Activity 1-4) and 2 types of training materials (Activity 1-5)</p> <p>2-1. Implement 3 types of master trainer's training for the staff of NHA's HQ and ROs at the target bridges in/around Islamabad (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database)</p> <p>2-2. By master trainers (trained in Activity 2-1), implement 3 types of training for the staff of MUs (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database)</p> <p>2-3. By the staff of MUs (trained in Activity 2-2), implement (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database for all the bridges</p> <p>3-1. Implement training for the staff of NHA's HQ of operation and management of the existing BMS</p> <p>3-2. Transfer the data from a bridge inspection database input by the staff of MUs to the existing BMS (Smart</p> | <p><b>1. EXPERTS</b></p> <ul style="list-style-type: none"> <li>1) Bridge Inspection Expert</li> <li>2) Bridge Repair Expert</li> <li>3) BMS Expert</li> <li>4) Capacity Development Expert</li> <li>5) Project Monitoring Expert</li> <li>6) Local Coordinator (Pakistani)</li> </ul> <p><b>2. EQUIPMENT</b></p> <ul style="list-style-type: none"> <li>Non-destructive testing equipment such as <ul style="list-style-type: none"> <li>· Ground Penetrating Radar</li> <li>· Electrochemical Polarization Corrosion Measurement</li> <li>· Measurement by Sonic Testing</li> <li>· Schmidt Hammer</li> <li>· Carbonation Depth measurement Kit</li> <li>· Crack Scale</li> <li>· Test Hammer</li> </ul> </li> <li>· Licensed Database with Server and Terminals</li> </ul> <p>(Input other than indicated here will be determined through mutual consultations between JICA and NHA during the implementation of the Project as necessary)</p> | <p><b>PERSONNEL</b></p> <ul style="list-style-type: none"> <li>Administrative Personnel</li> <li>1) Project Director: <ul style="list-style-type: none"> <li>Member (Operations)</li> </ul> </li> <li>2) Project Manager: <ul style="list-style-type: none"> <li>Director (RAMS)</li> </ul> </li> <li>Counterpart Personnel</li> <li>1) Project Coordinator: <ul style="list-style-type: none"> <li>Deputy Director (BMS)</li> </ul> </li> <li>2) Assistant Project Coordinator: <ul style="list-style-type: none"> <li>Assistant Director (BMS)</li> </ul> </li> </ul> <p><b>2. OFFICE &amp; FACILITIES</b></p> <ul style="list-style-type: none"> <li>· Office for JICA Experts in NHA's HQ Building with office furniture, internet and telephone.</li> </ul> <p><b>3. ARRANGEMENT</b></p> <ul style="list-style-type: none"> <li>· Arrangements for master trainers' training and the training at all the 36 MUs.</li> <li>· Transportation for the field trips of JICA Experts in/around Islamabad.</li> </ul> <p><b>4. BUDGET ALLOCATION</b></p> <ul style="list-style-type: none"> <li>Budget for travel expenses and allowances for the participants of master trainers' training and the training at all the 36 MUs.</li> </ul> | <ul style="list-style-type: none"> <li>· NHA staff, the participants in the training (Activity 2-1 and 2-2), do not retire from NHA.</li> <li>· Pakistan, especially Islamabad, is continuously safe enough for JICA Experts to implement the activities.</li> </ul> <p style="text-align: center;"><b>➔</b></p> <p><b>&lt;Issues and countermeasures&gt;</b></p> |

|   |  |  |  |
|---|--|--|--|
| 3-3. Estimate the cost necessary for bridge maintenance in the fiscal year of 2019 based on the data transferred to the existing BMS (Smart Bridge) in Activity 3-2 |  |  |  |
|---|--|--|--|



| Activity   | Plan |        | Actual |        | 2nd | 1st |
|--|------|--------|--------|--------|-----|-----|
|  | Plan | Actual | Plan   | Actual |     |     |
| 1-2 Develop a draft bridge inspection format based on the findings of Activity 0-1, 0-2, 0-3 & 0-4.  |      |        |        |        |     |     |
| 1-3 Develop a manual for culvert inspection and a culvert inspection format.   |      |        |        |        |     |     |
| 1-3-1 Draft a manual for culvert inspection based on the findings of Activity 0-1 & 0-2.   |      |        |        |        |     |     |
| 1-3-2 Draft a culvert inspection format based on the findings of Activity 0-1, 0-2 & 0-3.  |      |        |        |        |     |     |
| 1-4 Develop a manual for culvert inspection and a culvert inspection format.   |      |        |        |        |     |     |
| 1-4-1 Study the current IT environment of 13 ROs and 36 MUs including the number of PCs deployed and the condition of internet connection. |      |        |        |        |     |     |
| 1-4-2 Consider the specification of a bridge inspection of a bridge inspection database (ex. Excel/Access).                                |      |        |        |        |     |     |
| 1-4-3 Develop a draft bridge inspection database.  |      |        |        |        |     |     |
| 1-5 Develop 2 types of draft training materials for the master trainers of NHA's HQ and ROs.   |      |        |        |        |     |     |
| 1-5-1 Develop bridge inspection training materials for MT training (basic & advance).  |      |        |        |        |     |     |
| 1-5-2 Develop bridge repair method selection manuals for MT training (basic & advanced).   |      |        |        |        |     |     |
| 1-6 Finalize the manuals, a format, a database and training materials referring to the lessons revised in Activity 2-1, 2-2 & 2-3.         |      |        |        |        |     |     |
| 1-6-1 Review the lessons learned from Activity 2-1, 2-2 & 2-3.   |      |        |        |        |     |     |
| 1-6-2 Revise the manuals, a format, a database and training materials referring to the lessons reviewed in Activity 1-6-1.                 |      |        |        |        |     |     |
| 1-6-3 Re-review the lessons learned from Activity 2-1, 2-2 & 2-3.  |      |        |        |        |     |     |
| 1-6-4 Finalize the manuals, a format, a database and training materials referring to the lessons reviewed in Activity 1-6-3.               |      |        |        |        |     |     |
| <b>Output 2: Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and</b>   |      |        |        |        |     |     |
| 2-1 Implement 3 types of MT training for the staff of NHA's HQ and ROs at the target bridges in/around Islamabad.                          |      |        |        |        |     |     |
| 2-1-1 Set up a criteria for selection of participants in MT training. Decide the participants in MT training from NHA's HQ and 13ROs.      |      |        |        |        |     |     |
| 2-1-2 Decide the target bridges of MT training (about 5 bridges in/around Islamabad).  |      |        |        |        |     |     |
| 2-1-3 Set up a criteria for the equipment to be provided for non-destructive bridge testing.   |      |        |        |        |     |     |
| 2-1-4 Prepare the contents and syllabus of MT training.  |      |        |        |        |     |     |
| 2-1-5 Carry out a questionnaire for the participants of MT training (at beginning  |      |        |        |        |     |     |

| Participants or MT training (at beginning, interim, and final stages).   | Progress Tracking |      |        |      |        |      |        |      |        |      |        |      | 1st | 2nd |     |     |
|--|-------------------|------|--------|------|--------|------|--------|------|--------|------|--------|------|-----|-----|-----|-----|
|  | Actual            | Plan | Actual | Plan | Actual | Plan | Actual | Plan | Actual | Plan | Actual | Plan |     |     |     |     |
| 2-1-6 Implement 3 types of master trainers' training.  |                   |      |        |      |        |      |        |      |        |      |        |      |     |     | 1st | 2nd |
| 2-1-7 Discuss to decide training in Japan.   |                   |      |        |      |        |      |        |      |        |      |        |      |     |     | 1st | 2nd |
| 2-1-8 Carry out a capacity test for MT in order to grant a certificate to those participants scored 80% or higher at the capacity test.      |                   |      |        |      |        |      |        |      |        |      |        |      |     |     | 1st | 2nd |
| 2-2 By MTs (trained in Activity 2-1), implement 3 types of training for the staff of MUs.  |                   |      |        |      |        |      |        |      |        |      |        |      |     |     |     |     |
| 2-2-1 Set up a criteria and minimum requirement of participants from MUs in training by MTs of ROs.  |                   |      |        |      |        |      |        |      |        |      |        |      |     |     | 2nd | 1st |
| Decide the participants in training at each 13 ROs.  |                   |      |        |      |        |      |        |      |        |      |        |      |     |     |     |     |
| 2-2-2 Prepare schedule for training at each 13 ROs and OJT training at each 36 MUs.  |                   |      |        |      |        |      |        |      |        |      |        |      |     |     |     | 1st |
| 2-2-3 Decide the target bridges of OJT training at each of 36 MUs.   |                   |      |        |      |        |      |        |      |        |      |        |      |     |     |     | 1st |
| 2-2-4 By MTs, implement 3 types of training for the staff of MUs.  |                   |      |        |      |        |      |        |      |        |      |        |      |     |     |     | 1st |
| 2-2-5 By MTs of NHA's HQ and JICA Experts (only if no security concerns), monitor the training by MTs of ROs.                                |                   |      |        |      |        |      |        |      |        |      |        |      |     |     | 2nd | 1st |
| 2-3 By the staff of MUs (trained in Activity 2-2), implement 3 types of activities for all the bridges under the jurisdiction of NHA.        |                   |      |        |      |        |      |        |      |        |      |        |      |     |     |     |     |
| 2-3-1 Prepare schedule for 3 types of activities at each of 36 MUs.  |                   |      |        |      |        |      |        |      |        |      |        |      |     |     |     | 1st |
| 2-3-2 By the staff of MUs, implement 3 types of activities for all the bridges of each of 36   |                   |      |        |      |        |      |        |      |        |      |        |      |     |     |     | 1st |
| 2-3-3 By MTs of NHA's HQ and JICA Experts (only if no security concerns), monitor 3 types of activities by the staff of MUs.                 |                   |      |        |      |        |      |        |      |        |      |        |      |     |     | 2nd | 1st |
| 2-3-4 By MTs of ROs, confirm all the bridges of each MU has been inspected and their data input to a bridge inspection database.             |                   |      |        |      |        |      |        |      |        |      |        |      |     |     |     | 1st |
| 2-3-5 By MTs of NHA's HQ and JICA Experts, evaluate the accuracy of 3 types of activities by the staff of MUs.                               |                   |      |        |      |        |      |        |      |        |      |        |      |     |     | 2nd | 1st |
| <b>Output 3: Data on all the bridges of National Highways in Pakistan input by MUs to the existing BMS (Smart Bridge) available to NHA's</b> |                   |      |        |      |        |      |        |      |        |      |        |      |     |     |     |     |
| 3-1 Implement a training for the staff of NHA's HQ for management of the existing BMS (Smart Bridge).  |                   |      |        |      |        |      |        |      |        |      |        |      |     |     |     |     |
| 3-1-1 Prepare the contents and syllabus of training for the staff of NHA's HQ for management of the existing BMS (Smart Bridge).             |                   |      |        |      |        |      |        |      |        |      |        |      |     |     | 1st | 2nd |
| 3-1-2 Implement training for the staff of NHA's HQ for management of the existing BMS (Smart Bridge).  |                   |      |        |      |        |      |        |      |        |      |        |      |     |     | 1st | 2nd |
| 3-2 Transfer the data from a bridge inspection database input by the staff of MUs to the existing BMS (Smart Bridge).                        |                   |      |        |      |        |      |        |      |        |      |        |      |     |     |     |     |





THE PROJECT FOR TECHNICAL ASSISTANCE  
ON IMPLEMENTATION OF  
BRIDGE MANAGEMENT SYSTEM IN NHA

*JCC*

Joint Coordination Committee



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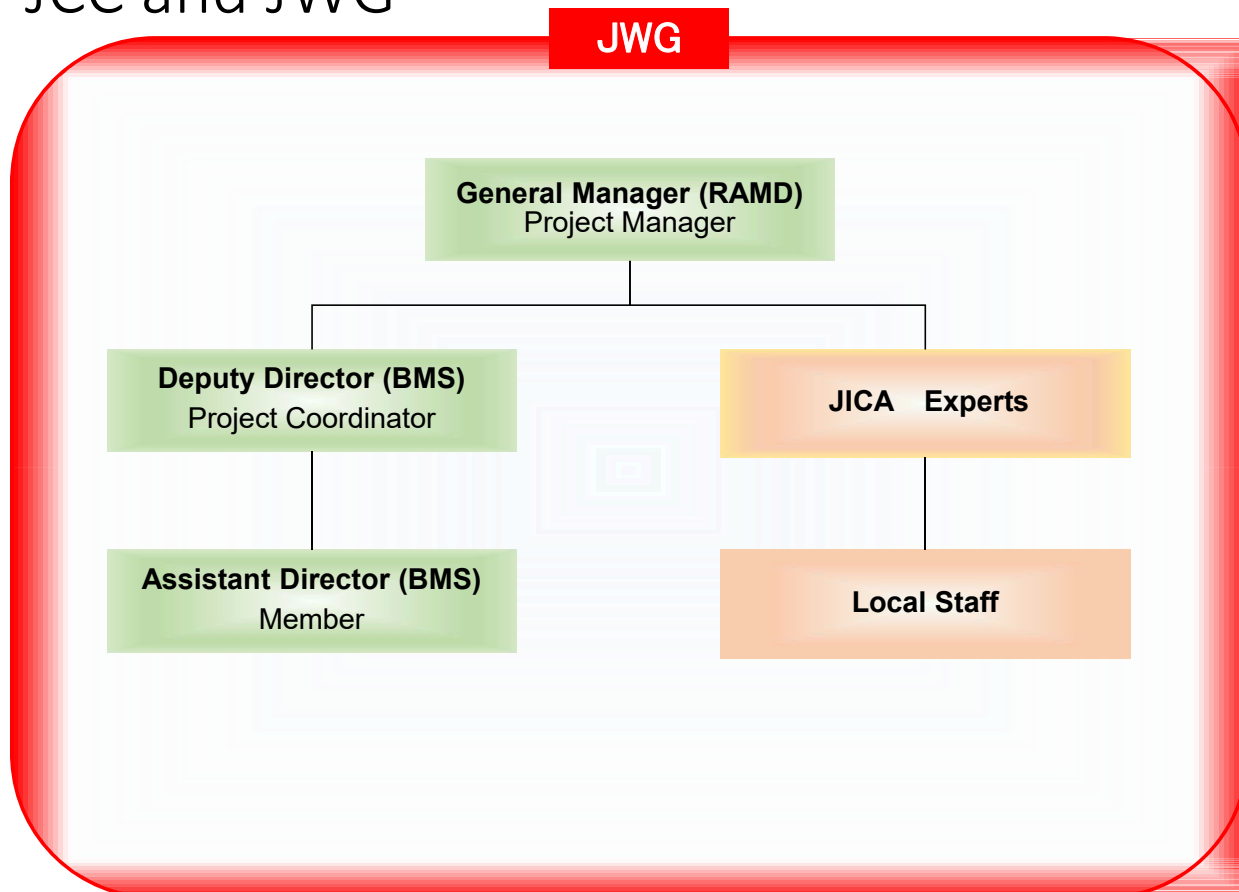
## Agenda

1. Opening of the Meeting
2. Introduction of Participants
3. Outline of the Project
  - Purpose and Output of this project
  - Summary of Scope of Works/Activities
  - Schedule of the project
4. Clarification from JICA Experts
  - Need to revise the Scope
  - Treatment of Technical Advisor in JCC
5. Summary of the Monitoring Sheets
6. Progress and Future Plan
7. Discussion
8. Remarks
9. Others

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# JCC and JWG



# JCC and JWG

| Pakistan - NHA  | Japan – JICA  |
|---|---|
| <b>Person in Charge</b><br>Mr. Raja Nowsherwan<br>Member (Planning) NHA | JICA Pakistan Office<br>Chief Representative<br>Mr. Yasuhiro Tojo   |
| <b>Project Manager</b><br>Mr. Ikramus Saqlain Haider<br>GM (RAMD) NHA   | Representative<br>Ms. Tomoko Fujikawa<br>Senior Program Officer<br>Ms. Naila Almas  |
| <b>Member</b><br>Dr. Asim Inam<br>Director (Design) NHA                 | Technical Advisor<br>(to be nominated by NHA)   |
| <b>Secretary</b><br>Mr. Muhammad Asif Azam<br>Deputy Director (BMS) NHA | <b>Consultant Team</b><br>Project Manager/Bridge Inspection Expert<br>Yukio IGO<br>Bridge Repair Expert<br>Yoshiichi FUJIMOTO<br>BMS Expert<br>Akio MORI<br>Capacity Development Ex.<br>Haruo TOMIYAMA<br>Project Monitoring Expert<br>Kenichi TOMI<br>Program Coordinator<br>Kotoko YONEDA |
| Mr. Sajjad Ahmed<br>Assistant Director (Survey)                         | Local Expert / Administrator<br>(to be nominated)   |

THE PROJECT FOR TECHNICAL ASSISTANCE  
ON IMPLEMENTATION OF  
BRIDGE MANAGEMENT SYSTEM IN NHA

## *Outline of the Project*



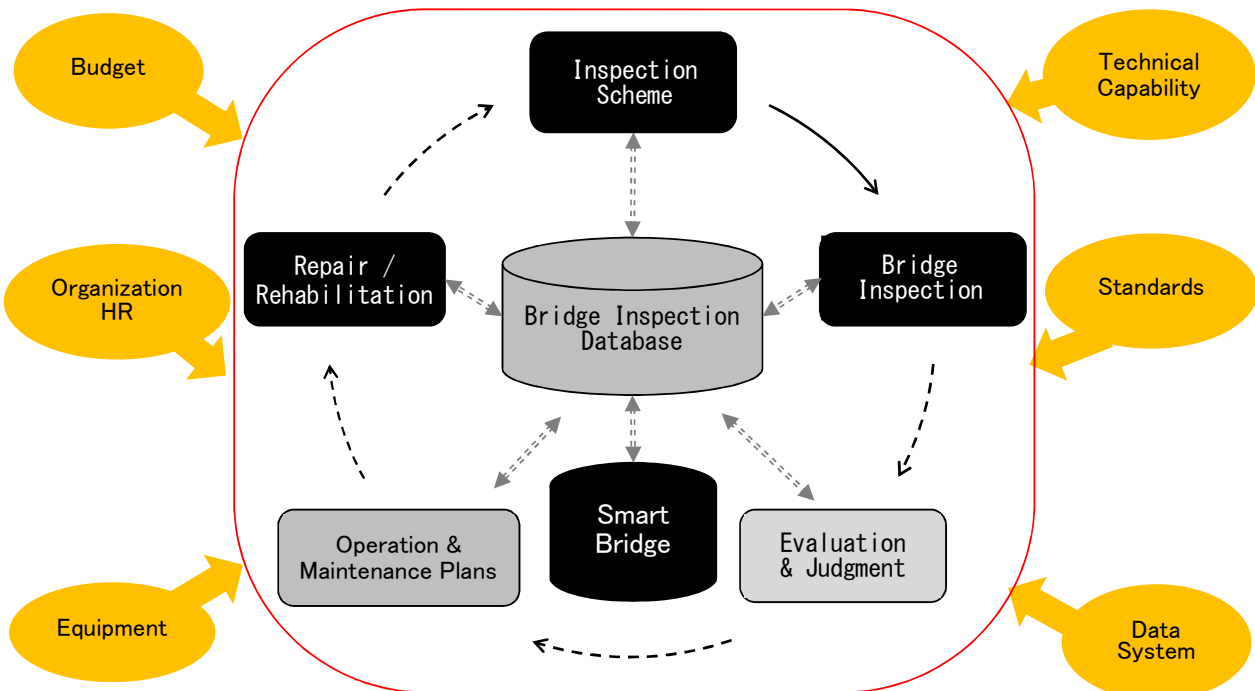
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- Bridge Operation & Maintenance
- Activities
- Workflow – Feedback from Trial –
- Work Schedule
- Organization for Bridge Maintenance
- JCC & JWG
- Level of Training Materials

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# Bridge Operation & Maintenance



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## Activities

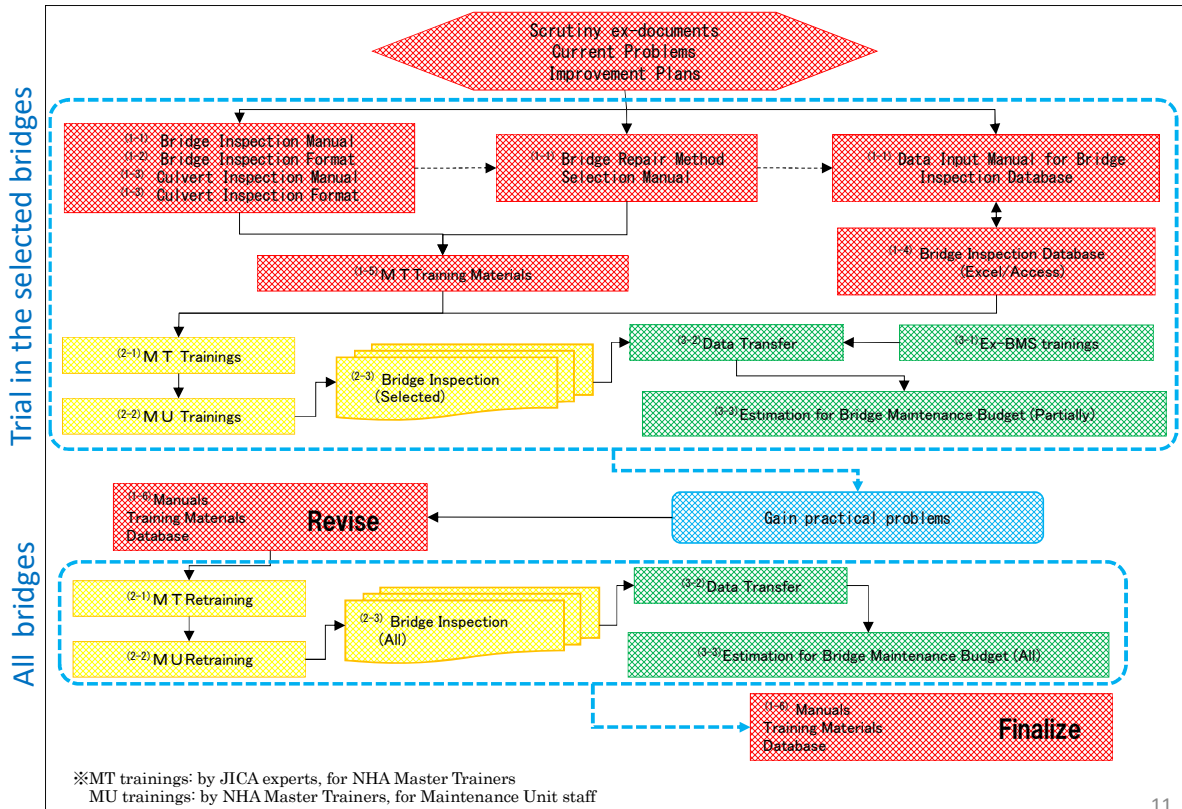
**Manuals & Formats**

**Training and Fostering**

**Bridge Management System**

10

# Workflow - Feedback from Trial -



11

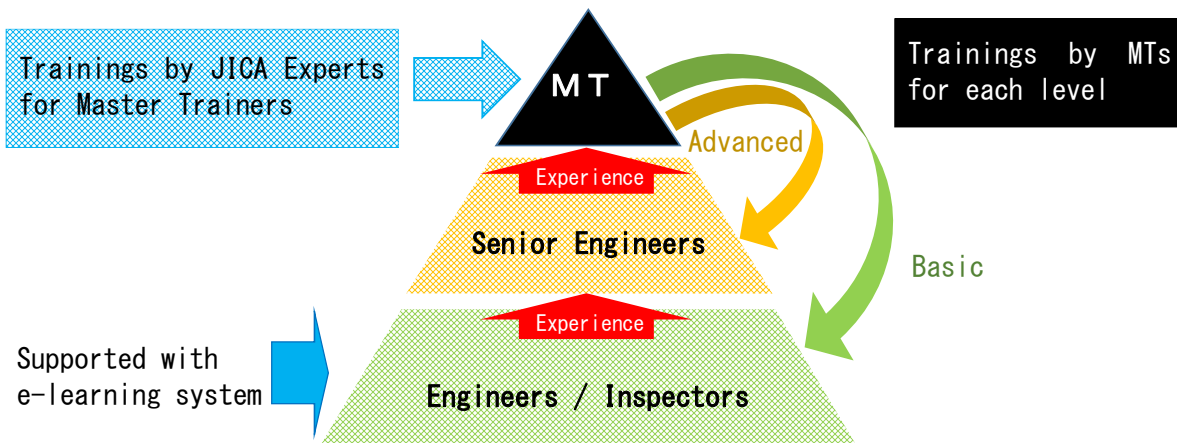
# Work Schedule

| Items               | Time | 2016 (FY) |   |   |   |    | 2017 (FY) |    |   |   |   | 2018 (FY) |   |   |   |   |   |    |    |
|---------------------|------|-----------|---|---|---|----|-----------|----|---|---|---|-----------|---|---|---|---|---|----|----|
|                     |      | 6         | 7 | 8 | 9 | 10 | 11        | 12 | 1 | 2 | 3 | 4         | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| ex-documents        |      | ■         | ■ |   |   |    |           |    |   |   |   |           |   |   |   |   |   |    |    |
| Manual and Format   |      |           | ■ | ■ | ■ | ■  |           |    |   |   |   | ■         | ■ | ■ | ■ |   |   |    |    |
| Inspection Database |      |           | ■ | ■ | ■ | ■  |           |    |   |   |   | ■         | ■ | ■ | ■ |   |   |    |    |
| MT Training         |      | ■         | ■ | ■ | ■ | ①  | ■         | ■  | ■ | ■ | ② | ■         | ■ | ■ | ■ | ■ | ■ | ■  |    |
| MU Training         |      |           |   |   |   | ■  | ■         | ■  | ■ | ■ | ■ | ■         | ■ | ■ | ■ | ■ | ■ | ■  |    |
| Brige Inspection    |      |           |   |   |   | ■  | ■         | ■  | ■ | ■ | ■ | ■         | ■ | ■ | ■ | ■ | ■ | ■  |    |
| BMS                 |      |           |   |   |   | ■  | ■         | ■  | ■ | ■ | ■ | ■         | ■ | ■ | ■ | ■ | ■ | ■  |    |
| Report              |      |           |   |   |   |    |           |    |   |   |   |           |   |   |   |   |   | △△ |    |
| JCC                 |      | ■         |   |   |   | ■  |           |    |   |   | ■ |           |   |   |   | ■ |   |    |    |
| JWG                 |      |           | ■ | ■ | ■ | ■  |           |    |   |   | ■ | ■         | ■ |   |   |   |   |    | ■  |
| Workshop            |      |           |   |   |   | ■  | ■         | ■  | ■ | ■ |   |           |   |   | ■ | ■ | ■ |    |    |
| Seminar             |      |           |   |   |   | ■  | ■         | ■  | ■ | ■ | ■ | ■         | ■ | ■ | ■ | ■ | ■ | ■  | ■  |
| Questionnaire       |      |           |   |   |   | ■  | ■         | ■  | ■ | ■ | ■ | ■         | ■ | ■ | ■ | ■ | ■ | ■  | ■  |
| Flood Season        |      | ■         | ■ | ■ | ■ | ■  |           |    |   |   | ■ | ■         | ■ | ■ | ■ | ■ | ■ |    |    |
| Ramadan             |      | ■         | ■ | ■ | ■ | ■  |           |    |   |   | ■ | ■         | ■ | ■ | ■ | ■ | ■ |    |    |

Remarks : ■—Preparation ■ works in Pakistan □ works in Japan △—△ Reports

12

# Level of Training Materials



13

## Components of PDM (1)

### Overall Goal

Bridge maintenance status improved on the bridges of National Highways in Pakistan.

### 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.

## Components of PDM (2)

### Outputs

1. Manuals and a database developed for bridge inspection and bridge repair method selection.

15

## Components of PDM (3)

### Outputs

2. Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and bridge repair method selection of uniformed contents implemented on all the bridges of National Highways in Pakistan.

16



## Components of PDM (4)

### Outputs

3. Data on all the bridges of National Highways in Pakistan input by MUs to the existing BMS (Smart Bridge) available to NHA's HQ and ROs.

17

## Components of PDM (5)

### Equipment

Non-destructive testing equipment such as

- Ground Penetrating Radar
- Electrochemical Polarization Corrosion Measurement
- Measurement by Sonic Testing
- Schmidt Hammer
- Carbonation Depth measurement Kit
- Crack Scale
- Test Hammer
- Licensed Database with Server and Terminals

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## Summery of Our Scope (1)

### Manuals & Formats

- Bridge Inspection Manual
- Bridge Inspection Format
- Culvert Inspection Manual
- Culvert Inspection Formaat
- Bridge Repair Method Selection Manual
- Revise and Finalize

19

## Summery of Our Scope (2)

### Training & Fostering

- MT Training Materials (Basic & Advance)
- MT Training & Retraining (in-office & on-site)
- Monitoring of MU Training
- Workshops & Seminars
- E-learning System

20

# Summery of Our Scope (3)

## Bridge Management System

- Bridge Inspection Database
- Data input Manual for Bridge Inspection Database
- Data Transfer from Bridge Inspection Database to Ex-BMS
- Ex-BMS training
- Estimation for Bridge Maintenance Budgets

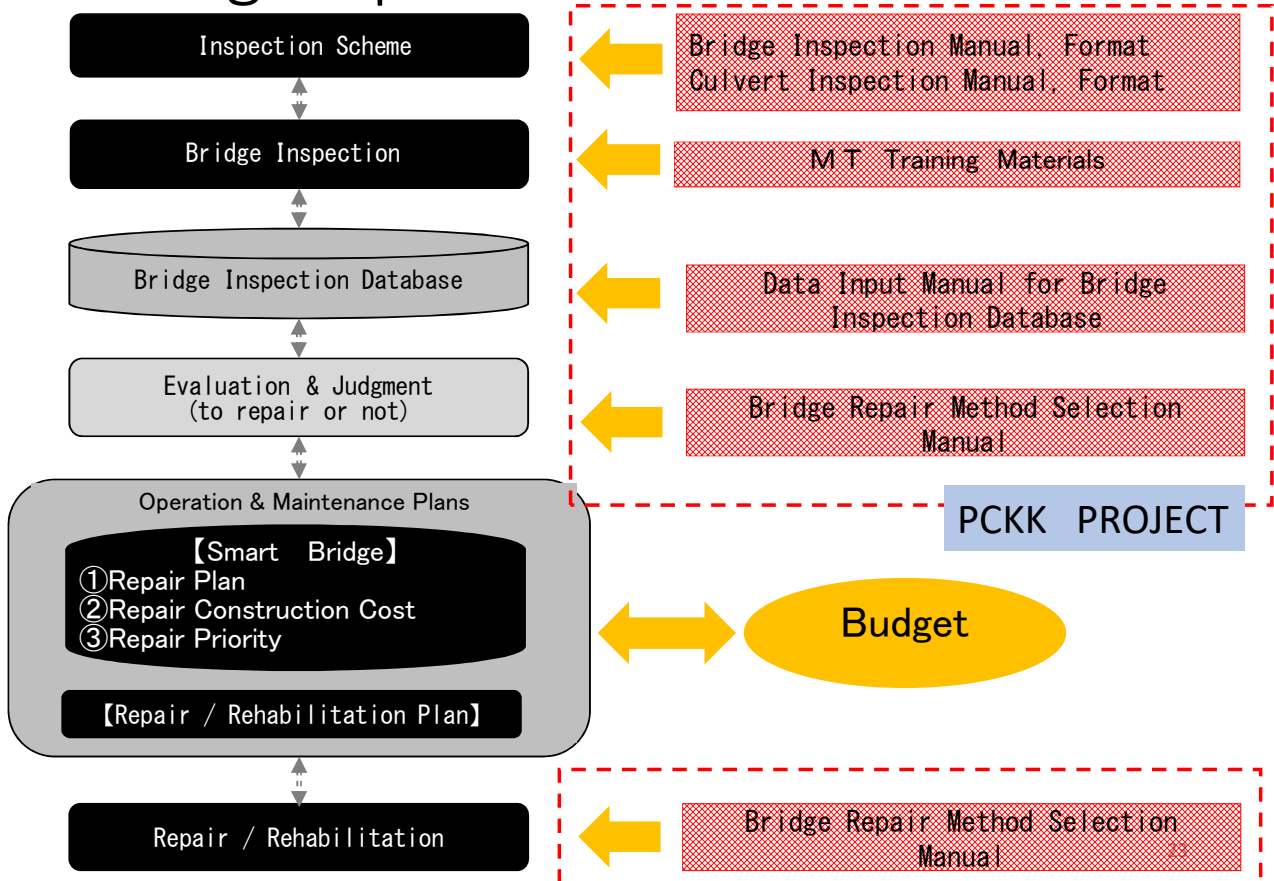
21

## Current Problems in NHA

1. Implementation of Bridge Management System
2. Provision of required equipment
3. Modifications in Bridge Database and BMS Software
4. Preparation and up-dation of Training Manual
5. Repair/Maintenance SOP (Standard Operating Procedure)
6. Selection of candidate structures and engineers for Training along with arrangements.
7. Finalization of Training levels for inspectors, engineers and master trainers

22

# Bridge Operation & Maintenance



## Request for NHA

### 1. Documents

Organization chart

Bridge basically data (all bridges)

Inspection results data (all bridges)

List of consultant firms and constructors

Bridge inspection handbook (or manual)

Smart bridge system manual and operating manual

Smart bridge system

Input and output example of smart bridge

Example of bridge repair design

Road asset management system or manual

### 2. Questionnaire

Delivery questionnaires' to Mater trainer and Maintenance unit member

Recovery of the questionnaire

### 3. Support of the site inspection of the target bridges

# Project Design Matrix (1)

| Narrative Summary   | Objectively Verifiable Indicators  | Means of Verification  | Important Assumptions  |
|---|--|--|--|
| <p><u>Overall Goal</u><br/>Bridge maintenance status improved on the bridges of National Highways in Pakistan.</p>  | <p>Average bridge damage value, calculated by the existing BMS (Smart Bridge), decreased by <b>xx%</b> in [January, 2022] from the start of the Project.</p> | <p>Output data of the existing BMS</p>   |  |
| <p><u>Project Purpose</u><br/>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.</p> | <p>Bridge maintenance budget document with breakdowns prepared in [<b>November, 2018</b>].</p>   | <p>Analysis on each of input data to the existing BMS (Smart Bridge) and bridge maintenance budget document (with breakdown)</p> | <ul style="list-style-type: none"> <li>NHA's road maintenance budget does not decrease from the start of the Project.</li> <li>Natural disasters with the risk of damages on bridges do not occur on National Highways in Pakistan.</li> </ul> |

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# Project Design Matrix (2)

| Narrative Summary   | Objectively Verifiable Indicators   | Means of Verification   | Important Assumptions   |
|---|---|---|---|
| <p><u>Outputs</u><br/>1. Manuals and a database developed for bridge inspection and bridge repair method selection.</p> | <p>1-1. 3 types of draft manuals (for (1) bridge inspection, (2) data input to a bridge inspection database, and (3) bridge repair method selection) developed by [<b>November, 2016</b>].</p> <p>1-2. A draft bridge inspection format developed by [<b>November, 2016</b>].</p> <p>1-3. A manual for culvert inspection and a culvert inspection format developed by [<b>November, 2016</b>].</p> <p>1-4. A draft bridge inspection database developed by [<b>November, 2016</b>].</p> <p>1-5. 2 types of draft training materials for the master trainers of NHA's HQ and ROs (for (1) bridge inspection and (2) bridge repair method selection) developed by [<b>November, 2016</b>].</p> <p>1-6. Manuals (1-1 &amp; 1-3), a bridge inspection format (1-2 &amp; 1-3), a database (1-4) and training materials (1-5) finalized by [<b>September, 2018</b>].</p> | <p>1-1. 3 types of draft manuals</p> <p>1-2. A draft bridge inspection format</p> <p>1-3. A manual for culvert inspection and a culvert inspection format</p> <p>1-4. A draft bridge inspection database</p> <p>1-5. 2 types of draft training materials</p> <p>1-6. 3 types of manuals, a bridge inspection format, a database and 2 types of training materials</p> | <p>The existing BMS (Smart Bridge) is continuously in use by NHA for cost estimate of bridge maintenance.</p> |

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## Project Design Matrix (3)

| Narrative Summary   | Objectively Verifiable Indicators  | Means of Verification   | Important Assumptions |
|---|--|---|-----------------------|
| <p><u>Outputs</u></p> <p>2. Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and bridge repair method selection of uniformed contents implemented on all the bridges of National Highways in Pakistan.</p> | <p>2-1. 3 types of master trainers' training (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database) implemented by <b>[October, 2017]</b>.</p> <p>2-2. 3 types of training (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database) implemented by the master trainers (trained in Activity 2-1) at all the 36 MUs by <b>[November, 2017]</b>.</p> <p>2-3. Bridge inspection, bridge repair method selection, and data input to a bridge inspection database completed at all the 36 MUs by <b>[June, 2018]</b>.</p> <p>2-4. 90% or more results of bridge repair method selection and data input to a bridge inspection database by the staff of MUs evaluated to be accurate by NHA's HO &amp; JICA Experts by <b>[October, 2018]</b>.</p> <p>2-5. <b>80%</b> or more master trainers of NHA's HQ and ROs scored at the capacity test after the training <b>80%</b> or higher than that before the training.</p> | <p>2-1. Training records and reports</p> <p>2-2. Training records and reports</p> <p>2-3. Completed bridge inspection formats and input data to a bridge inspection database</p> <p>2-4. Input data to a bridge inspection database and its evaluation</p> <p>2-5. Test records and reports</p> |                       |

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## Project Design Matrix (4)

| Narrative Summary   | Objectively Verifiable Indicators   | Means of Verification   | Important Assumptions |
|---|---|---|-----------------------|
| <p><u>Outputs</u></p> <p>3. Data on all the bridges of National Highways in Pakistan input by MUs to the existing BMS (Smart Bridge) available to NHA's HQ and ROs.</p> | <p>3-1. Training for management of the existing BMS (Smart Bridge) implemented by <b>[October, 2017]</b>.</p> <p>3-2. Data on all the bridges of National Highways in Pakistan input to the existing BMS (Smart Bridge) by <b>[October, 2018]</b>.</p> <p>3-3. Cost estimate necessary for bridge maintenance in the fiscal year of <b>2019</b> based on the data input to the existing BMS (Smart Bridge).</p> | <p>3-1. Training records and report</p> <p>3-2. Input data to the existing BMS (Smart Bridge)</p> <p>3-3. Bridge maintenance budget document with breakdown</p> |                       |

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# Project Design Matrix (5)

| Activities  | Input  |  | Important Assumptions   |
|---|--|--|---|
|   | Japanese side  | Pakistani side   |   |
| <p>1-1. Develop 3 types of draft manuals (for (1) bridge inspection, (2) data input to a bridge inspection database, and (3) bridge repair method selection).</p> <p>1-2. Develop a draft bridge inspection format.</p> <p>1-3. Develop a manual for culvert inspection and a culvert inspection format.</p> <p>1-4. Develop a draft bridge inspection database (in Excel/Access).</p> <p>1-5. Develop 2 types of draft training materials for the master trainers of NHA's HQ and ROs (for (1) bridge inspection and (2) bridge repair method selection).</p> <p>1-6. Review and finalize the above 3 types of manuals (Activity 1-1), a format (Activity 1-2), a data base (Activity 1-4) and 2 types of training materials (Activity 1-5).</p> | <p>1. EXPERTS</p> <p>1) Bridge Inspection Expert</p> <p>2) Bridge Repair Expert</p> <p>3) BMS Expert</p> <p>4) Capacity Development Expert</p> <p>5) Project Monitoring</p> <p>6) Local Coordinator (Pakistani)</p> <p>2. EQUIPMENT</p> <p>Non-destructive testing equipment such as</p> <ul style="list-style-type: none"> <li>·Ground Penetrating Radar</li> <li>·Electrochemical Polarization Corrosion Measurement</li> <li>·Measurement by Sonic Testing</li> <li>·Schmidt Hammer</li> <li>·Carbonation Depth Measurement</li> <li>Kit</li> <li>·Crack Scale</li> <li>·Test Hammer</li> <li>·Licensed Database with Server and Terminals</li> </ul> <p>(Input other than indicated here will be determined through mutual consultations between JICA and NHA during the implementation of the Project as necessary)</p> | <p>1. PERSONNEL</p> <p>Administrative Personnel</p> <p>1) Project Director: Member (Operations)</p> <p>2) Project Manager: Director (RAMS)</p> <p>Counterpart Personnel</p> <p>1) Project Coordinator: Deputy Director (BMS)</p> <p>2) Assistant Project Coordinator: Assistant Director (BMS)</p> <p>2. OFFICE &amp; FACILITIES</p> <ul style="list-style-type: none"> <li>·Office for JICA Experts in NHA's HQ Building with office furniture, internet and telephone.</li> </ul> <p>3. ARRANGEMENT</p> <ul style="list-style-type: none"> <li>·Arrangements for master trainers' training and the training at all the 36 MUs.</li> <li>·Transportation for the field trips of JICA Experts in/around Islamabad.</li> </ul> <p>4. BUDGET ALLOCATION</p> <p>Budget for travel expenses and allowances for the participants of master trainers' training and the training at all the 36 MUs.</p> | <p>NHA staff, the participants in the training (Activity 2-1 and 2-2), do not retire from NHA.</p> <div style="border: 1px solid black; background-color: #0056b3; color: white; padding: 5px; text-align: center; margin: 10px 0;"><b>Preconditions</b></div> <p>Pakistan, especially Islamabad, is continuously safe enough for JICA Experts to implement the activities.</p> |

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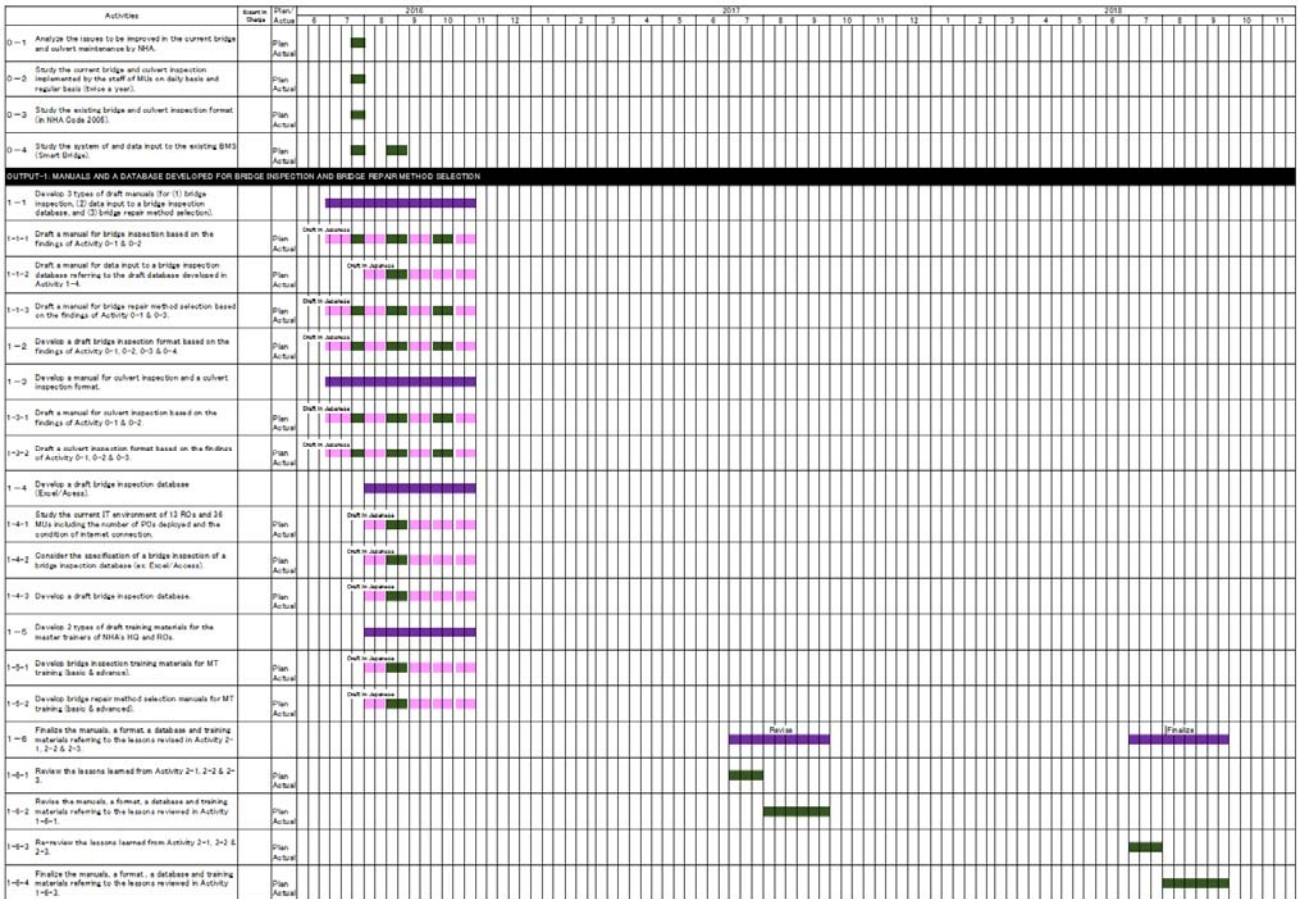
# Project Design Matrix (6)

| Activities   | Input         |                | Important Assumptions |
|--|---------------|----------------|-----------------------|
|  | Japanese side | Pakistani side |                       |
| <p>2-1. Implement 3 types of master trainer's training for the staff of NHA's HQ and ROs at the target bridges in/around Islamabad (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database).</p> <p>2-2. By master trainers (trained in Activity 2-1), implement 3 types of training for the staff of MUs (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database).</p> <p>2-3. By the staff of MUs (trained in Activity 2-2), implement (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database for all the bridges.</p> <p>3-1. Implement training for the staff of NHA's HQ of operation and management of the existing BMS (Smart Bridge).</p> <p>3-2. Transfer the data from a bridge inspection database input by the staff of MUs to the existing BMS (Smart Bridge).</p> <p>3-3. Estimate the cost necessary for bridge maintenance in the fiscal year of 2019 based on the data transferred to the existing BMS (Smart Bridge) in Activity 3-2.</p> |               |                |                       |

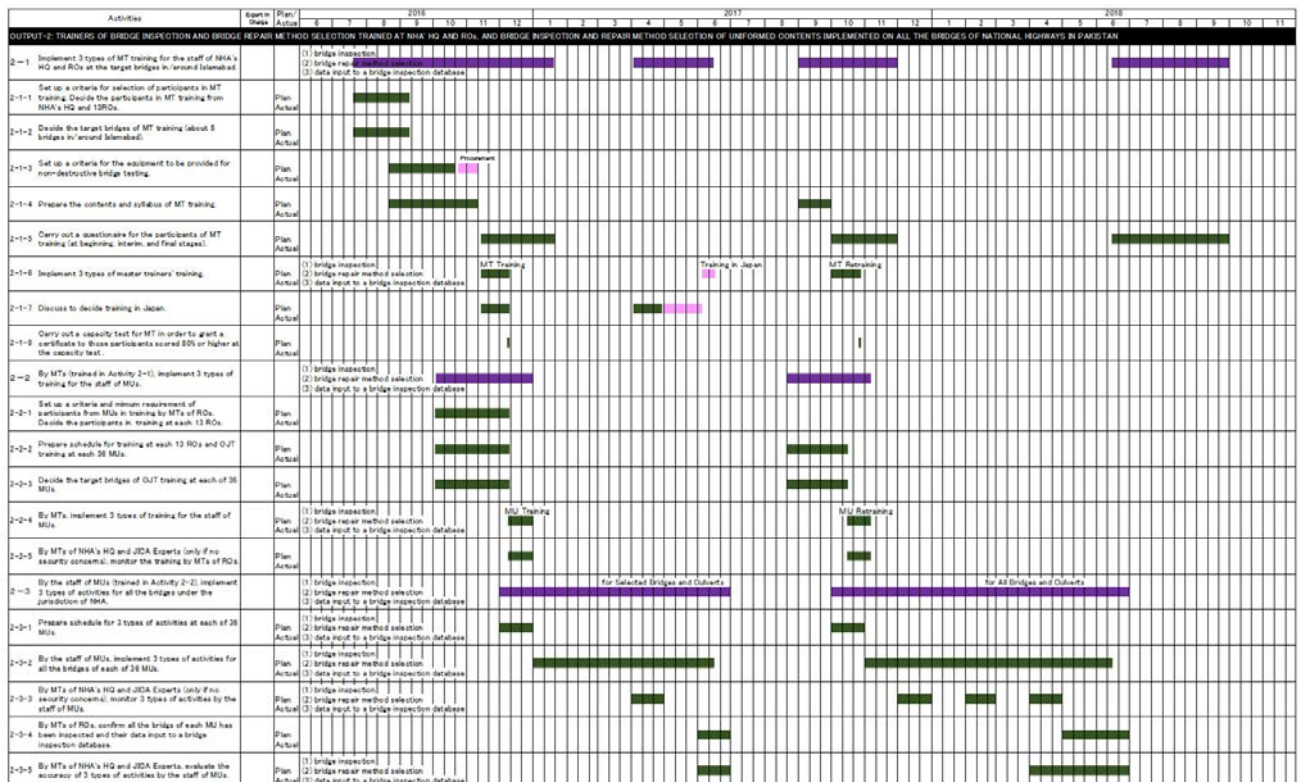
30



# Plan of Operation (1)



# Plan of Operation (2)







Thank you for attention.

(2) Version 2 (9 December 2016)

## TO CR of JICA Pakistan OFFICE

## PROJECT MONITORING SHEET

**Project Title : The Project for Technical Assistance on Implementation  
of Bridge Management System in NHA**

**Version of the Sheet: Ver.2 (Term: July, 2016 - December, 2016)**

**Name: Kenichi TOMI**

**Title: Project Monitoring**

**Submission Date: 9<sup>th</sup> December, 2016**

## I. Summary

## 1 Progress

## 1-1 Progress of Inputs

## (1) Experts

|                      |          | Duration: from July 20, 2016 (Start) to December 31, 2016 |                 |       |             |                 |       | Unit: Days    |
|----------------------|----------|---|-----------------|-------|-------------|-----------------|-------|---------------|
|                      |          | Plan  |                 |       | Actual      |                 |       | Actual / Plan |
|                      |          | by previous   | during 6 months | total | by previous | during 6 months | total |               |
| Bridge Inspection    | Pakistan | 0   | 77              | 77    | 0           | 75              | 75    | 97%           |
|                      | Japan    | 0   | 17              | 17    | 0           | 21              | 21    | 124%          |
| Bridge Repair        | Pakistan | 0   | 77              | 77    | 0           | 75              | 75    | 97%           |
|                      | Japan    | 0   | 17              | 17    | 0           | 10              | 10    | 59%           |
| Bridge Man. System   | Pakistan | 0   | 29              | 29    | 0           | 11              | 11    | 38%           |
|                      | Japan    | 0   | 60              | 60    | 0           | 13              | 13    | 22%           |
| Capacity Development | Pakistan | 0   | 61              | 61    | 0           | 61              | 61    | 100%          |
|                      | Japan    | 0   | 0               | 0     | 0           | 6               | 6     | 10000%        |
| Project Monitoring   | Pakistan | 0   | 41              | 41    | 0           | 25              | 25    | 61%           |
|                      | Japan    | 0   | 0               | 0     | 0           | 0               | 0     |               |

Because BMS with the prioritization function is newly made in addition to Bridge Inspection Database, the schedule of Bridge Maintenance System Expert has been revised.

## (2) Equipment

Crack Scale and Test Hammer are used in MT training and following OJT in the selected bridge inspection, 100 sets in consideration of 50 Inspectors have been prepared and transported to Islamabad, but not been transferred to C/P yet.

Other non-destructive test equipment will be discussed after the 1<sup>st</sup> MT training with the knowledge through the two senior engineers' visit to Japan.

Computers (Licensed Server and Terminals) will be discussed after the

specifications of Bridge Inspection Database and new BMS are fixed.

### **(3) Training in Japan**

It was strongly requested by C/P in the 1<sup>st</sup> JCC that the two senior engineers should visit to Japan prior to the 1<sup>st</sup> MT Training. This training is scheduled from January 15<sup>th</sup> to 27<sup>th</sup>, 2017. Its tentative arrangement is done.

Other than the two senior engineer visit to Japan, the MT trainers' (approximately 10 to 12 persons, 2 weeks) originally planned in June,2017 shall be postponed to October, 2017. Those persons will be selected through the examination carried out in the 1<sup>st</sup> MT training and the submission of bridge inspection results in the following selected bridge inspection in the field.

### **(4) In-country Training**

Because the senior engineers' visit to Japan is scheduled in January as the earliest implementation, the 1<sup>st</sup> MT Training originally planned in November, 2016 which shall be reflected on the knowledge from the senior engineers' visit to Japan ought to be postponed to March, 2017.

## **1-2 Progress of Activities**

The draft of Bridge/Culvert Inspection Formats, Bridge Inspection Manual, Bridge Repair Method Selection Manual, and MT Training materials (PowerPoint slides) will be prepared by the end of December. Those will be edited by the newly hired local engineer for the customization and localization.

As per two senior engineers' visit to Japan, the member has been decided and are preparing for the paper works so far.

Though it has taken so much time to collect information understand the current situation in NHA and Pakistan and it has been very difficult for Experts to make progress without sufficient human resources from C/P, the schedule will catch up with the originally planned time frame if the 1<sup>st</sup> MT Training is successfully held by the end of March, 2017.

## **1-3 Achievement of Output**

As to 3 types of draft manuals (1-1), 2 drafts of Bridge Inspection Manual and Bridge Repair Method Selection Manual will be finished by the end of December, while a draft of Data Input Manual to a bridge inspection database shall be made according to Bridge Inspection Database and new BMS with the prioritization

function.

As to a draft bridge inspection format (1-2), it will be finished by the end of December.

As to a manual for culvert inspection and a culvert inspection format (1-3), those will be made as the part of bridge inspection manual and format and will be finished together.

As to a draft bridge inspection database (1-4), it shall be made according to Bridge Inspection Database and new BMS with the prioritization function as well.

As to 2 types of draft training materials (1-5), the basic ones will be prepared by the end of December for the 1<sup>st</sup> MT Training, the advanced ones will be prepared after Experts understand levels/capabilities of MT Trainer candidates through the 1<sup>st</sup> MT Training. Those will be transformed to e-learning materials.

Other activities have not been scheduled by the end of December, 2016.

#### **1-4 Achievement of the Project Purpose**

Not enough progress has been carried out so far in order to evaluate the achievement.

#### **1-5 Changes of Risks and Actions for Mitigation**

Risks to be considered hereinafter.

- (1) Insufficient NHA personnel added into JWG.
- (2) NHA's understanding on responsibilities of activities shown in PO.
- (3) NHA staff's recognition of importance of bridge management.

#### **1-6 Progress of Actions undertaken by JICA**

JICA Pakistan Office has been instructed NHA repeatedly.

#### **1-7 Progress of Actions undertaken by Gov. of NHA**

One room for Experts (not separated rooms) has not been provided so far.

#### **1-8 Progress of Environmental and Social Considerations (if applicable)**

(None)

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

As PCKK pushed forward with Diversity & Inclusion Policy, please check the possibility to assign female engineers to the Project.

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

NHA General Specifications (issued in December 1998) must be out of date, especially in design & construction from the viewpoint of durability and maintenance.

**2 Delay of Work Schedule and/or Problems (if any)**

**2-1 Detail**

(1) Despite that drafts of manuals and formats are in the 1<sup>st</sup> responsibility of NHA side, those are solely prepared by Expert side. In the revise and finalizing manuals and formats, the similar situation will occur as well. In order to avoid from failing into the one-time phenomena as well as Smart Bridge and NHA General Specifications, those manuals and formats shall be revised in the future in accordance with the changing situations.

(2) Shortage of communication among Experts is anticipated.

(3) It seems to be taken so much time that the issues have decided in NHA.

(4) Some minutes of meetings seem to be missed.

**2-2 Cause**

(1) Insufficient human resource has been allocated to JWG and the Project.

(2) The separated rooms have been provided to Experts by NHA.

(3) What was decided by the lower level in hierarchy has often changed by the upper levels.

(4) Minutes of meetings as to prioritization, two senior engineers' visit to Japan, additional scopes, etc. shall be recorded and stored properly.

**2-3 Action to be taken**

- (1) Additional personnel shall be join JWG and the Project. Potential candidates shall be selected through the 1<sup>st</sup> MT Training. So many NHA engineers as possible shall be involved in the Project to recognize that those are their own assets in the future.**
- (2) One larger room should be provided for Experts.**
- (3) The important issues should promptly be reported and commented by the member of JCC.**
- (4) Minutes of meetings must be made promptly.**

#### **2-4 Roles of Responsible Persons/Organization (JICA, NHA, etc.)**

**NHA shall understand the importance of raising the engineers for its future and issue the order for him/her to join as an eager engineer into JWG and the Project. NHA shall prepare one larger room for the Project.**

### **3 Modification of the Project Implementation Plan**

#### **3-1 PO**

##### **(1) Project Purpose**

**[Before] 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.**

**[Amendment] Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of entire NHA Network.**

**[Reason] Because bridge inspection data has not been carried out regularly since the ex-BMS (Smart Bridge) was developed, NHA' s bridge maintenance plan including all the procedures must be prepared as priority.**

##### **(2)Output 1**

**[Before] Manuals and a database developed for bridge inspection and bridge repair method selection.**

**[Amendment] Manuals, Database and BMS developed for bridge inspection and bridge repair method selection.**

**[Reason] Because bridge inspection data has not been carried out regularly since the ex-BMS (Smart Bridge) was developed, BMS with the prioritization function is newly made in this project.**

##### **(3) Activity 1**



**[Reason]** Because (a) BMS with the prioritization function is newly made in addition to Bridge Inspection Database, and (b) the training is conducted for Master Trainer candidates in order to improve capability of NHA staff though all of them are not expected to achieve to deserve to be the certified Master Trainer, those expressions and wordings are modified.

**(4) Activity 2**

**[Reason]** Because (a) the training target is not only bridge but also culvert and (b) all the staff of MUs are not dedicated to bridge/culvert inspection, those expressions are revised.

**(5) Output 3**

**[Before]** Data on all the bridges of National Highways in Pakistan input by MUs to the existing BMS (Smart Bridge) available to NHA's HQ and ROs.

**[Amendment]** Data on all the bridges of National Highways in Pakistan input by MUs to Database available to NHA's HQ and ROs.

**[Reason]** Because MUs will input data to Bridge Inspection Database, not Smart Bridge (correction of improper usage).

**(6) Activity 3**

**[Reason]** Because (a) BMS is newly made instead of the existing BMS (Smart Bridge), (b) to clarify the roles of NHA staff and HQ RAMD staff respectively, and (c) to define the task of maintenance plan not just limited only to budget estimation.

**3-2 Other modifications on detailed implementation plan**

*(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)*

As strongly requested by NHA, the assignments of Experts will be rearranged in order to keep at least one person in Islamabad as much as possible though the assignments as Expert group were considered for safety and security reasons.

**4 Preparation of NHA toward after completion of the Project**

Standard Operation Procedure (SOP) related with Bridge Maintenance will be made and kept.

|  |
|--|
|  |
|--|

**II. Project Monitoring Sheet I & II**     *as Attached*

Project Design Matrix

**Project Title:** The Project for Technical Assistance on Implementation of Bridge Management System in NHA  
**Implementing Agency:** National Highway Authority

Version 2

Dated 9, December, 2016

**Target Group:**

**Period of Project:** July, 2016 – January, 2019 (30 months)

**Project Site:** in/around Islamabad, Pakistan

**Model Site:**

| Narrative Summary   |  | Objectively Verifiable Indicators  | Means of Verification  | Important Assumption   | Achievement | Remarks                             |
|---|--|--|--|--|-------------|-------------------------------------|
| <b>Overall Goal</b><br>Bridge maintenance status improved on the bridges of National Highways in Pakistan.  | Average bridge damage value, calculated by the existing BMS (Smart Bridge), decreased by XX% in [January, 2022] from the start of the  | Average bridge damage value, calculated by the existing BMS (Smart Bridge), decreased by XX% in [January, 2022] from the start of the  | Output data of the existing BMS  |  |             | The existing BMS has not been used. |
| <b>Project Purpose</b><br>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. | Bridge maintenance budget document with breakdowns prepared in [November, 2018].   | Bridge maintenance budget document with breakdowns prepared in [November, 2018].   | Analysis on each of input data to the existing BMS (Smart Bridge) and bridge maintenance budget document (with breakdown)                                | <ul style="list-style-type: none"> <li>NHA's road maintenance budget does not decrease from the start of the Project.</li> <li>Natural disasters with the risk of damages on bridges do not occur on National Highways in Pakistan.</li> </ul> |             |                                     |
| <b>Outputs</b><br>1. Manuals and a database developed for bridge inspection and bridge repair method selection.   | 1-1. 3 types of draft manuals (for (1) bridge inspection, (2) data input to a bridge inspection database, and (3) bridge repair method selection) developed by [November, 2016]<br>1-2. A draft bridge inspection format developed by [November, 2016].<br>1-3. A manual for culvert inspection and a culvert inspection format developed by [November, 2016].<br>1-4. A draft bridge inspection database developed by [November, 2016].<br>1-5. 2 types of draft training materials for the master trainers of NHA's HQ and ROs (for (1) bridge inspection and (2) bridge repair method selection) developed by [November, 2016]<br>1-6. Manuals (1-1 & 1-3), a bridge inspection format (1-2 & 1-3), a database (1-4) and training materials (1-5) finalized by [September, 2018]. | 1-1. 3 types of draft manuals<br>1-2. A draft bridge inspection format<br>1-3. A manual for culvert inspection and a culvert inspection format<br>1-4. A draft bridge inspection database<br>1-5. 2 types of draft training materials<br>1-6. 3 types of manuals, a bridge inspection format, a database and 2 types of training materials | <ul style="list-style-type: none"> <li>The existing BMS (Smart Bridge) is continuously in use by NHA for cost estimate of bridge maintenance.</li> </ul> | Bridge Inspection Database is separately scheduled from others.<br><br>Bridge Inspection data has not been carried out regularly since the existing BMS (Smart Bridge) was developed.  |             |                                     |

|   |   |   |  |  |
|---|---|---|--|--|
| <p>2. Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and bridge repair method selection of uniformed contents implemented on all the bridges of National Highways in Pakistan.</p> | <p>2-1. 3 types of master trainers' training (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database) implemented by (October. 2017)</p> <p>2-2. 3 types of training (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database) implemented by the master trainers (trained in Activity 2-1) at all the 36 MUs by (November, 2017)</p> <p>2-3. Bridge inspection, bridge repair method selection, and data input to a bridge inspection database completed at all the 36 MUs by (June. 2018).</p> <p>2-4. 90% or more results of bridge repair method selection and data input to a bridge inspection database by the staff of MUs evaluated to be accurate by NHA's HQ &amp; JICA Experts by (October. 2018)</p> <p>2-5. 80% or more master trainers of NHA's HQ and ROs scored at the capacity test after the training 80% or higher than that before the training.</p> | <p>2-1. Training records and reports</p> <p>2-2. Training records and reports</p> <p>2-3. Completed bridge inspection formats and input data to a bridge inspection database</p> <p>2-4. Input data to a bridge inspection database and its evaluation</p> <p>2-5. Test records and reports</p> | <p>The 1st Training in Japan is additionally scheduled from January 15th to 27th, 2017.</p> <p>The 1st MT training is postponed from November to March, 2017.</p> <p>The number of MT training participants will be increased because the training is conducted for candidates in order to improve capability of NHA staff though all of them are not expected to achieve to deserve to be the certified Master.</p> | <p>Dispatching two senior engineers to Japan before MT training is strongly suggested.</p> |
| <p>3. Data on all the bridges of National Highways in Pakistan input by MUs to the existing BMS (Smart Bridge) available to NHA's HQ and ROs.</p>   | <p>3-1. Training for management of the existing BMS (Smart Bridge) implemented by (October. 2017).</p> <p>3-2. Data on all the bridges of National Highways in Pakistan input to the existing BMS (Smart Bridge) by (October. 2018).</p> <p>3-3. Cost estimate necessary for bridge maintenance in the fiscal year of 2019 based on the data input to the existing BMS (Smart Bridge).</p>  | <p>3-1. Training records and reports</p> <p>3-2. Input data to the existing BMS (Smart Bridge)</p> <p>3-3. Bridge maintenance budget document with breakdown</p>  | <p>BMS with the prioritization function is newly made in addition to Bridge Inspection Database.</p>   | <p>BMS with the prioritization function is strongly required.</p>                          |

| Activities   | The Japanese Side  | Inputs  | Pre-Conditions   |
|--|--|---|--|
| <p>1-1. Develop 3 types of draft manuals (for (1) bridge inspection, (2) data input to a bridge inspection database, and (3) bridge repair method selection)</p> <p>1-2. Develop a draft bridge inspection format.</p> <p>1-3. Develop a manual for culvert inspection and a culvert inspection format.</p> <p>1-4. Develop a draft bridge inspection database (in Excel/Access).</p> <p>1-5. Develop 2 types of draft training materials for the master trainers of NHA's HQ and ROs (for (1) bridge inspection and (2) bridge repair method selection)</p> <p>1-6. Review and finalize the above 3 types of manuals (Activity 1-1), a format (Activity 1-2), a data base (Activity 1-4) and 2 types of training materials (Activity 1-5)</p> <p>2-1. Implement 3 types of master trainer's training for the staff of NHA's HQ and ROs at the target bridges in/around Islamabad (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database)</p> <p>2-2. By master trainers (trained in Activity 2-1), implement 3 types of training for the staff of MUs (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database for all the bridges)</p> <p>3-1. Implement training for the staff of NHA's HQ of operation and management of the existing BMS</p> <p>3-2. Transfer the data from a bridge inspection database input by the staff of MUs to the existing BMS (Smart</p> | <p><b>The Japanese Side</b></p> <p>1. EXPERTS</p> <ul style="list-style-type: none"> <li>1) Bridge Inspection Expert</li> <li>2) Bridge Repair Expert</li> <li>3) BMS Expert</li> <li>4) Capacity Development Expert</li> <li>5) Project Monitoring Expert</li> <li>6) Local Coordinator (Pakistani)</li> </ul> <p>2. EQUIPMENT</p> <ul style="list-style-type: none"> <li>Non-destructive testing equipment such as                             <ul style="list-style-type: none"> <li>· Ground Penetrating Radar</li> <li>· Electrochemical Polarization</li> <li>· Corrosion Measurement</li> <li>· Measurement by Sonic Testing</li> <li>· Schmidt Hammer</li> <li>· Carbonation Depth measurement Kit</li> <li>· Crack Scale</li> <li>· Test Hammer</li> </ul> </li> <li>Licensed Database with Server and Terminals</li> </ul> <p>(Input other than indicated here will be determined through mutual consultations between JICA and NHA during the implementation of the Project as necessary)</p> | <p><b>The Pakistani Side</b></p> <p>1. PERSONNEL</p> <ul style="list-style-type: none"> <li>Administrative Personnel</li> <li>1) Project Director:                             <ul style="list-style-type: none"> <li>Member (Operations)</li> <li>2) Project Manager:                                     <ul style="list-style-type: none"> <li>Director (RAMS)</li> </ul> </li> </ul> </li> <li>Counterpart Personnel                             <ul style="list-style-type: none"> <li>1) Project Coordinator:                                     <ul style="list-style-type: none"> <li>Deputy Director (BMS)</li> <li>2) Assistant Project Coordinator:   <ul style="list-style-type: none"> <li>Assistant Director (BMS)</li> </ul> </li> </ul> </li> </ul> </li> <li>2. OFFICE &amp; FACILITIES                             <ul style="list-style-type: none"> <li>· Office for JICA Experts in NHA's HQ Building with office furniture, internet and telephone.</li> </ul> </li> <li>3. ARRANGEMENT                             <ul style="list-style-type: none"> <li>· Arrangements for master trainers' training and the training at all the 36 MUs.</li> <li>· Transportation for the field trips of JICA Experts in/around Islamabad.</li> </ul> </li> <li>4. BUDGET ALLOCATION                             <ul style="list-style-type: none"> <li>Budget for travel expenses and allowances for the participants of master trainers' training and the training at all the 36 MUs.</li> </ul> </li> </ul> | <p>· NHA staff, the participants in the training (Activity 2-1 and 2-2), do not retire from NHA.</p> <ul style="list-style-type: none"> <li>· Pakistan, especially Islamabad, is continuously safe enough for JICA Experts to implement the activities.</li> </ul> <p style="text-align: center;"><b>➔</b></p> <p><b>&lt;Issues and countermeasures&gt;</b></p> <p>Crack Scale and Test Hammer shall be prepared for MT Training and OJT, while other non destructive test equipment and computers (Licensed Database with Server and Terminals) will be discussed after the 1st MT Training (April, 2017)</p> <p>Standard Operation Procedure (SOP) related to bridge maintenance is need to be built up.</p> |

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| 3-3. Estimate the cost necessary for bridge maintenance in the fiscal year of 2019 based on the data transferred to the existing BMS (Smart Bridge) in Activity 3-2 |  |  |  |
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Tentative Plan of Operation

Version 2

Dated 9, December, 2016

| Monitoring     |          |    |     |    |          |    |     |    |          |    |          |    |         |  |
|----------------|----------|----|-----|----|----------|----|-----|----|----------|----|----------|----|---------|--|
| Project Title: |          |    |     |    |          |    |     |    |          |    | Solution |    |         |  |
| Inputs         |          |    |     |    |          |    |     |    |          |    | Issue    |    |         |  |
| Year           | 1st Year |    |     |    | 2nd Year |    |     |    | 3rd Year |    |          |    | Remarks |  |
|                | I        | II | III | IV | I        | II | III | IV | I        | II | III      | IV |         |  |
| Expert         |          |    |     |    |          |    |     |    |          |    |          |    |         |  |
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| Actual         |          |    |     |    |          |    |     |    |          |    |          |    |         |  |

| Activity   | Plan |        | Actual |        | 2nd | 1st | Still drafting by Experts.                 | Need more human resource from NHA.           |
|--|------|--------|--------|--------|-----|-----|--|--|
|  | Plan | Actual | Plan   | Actual |     |     |  |  |
| 1-1-3 Draft a manual for bridge repair method selection based on the findings of Activity 0-1 & 0-3.                                       |      |        |        |        |     | 1st |  |  |
| 1-2 Develop a draft bridge inspection format based on the findings of Activity 0-1, 0-2, 0-3 & 0-4.  |      |        |        |        |     | 1st | Finalized                                  |  |
| 1-3 Develop a manual for culvert inspection and a culvert inspection format.   |      |        |        |        |     |     |  |  |
| 1-3-1 Draft a manual for culvert inspection based on the findings of Activity 0-1 & 0-2.   |      |        |        |        |     | 1st | Still drafting by Experts.                 | Need more human resource from NHA.           |
| 1-3-2 Draft a culvert inspection format based on the findings of Activity 0-1, 0-2 & 0-3.  |      |        |        |        |     | 1st | Finalized                                  |  |
| 1-4 Develop a manual for culvert inspection and a culvert inspection format.   |      |        |        |        |     |     |  |  |
| 1-4-1 Study the current IT environment of 13 ROs and 36 MUs including the number of PCs deployed and the condition of internet connection. |      |        |        |        |     | 1st | 10 ROs and 47 MUs.                         |  |
| 1-4-2 Consider the specification of a bridge inspection of a bridge inspection database (ex. Excel/Access).                                |      |        |        |        |     | 1st | Bridge database and new BMS are necessary. | Decision will be made after 1st MT Training. |
| 1-4-3 Develop a draft bridge inspection database.  |      |        |        |        |     | 1st | ditto                                      | ditto  |
| 1-5 Develop 2 types of draft training materials for the master trainers of NHA's HQ and ROs.   |      |        |        |        |     |     |  |  |
| 1-5-1 Develop bridge inspection training materials for MT training (basic & advance).  |      |        |        |        |     | 1st | Still drafting by Experts.                 | Draft by the end of December.                |
| 1-5-2 Develop bridge repair method selection manuals for MT training (basic & advanced).   |      |        |        |        |     | 1st | Still drafting by Experts.                 | Draft by the end of December.                |
| 1-6 Finalize the manuals, a format, a database and training materials referring to the lessons revised in Activity 2-1, 2-2 & 2-3.         |      |        |        |        |     |     |  |  |
| 1-6-1 Review the lessons learned from Activity 2-1, 2-2 & 2-3.   |      |        |        |        |     | 1st |  |  |
| 1-6-2 Revise the manuals, a format, a database and training materials referring to the lessons reviewed in Activity 1-6-1.                 |      |        |        |        |     | 1st |  |  |
| 1-6-3 Re-review the lessons learned from Activity 2-1, 2-2 & 2-3.  |      |        |        |        |     | 1st |  |  |
| 1-6-4 Finalize the manuals, a format, a database and training materials referring to the lessons reviewed in Activity 1-6-3.               |      |        |        |        |     | 1st |  |  |
| <b>Output 2: Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and</b>   |      |        |        |        |     |     |  |  |
| 2-1 Implement 3 types of MT training for the staff of NHA's HQ and ROs at the target bridges in/around Islamabad.                          |      |        |        |        |     |     |  |  |
| 2-1-1 Set up a criteria for selection of participants in MT training. Decide the participants in MT training from NHA's HQ and 13ROs.      |      |        |        |        |     | 1st | Still discussing.                          | NHA requested 50 candidates to participate.  |
| 2-1-2 Decide the target bridges of MT training (about 5 bridges in/around Islamabad).  |      |        |        |        |     | 1st | 2 bridges                                  | Shahia Bridge, Wah Garden Bridge             |
| 2-1-3 Set up a criteria for the equipment to be provided for non-destructive bridge testing.   |      |        |        |        |     | 1st | Crack Scale and Test Hammer                | 100 sets for OJT                             |
| 2-1-4 Prepare the contents and syllabus of MT  |      |        |        |        |     | 1st | Schedule confirmation                      |  |





| 3-2 Transfer the data from a bridge inspection database input by the staff of MUs to the existing BMS (Smart Bridge).   |        |          |    |     |    |          |    |     |    |          |    |      |        |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|--------|----------|----|-----|----|----------|----|-----|----|----------|----|------|--------|----------|----|-----|----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Plan  | Actual | 1st Year |    |     |    | 2nd Year |    |     |    | 3rd Year |    |      |        | 4th Year |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        | I        | II | III | IV | I        | II | III | IV | I        | II | III  | IV     | I        | II | III | IV |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3-2-1 Trial of transferring the sample data from a bridge inspection database input by the staff of MUs to the existing BMS (Smart Bridge).                         |        |          |    |     |    |          |    |     |    |          |    | 2nd  | 1st    |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3-2-2 Transfer all the data from a bridge inspection database input by the staff of MUs to the existing BMS (Smart Bridge).   |        |          |    |     |    |          |    |     |    |          |    | 2nd  | 1st    |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3-3 Estimate the cost necessary for bridge maintenance in the fiscal year of 2019 based on the data transferred to the existing BMS (Smart Bridge) in Activity 3-2. |        |          |    |     |    |          |    |     |    |          |    | 2nd  | 1st    |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Duration / Phasing  |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Monitoring Plan   |        |          |    |     |    |          |    |     |    |          |    | Year |        |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Monitoring  |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Joint Coordination Committee  |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Set-up the Detailed Plan of Operation   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Submission of Monitoring Sheet  |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Monitoring Mission from Japan   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Joint Monitoring  |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Post Monitoring   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Reports/Documents   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Project Completion Report   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Public Relations  |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          |    |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|   |        |          |    |     |    |          |    |     |    |          |    | Plan | Actual |          | </ |     |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

The project for technical assistance  
on implementation of  
Bridge Management System in NHA

**JCC**

**Joint Coordination Committee**

December 9<sup>th</sup> 2016

At

Auditorium NHA HQ Islamabad



1

## **Agenda**

1. Opening of the Meeting
2. Introduction of Participants
3. Outline of the Project
  - Revision of PDM (Project Design Matrix)
  - Revised Schedule of the Project
  - Progress of the Project
  - NHA staff (2 persons) visit to Japan
4. Discussion
5. Others

2

# Revised Scope of Works

- Adding **BMS** software database with **prioritizing** function
- Addition of Expert for BMS programing



- Prototype Database by July in 2017, and Prototype BMS by December in 2017.
- Both finalized by June in 2018

3

## Project Purpose

| Before   | Amended Version   |
|--|---|
| 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.  | Annual <b>bridge maintenance plan</b> prepared on the basis of the latest bridge inspection data of entire NHA network. |
| <b>Reason:</b> Because bridge inspection data has not been carried out regularly since the ex-BMS (Smart Bridge) was developed, NHA's bridge maintenance plan including all the procedures must be prepared as priority. |   |

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## Output 1

| Before   | Amended Version   |
|--|---|
| Manuals and a database developed for bridge inspection and bridge repair method selection  | Manuals, Database and <b>BMS</b> developed for bridge inspection and bridge repair method selection |
| <b>Reason:</b> Because bridge inspection data has not been carried out regularly since the ex-BMS (Smart Bridge) was developed, BMS with the <b>prioritization</b> function is newly made in this project. |   |

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## Output 3

| Before  | Amended Version  |
|---|--|
| Data on all the bridges of National Highways in Pakistan input by MUs to the existing BMS (Smart Bridge) available to NHA's HQ and ROs. | Data on all the bridges of National Highways in Pakistan input by MUs to Database available to NHA's HQ and ROs. |
| <b>Reason:</b> Because MUs will input data to Bridge Inspection Database, not Smart Bridge (correction of improper usage).              |  |

**Need to be coincident with additional SOP.**

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# Activity 1

| Before  | Amended Version  |
|---|--|
| 1-1 Develop 3 types of draft manuals (for (1) bridge inspection, (2) data input to a bridge inspection database, and (3) bridge repair method selection).   | 1-1 Develop 3 types of draft manuals i.e. (1) bridge/culvert inspection, (2) bridge repair method selection and (3) data input to Database.  |
| 1-2 Develop a draft <b>bridge</b> inspection format.  | 1-2 Develop draft <b>bridge/culvert</b> inspection formats.  |
| 1-3 Develop a manual for culvert inspection and a culvert inspection format.  | —  |
| 1-4 Develop a draft bridge inspection <b>database</b> (in Excel/Access).  | 1-4 Develop prototype <b>Database &amp; BMS</b> .  |
| 1-5 Develop 2 types of draft training materials for the master trainers of NHA's HQ and ROs (for (1) bridge inspection and (2) bridge repair method selection).   | 1-5 Develop 2 types of draft training materials for training i.e. (1) bridge/culvert inspection and (2) bridge repair method selection.  |
| 6. Review and finalize the above 3 types of manuals (Activity 1-1), a format (Activity 1-2), a data base (Activity 1-4) and 2 types of training materials (Activity 1-5).   | 6. Review and finalize the above 3 types of manuals (Activity 1-1), inspection formats (Activity 1-2), prototypes (Activity 1-3) and 2 types of training materials (Activity 1-4). |
| <b>Reason:</b> Because (1) BMS with the prioritization function is newly made in addition to Bridge Inspection Database, and (2) the training is conducted for Master Trainer candidates in order to improve capability of NHA staff though all of them are not expected to achieve to deserve to be the certified Master Trainer, those expressions and wordings are modified. |  |

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# Activity 2

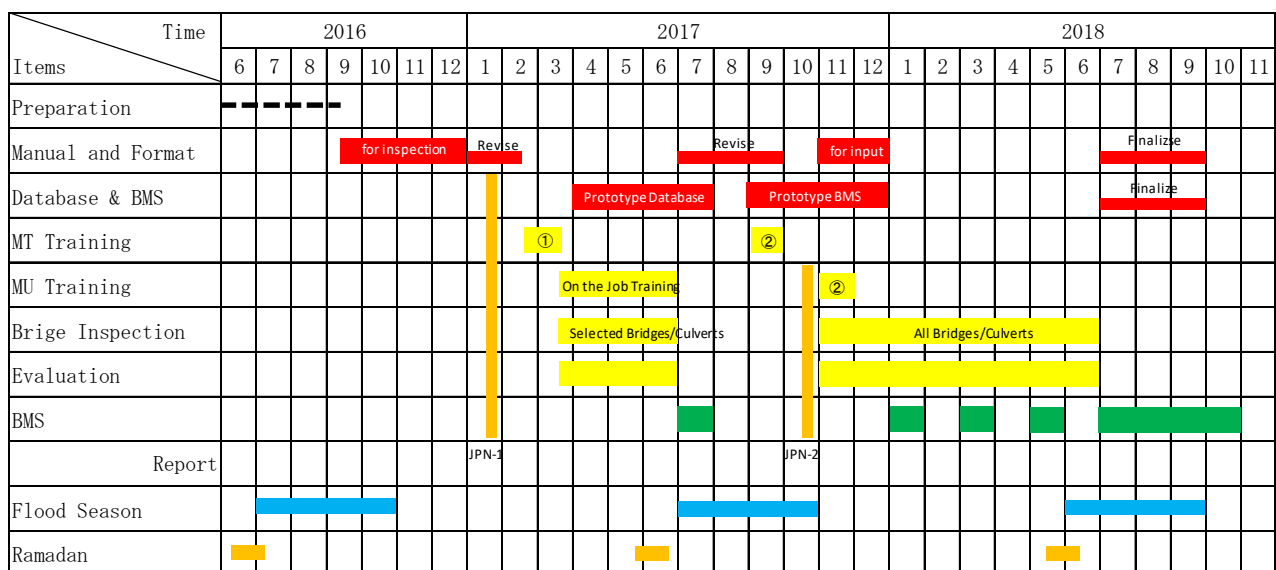
| Before  | Amended Version   |
|---|---|
| 2-1 Implement 3 types of master trainer's training for the staff of NHA's HQ and ROs at the target bridges in/around Islamabad (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database). | 2-1 Implement 3 types of master trainer's training for the staff of NHA's HQ and ROs at the target bridges (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database)  |
| 2-2 <b>By master trainers</b> (trained in Activity 2-1), implement 3 types of training <b>for the staff of MUs</b> (for (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database).             | 2-2 Implement 3 types of <b>OJT</b> for the field staff by Master Trainers (trained in Activity 2-1), (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) inspection data input to Database. |
| 2-3 <b>By the staff of MUs</b> (trained in Activity 2-2), implement (1) bridge inspection, (2) bridge repair method selection, and (3) data input to a bridge inspection database for all the bridges.  | 2-3 Implement (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database for all the bridges/culverts, <b>by field staff</b> (trained in Activity 2-1 & 2-2).                |
| <b>Reason:</b> Because (1) the training target is not only bridge but also culvert and (2) all the staff of MUs are not dedicated to bridge/culvert inspection, those expressions are revised.  |   |

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# Activity 3

| Before  | Amended Version  |
|---|--|
| 3-1 Implement training for the staff of NHA's HQ of operation and management of the existing BMS (Smart Bridge).  | 3-1 Implement training for NHA HQ regarding management of BMS (software and database).   |
| 3-2 Transfer the data from a bridge inspection database input by the staff of MUs to the existing BMS (Smart Bridge).   | 3-2 Monitor bridge data input by NHA staff (Activity 2-3) to Database, and data transfer to BMS by HQ RAMD (Road Asset Management Department) staff. |
| 3-3 Estimate the cost necessary for bridge maintenance in the fiscal year of 2019 based on the data transferred to the existing BMS (Smart Bridge) in Activity 3-2.   | 3-3 Prepare the annual bridge/culvert maintenance plan including estimated budget for 2019 based on the data transferred to BMS (Activity 3-2).      |
| <p><b>Reason:</b> Because (1) <b>BMS is newly made</b> instead of the existing BMS (Smart Bridge), (2) to clarify the <b>roles</b> of NHA staff and HQ RAMD staff respectively, and (3) to define the task of <b>maintenance plan</b> not just limited only to budget estimation.</p> |  |

# Work Schedule



# Manuals & Formats

| Manuals and Formats                                    | Draft to be prepared by |
|--|-------------------------|
| 1. Inspection Sheet Format                             | December 2016           |
| 2. Manual for general inspection of Bridge and Culvert | December 2016           |
| 3. Manual for Repair of Bridge                         | December 2016           |
| 4. Training Materials                                  | December 2016           |
| 5. BMS Manual  | December 2017           |
| 6. SOP for implementation of BMS                       | December 2017           |

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## Contents of Inspection Manual

1. **Scope** : shows definition of this manual
2. **Frequency of General Inspection**
3. **Method of General Inspection**
4. **Organization of General Inspection** shows role of HQ staff, MTs and Inspectors
5. **Damage Rank**: shows type of damage and how damage level is to be decided by the inspector
6. **Soundness Diagnosis**: shows how to decide necessity of countermeasure e against each damage and overall total soundness diagnosis of bridge.
7. **Countermeasure**: shows how to decide the method of countermeasure.

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# Important Points

1. Frequency of general inspection is basically once in 5 years.
2. Proposed role of each member
  - i) Inspector----- Site inspection, Fills inspection sheets
  - ii) Master Trainer--- Supervises inspection,  
Decides classified evaluation,  
Decides soundness and countermeasures
  - iii) HQ Staff----- Maintenance plan,  
Random verification of inspected data,  
Random verification of countermeasure,  
Preparation of Maintenance Plan

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**Table 1 : Type of Damages**

| Type                            | Object                                | Main necessary information   |
|---------------------------------|---------------------------------------|--|
| Corrosion                       | Metal member                          | Range, depth   |
| Others                          | Metal member                          | Fatigue crack: length, location<br>Bolts: Number, location<br>Fracture: location |
| Crack                           | Concrete member<br>(include PC)       | Length, width, type, location  |
| Spalling, R-bar corrosion       |                                       | Range, depth or corrosion of R-bar   |
| Water leakage, efflorescence    |                                       | Length, water volume   |
| Slab crack                      |                                       | Width, type  |
| Damage of joint                 | Expansion joint                       | Space, roughness   |
| Damage of pavement              | Pavement<br>(include concrete)        | Roughness, range, refer to metal member  |
| Damage of bearing               | Bearing, bearing base or seat, anchor | Space, refer to metal and concrete member damage.                                |
| Damage of anchorage             | Anchorage of PC                       | Refer to metal and concrete member damage  |
| Unusual sound and vibration     | All member                            | Should be decided according to damage  |
| Deflection                      |                                       | Deflection volume  |
| Deformation and lack            |                                       | Deformation volume, lack range   |
| Soil chocked                    |                                       | Volume   |
| Settlement, decline or movement | Foundation                            | Volume, location   |
| Scouring                        | Foundation                            | Elevation of river bed   |

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**Table 2: Classified Evaluation for each damage or member  
(Necessity and Date of countermeasure)**

| Class |                                       | Description   |
|-------|---------------------------------------|---|
| A     | Good                                  | No damages and no functional troubles in a structure.   |
| B     | Require to Prevention and Maintenance | The damage which does not affect the basic function of structure had better be repaired in the view of preventing to become serious damage in future. |
| C1    | Require to Immediate Repairation      | The countermeasure should be implemented in an early time in the view of preventing serious damage in future.   |
| C2    |                                       | The countermeasure should be implemented in an early time because safety of structure is probably damaged.  |
| E1    | Require to emergency Repairation      | The countermeasure should be immediately implemented because the safety of structure is probably damaged.   |
| E2    |                                       | The immediate countermeasure is necessary because damage affects the safety of passenger or others but it doesn't affect the safety of structure.     |
| M     | Require to maintenance work           | Repaired in maintenance work.   |
| S1    | Require to additional survey          | Detail survey should be implemented.  |
| S2    |                                       | Follow-up survey should be implemented.   |

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**Table 3: Total Soundness Diagnosis of Bridge/Culvert**

| Class |                                 | Repair method  |
|-------|---------------------------------|--|
| I     | Good                            | No damages and no functional troubles in a structure.  |
| II    | Stage of Preventive Maintenance | The damage which does not affect the basic function of structure had better repair in the view of preventing to progress serious damage in future. |
| III   | Stage of Immediate Measure      | The countermeasure should be implemented in a early time because safety of structure probably damaged  |
| IV    | Stage of Unsafe                 | Immediate remedial action is required, because safety of structure is probably damaged or has the possibility to be damaged.                       |

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# Equipment

| Purpose                            | Equipment  |                         | Inspector | Maint. Unit                 | Master Trainer | RO | Inspection Squad | Total | Price in Pakistan | Price in Japan  |
|------------------------------------|--|-------------------------|-----------|-----------------------------|----------------|----|------------------|-------|-------------------|---|
| Compression Strength               | Core dia. 100 (→50, 30) (destructive) CORECASE with standard Drill Bit (100mm)                       | コア強度                    | -         | -                           | -              | -  | 2                |       |                   |   |
|                                    | Rebound Hammer<br>Schmidt Hammer   | 反発度法による強度推定             | -         | -                           | -              | -  | 2                |       |                   | Proceq N ¥93,312<br>Proceq NR ¥177,120<br>Test Anvil ¥240,840<br>Sanvo NS-2 ¥117,720                      |
| Crack Depth                        | Elastic Wave (ultrasonic, impact, hitting)<br>Sonic Testing<br>PUNDIT-LAB Ultrasonic System          | 弾性波(超音波、衝撃)<br>弾性波、打音法) | -         | -                           | -              | -  | 2                |       |                   | Pundit PL-200 ¥1,404,000<br>Pundit PL-200PE ¥2,160,000<br>Pundit Lab+ ¥1,080,000<br>Pundit Lab ¥1,026,000 |
| Rebar Arrangement                  | Electromagnetic Wave Radar<br>Ground Penetrating Rader   | 3次元電磁波レーダ               | -         | One Rader Rebar Detector    |                |    | 1                |       |                   | Hilti PS1000 ¥3,974,400   |
| Crack Width<br>Spalling, Honeycomb | Crack Scale  | クラックスケール                | 50        |                             | 47             | -  | 3                |       |                   |   |
|                                    | Test Hammer  | テストハンマー                 | 50        |                             | 47             | -  | 3                |       |                   |   |
| Rebar, Cover                       | Electromagnetic Induction<br>Profoscope/Profometer   | 電磁誘導                    | -         | One Magnetic Rebar Detector |                |    | 1                |       |                   | Hilti PS250 ¥1,987,200  |
| Carbonization                      | Carbonation Depth (Drilling),<br>Drill for Concrete  | 中性化深さ(ドリル法)             | -         | -                           | -              | -  | 2                |       |                   | Hilti TE 20-A36 ¥204,768<br>Hilti TE 4-A22 ¥133,099   |
|                                    | Phenolphthalein  | 中性化フェノールフタレイン           | -         | -                           | -              | -  | 2                |       |                   | 46,600  |
| Rebar Corrosion                    | Natural Electric Potential (ASTM)<br>Corrosion Analyzing Instrument (CANIN)<br>(Half Cell Potential) | 自然電位                    | -         | -                           | -              | -  | 2                |       |                   | Giater iCOR ¥3,348,000  |

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## Crack Gauge & Test Hammer



# Training in Japan (1)

|                               |  |
|-------------------------------|--|
| <b>Duration</b>               | <b>Jan 14 – Jan 28</b>   |
| <b>Organization Visit</b>     | <b>NEXCO Research Institute<br/>Hanshin Express Highway<br/>Japan Bridge Engineering Center<br/>Municipality (Yao City)<br/>PCKK (Experts)</b> |
| <b>Facility Visit</b>         | <b>Taiheiyo Consultant/Cement<br/>N2U-Bridge (Nagoya Univ.)</b>  |
| <b>Repair Work Site Visit</b> | <b>Work Site in Tokyo<br/>Work Site in Hyogo<br/>Work Site in Kyoto<br/>Work Site in Osaka</b>   |

## Master Trainers Training

|                               |  |
|-------------------------------|--|
| <b>No. of sessions</b>        | <b>3</b>                               |
| <b>Duration of Training</b>   | <b>1 week per session</b>              |
| <b>Participants</b>           | <b>60 (20 in each session)</b>         |
| <b>Candidate participants</b> | <b>Directors/DD/AD<br/>(Engineers)</b> |
| <b>Location</b>               | <b>HRTC</b>                            |

Master Trainers will be selected/decided based on evaluation during training by JICA Experts & NHA mutually

# MT Training Schedule (tentative)

|              | Mon | Tue | Wed                     | Thu | Fri | Sat | Sun |
|--------------|-----|-----|-------------------------|-----|-----|-----|-----|
| Feb,<br>2017 |     |     | 1                       | 2   | 3   | 4   | 5   |
|              | 6   | 7   | 8                       | 9   | 10  | 11  | 12  |
|              | 13  | 14  | 15                      | 16  | 17  | 18  | 19  |
|              | 20  | 21  | 22                      | 23  | 24  | 25  | 26  |
|              | 27  | 28  | 1 <sup>st</sup> Session | 2   | 3   | 4   | 5   |
| Mar,<br>2017 | 6   | 7   | 2 <sup>nd</sup> Session | 9   | 10  | 11  | 12  |
|              | 13  | 14  | 3 <sup>rd</sup> Session | 16  | 17  | 18  | 19  |
|              | 20  | 21  | 22                      | 23  | 24  | 25  | 26  |
|              | 27  | 28  | 29                      | 30  | 31  |     |     |

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# MT Training Schedule #1 (tentative)

| Date & Time |        | Theme                       | Content  |
|-------------|--------|-----------------------------|--|
| Day 1       | 10:00  | Guidance                    | Introduction- summary of training and schedule |
|             | 10:30  |                             |  |
|             | 10:30  | Break                       | -  |
|             | 10:40  |                             |  |
|             | 10:40  | Bridge Design(1)            | Bridge Engineering (1)                         |
|             | 11:30  |                             |  |
|             | 11:30  | Break                       | -  |
|             | 12:00  |                             |  |
|             | 12:00  | Bridge Design(2)            | Bridge Engineering (2)                         |
|             | 13:00  |                             |  |
|             | 13:00  | Lunch                       | -  |
|             | 14:00  |                             |  |
|             | 14:00  | Inspection Manual           | Summary of Inspection Manual                   |
|             | 14:50  |                             |  |
|             | 14:50  | Break                       | -  |
|             | 15:00  |                             |  |
|             | 15:00  | Inspection Manual           | Basic of evaluation                            |
|             | 15:50  |                             |  |
|             | 15:50  | Break                       | -  |
|             | 16:00  |                             |  |
| 16:00       | Test   | Easy test for bridge design |  |
| 16:30       |        |                             |  |
| 16:30       | Review | Review of today             |  |
| 17:00       |        |                             |  |

# MT Training Schedule #2 (tentative)

| Date & Time |                          | Theme                       | Content                 |  |
|-------------|--------------------------|-----------------------------|-------------------------|--|
| Day 2       | Damage, Inspection Sheet | 9:30                        | Damage(concrete)(1)     |  |
|             |                          | 10:30                       |                         | Damage and evaluation of concrete bridge         |
|             |                          | 10:30                       | Break                   | -  |
|             |                          | 11:00                       |                         |  |
|             |                          | 11:00                       | Damage(concrete)(2)     | Damage and evaluation of concrete bridge         |
|             |                          | 11:50                       |                         |  |
|             |                          | 11:50                       | Break                   | -  |
|             |                          | 12:00                       |                         |  |
|             |                          | 12:00                       | Damage(substructure)    | Damage and evaluation for substructure           |
|             |                          | 13:00                       |                         |  |
|             |                          | 13:00                       | Lunch                   | -  |
|             |                          | 14:00                       |                         |  |
|             |                          | 14:00                       | Damage(steel and other) | Damage and evaluation of steel bridge and others |
|             |                          | 14:50                       |                         |  |
|             |                          | 14:50                       | Break                   | -  |
|             |                          | 15:00                       |                         |  |
|             |                          | 15:00                       | Inspection(sheet)       | How to make Inspection Sheet(1)                  |
|             |                          | 15:50                       |                         |  |
|             |                          | 15:50                       | Break                   | -  |
|             |                          | 16:00                       |                         |  |
| 16:00       | Test                     | Easy test for bridge design |                         |  |
| 16:30       |                          |                             |                         |  |
| 16:30       | Review                   | Review of today             |                         |  |
| 17:00       |                          |                             |                         |  |

# MT Training Schedule #3 (tentative)

| Date & Time |                                  | Theme                       | Content              |   |
|-------------|----------------------------------|-----------------------------|----------------------|---|
| Day 3       | Inspection Sheet, Countermeasure | 9:30                        | Inspection(sheet)    |   |
|             |                                  | 10:30                       |                      | How to make Inspection Sheet(2)               |
|             |                                  | 10:30                       | Break                | -   |
|             |                                  | 11:00                       |                      |   |
|             |                                  | 11:00                       | Inspection(sheet)    | How to make Inspection Sheet(3)               |
|             |                                  | 11:50                       |                      |   |
|             |                                  | 11:50                       | Break                | -   |
|             |                                  | 12:00                       |                      |   |
|             |                                  | 12:00                       | Repair(1)            | Countermeasure for concrete                   |
|             |                                  | 13:00                       |                      |   |
|             |                                  | 13:00                       | Lunch                | -   |
|             |                                  | 14:00                       |                      |   |
|             |                                  | 14:00                       | Repaire(2)           | Countermeasure for steel and other materials. |
|             |                                  | 14:50                       |                      |   |
|             |                                  | 14:50                       | Break                | -   |
|             |                                  | 15:00                       |                      |   |
|             |                                  | 15:00                       | Non destructive test | Test for concrete and steel                   |
|             |                                  | 15:50                       |                      |   |
|             |                                  | 15:50                       | Break                | -   |
|             |                                  | 16:00                       |                      |   |
| 16:00       | Test                             | Easy test for bridge design |                      |   |
| 16:30       |                                  |                             |                      |   |
| 16:30       | Review                           | Review of today             |                      |   |
| 17:00       |                                  |                             |                      |   |

# MT Training Schedule #4 (tentative)

| Date & Time |                                      | Theme                        | Content                            |
|-------------|--------------------------------------|------------------------------|------------------------------------|
| Day 4       | Site inspection                      | 9:00                         | Move                               |
|             |                                      | 10:00                        | ⇒Shahia Bridge                     |
|             |                                      | 10:00                        | Site inspection                    |
|             |                                      | 11:00                        | Under bridge of concrete bridge(1) |
|             |                                      | 11:00                        | Break                              |
|             |                                      | 11:10                        | -                                  |
|             |                                      | 11:10                        | Site inspection                    |
|             |                                      | 12:10                        | Under bridge of concrete bridge(2) |
|             |                                      | 12:10                        | Move                               |
|             |                                      | 12:40                        | Shahia Bridge ⇒ HRTC               |
|             |                                      | 12:40                        | Lunch                              |
|             | 14:00                                | -                            |                                    |
|             | Reivew & Discussion                  | 14:00                        | Evaluation                         |
|             |                                      | 15:00                        | Evaluation of site inspection      |
|             |                                      | 15:00                        | Break                              |
|             |                                      | 15:10                        | -                                  |
|             |                                      | 15:10                        | Review                             |
| 16:00       |                                      | Review of inspection results |                                    |
| 16:00       | Examination                          |                              |                                    |
| 17:00       | Qualifying Examination of MT Trainer |                              |                                    |

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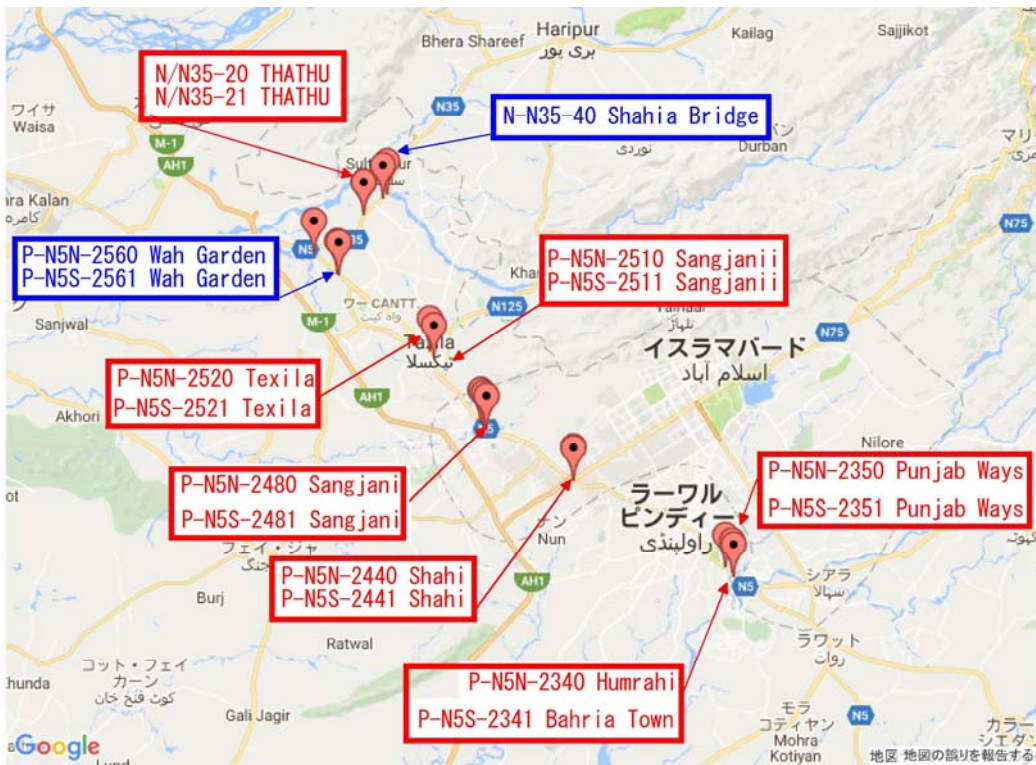
# MT Training Schedule #5 (tentative)

| Date & Time |                              | Theme                         | Content                            |
|-------------|------------------------------|-------------------------------|------------------------------------|
| Day 5       | Site inspection              | 9:00                          | Move                               |
|             |                              | 9:30                          | ⇒Wah garden bridge                 |
|             |                              | 9:30                          | Site inspection                    |
|             |                              | 10:30                         | Under bridge of concrete bridge(1) |
|             |                              | 10:30                         | Break                              |
|             |                              | 10:40                         | -                                  |
|             |                              | 10:40                         | Site inspection                    |
|             |                              | 11:40                         | Under bridge of concrete bridge(2) |
|             |                              | 11:40                         | Break                              |
|             |                              | 11:50                         | -                                  |
|             |                              | 11:50                         | Site inspection                    |
|             |                              | 12:30                         | Surface of concrete bridge         |
|             |                              | 12:30                         | Move                               |
|             |                              | 13:00                         | Wah garden bridge ⇒ HRTC           |
|             | 13:00                        | Lunch                         |                                    |
|             | 14:30                        | -                             |                                    |
|             | Reivew & Discussion          | 14:30                         | Evaluation                         |
| 15:20       |                              | Evaluation of site inspection |                                    |
| 15:20       |                              | Break                         |                                    |
| 15:30       |                              | -                             |                                    |
| 15:30       | Review                       |                               |                                    |
| 16:30       | Review of inspection results |                               |                                    |

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# Selected Bridges for MT training



## Shahia Bridge



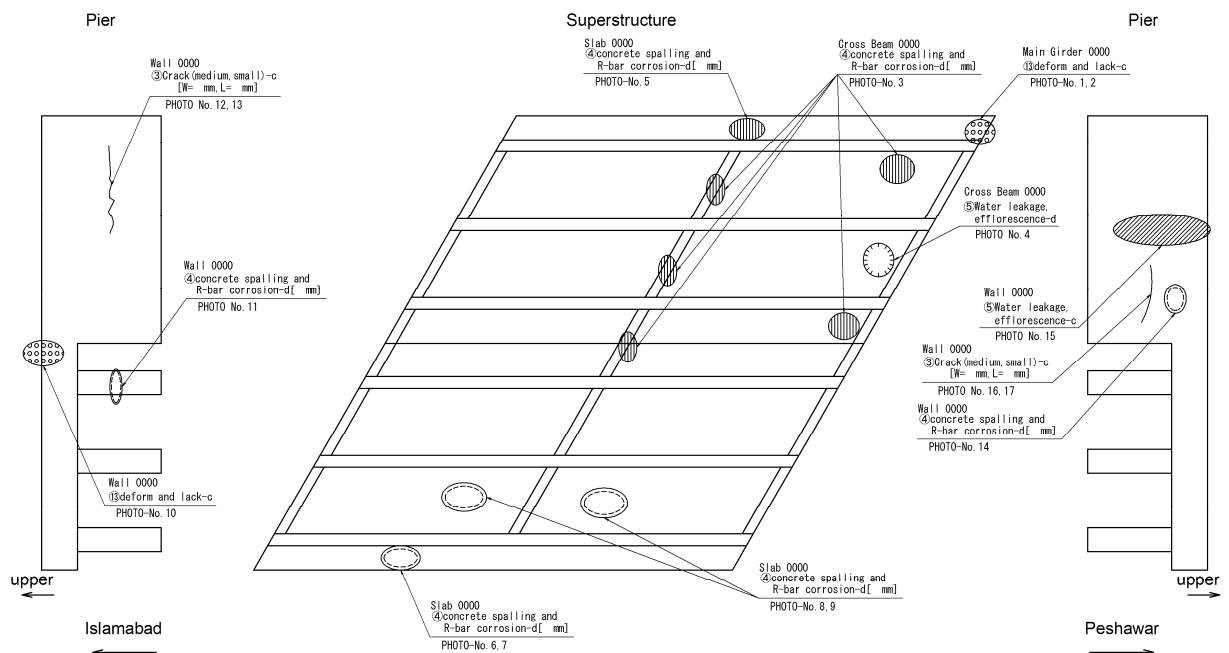




# Wah Garden Bridge






## Damages of Wah Garden Bridge



Wah Garden Bridge

| Explanatory notes |            |                  |            |
|-------------------|------------|------------------|------------|
| kinds of damages  | expression | kinds of damages | expression |
| crack             |            | float            |            |
| corrosion         |            | water leakage    |            |
| concrete spalling |            | deform or lack   |            |
| R-bar corrosion   |            | others           |            |
| efflorescence     |            |                  |            |

# Damages of Wah Garden Bridge

|   |   |                  |                  |                    |                    |  |  |                  |                  |                    |                    |            |
|---|---|------------------|------------------|--------------------|--------------------|--|--|------------------|------------------|--------------------|--------------------|------------|
| Photographic Pictures Including Damaged Section                                   | Picture Number  | 1                | Span Code        | 1                  | Photographing Date | 04/09/2015   | Picture Number   | 2                | Span Code        | 1                  | Photographing Date | 18/08/2015 |
|   | Member Name   | 主桁               | Element Number   |                    | Note               |  | Member Name  | 主桁               | Element Number   |                    | Note               |            |
|   | Damage Type   | 変形・欠損            | Degree of Damage | c                  | 23変形・欠損-c          |  | Damage Type  | 変形・欠損            | Degree of Damage | c                  | 写真番号-1の接写          |            |
|   |  |                  |                  |                    |                    |  |  |                  |                  |                    |                    |            |
| Picture Number  | 3   | Span Code        | 1                | Photographing Date | 04/09/2015         | Picture Number   | 4  | Span Code        | 1                | Photographing Date | 18/08/2015         |            |
| Member Name   | 横桁  | Element Number   |                  | Note               |                    | Member Name  | 横桁   | Element Number   |                  | Note               |                    |            |
| Damage Type   | 剥離・鉄筋露出   | Degree of Damage | d                | 27剥離・鉄筋露出-d [mm]   |                    | Damage Type  | 漏水・遊離石灰  | Degree of Damage | d                | 28漏水・遊離石灰-d        |                    |            |
|  |   |                  |                  |                    |                    |  |  |                  |                  |                    |                    |            |

## Agenda

1. Opening of the Meeting
2. Introduction of Participants
3. Outline of the Project
  - Revision of PDM (Project Design Matrix)
  - Revised Schedule of the Project
  - Progress of the Project
  - NHA staff (2 persons) visit to Japan
4. Discussion
5. Others

**Thank you!**

(3) Version 3 (12 July 2017)

## TO CR of JICA Pakistan OFFICE

## PROJECT MONITORING SHEET

**Project Title: The Project for Technical Assistance on Implementation of Bridge Management System in NHA**

**Version of the Sheet: Ver.3 (Term: January, 2017 - May, 2017)**

**Name: Kenichi TOMI**

**Title: Project Monitoring Expert**

**Name: Muhammad Asif Azam**

**Title: Project Coordinator, DD (BMS)**

**Name: Yukio IGO**

**Title: Project Manager/Bridge Inspection**

**Submission Date: 12<sup>th</sup> July, 2017**

## I. Summary

## 1 Progress

## 1-1 Progress of Inputs

## (1) Experts

Duration: from January 1, 2017 to May 31, 2017

Unit: Days

|                      |          | Plan        |                 |       | Actual      |                 |       | Actual / Plan |
|----------------------|----------|-------------|-----------------|-------|-------------|-----------------|-------|---------------|
|                      |          | by previous | during 6 months | total | by previous | during 6 months | total |               |
| Bridge Inspection    | Pakistan | 77          | 50              | 127   | 75          | 60              | 135   | 106%          |
|                      | Japan    | 17          | 14              | 31    | 21          | 19              | 40    | 129%          |
| Bridge Repair        | Pakistan | 77          | 32              | 109   | 75          | 28              | 103   | 94%           |
|                      | Japan    | 17          | 0               | 17    | 10          | 6               | 16    | 94%           |
| Bridge Man. System   | Pakistan | 29          | 11              | 40    | 11          | 11              | 22    | 55%           |
|                      | Japan    | 60          | 0               | 60    | 13          | 11              | 24    | 40%           |
| Capacity Development | Pakistan | 61          | 50              | 111   | 61          | 50              | 111   | 100%          |
|                      | Japan    | 0           | 0               | 0     | 6           | 5               | 11    | 10000%        |
| Project Monitoring   | Pakistan | 41          | 0               | 41    | 25          | 0               | 25    | 61%           |
|                      | Japan    | 0           | 0               | 0     | 0           | 0               | 0     |               |

*Experts for Training were input as planned during these 6 months for 2 weeks training in Japan for 2 trainees and the 1<sup>st</sup> Master Trainers Training for 65 trainees (1week x 3 times) at HRTC, while Expert for BMS was input less than planned because schedule was changed according to adding the new BMS.*

*Despite of PDM modification due to building new BMS with the prioritization function decided in JCC-2, delay of R/D amendment signature has been interrupting BMS Experts to give input to the Project.*

**(2) Counterpart**

Though input was required from 1) Project Coordinator (Deputy Director (BMS)) and 2) Assistant Project Coordinator (Assistant Director (BMS)), the latter has hardly been input since the Project started.

As to the 6<sup>th</sup> Expert visit (May 9<sup>th</sup> - May 24<sup>th</sup>), the Project progress was not progressed as planned because 1) Project Coordinator were out of office for the first week (May 9<sup>th</sup>- May 16<sup>th</sup>).

**(3) Equipment**

100 sets of Crack Scale and Test Hammer were handed over to NHA and 65 sets were delivered and used for the trainees in the 1<sup>st</sup> MT training. 100 Helmets were also done additionally from the viewpoint of safety, and safety vests were provided by HRTC.

Through discussion between Experts and C/P, NDT equipment as the below table is planned to be handed over by September 2017.

| Purpose                            | Equipment  | Total | Price in Pakistan   | Price in Japan  |
|------------------------------------|--|-------|---|---|
| Safety                             | Helmet   | 100   |   |   |
| Crack Width<br>Spalling, Honeycomb | Crack Scale  | 100   |   |   |
|                                    | Test Hammer  | 100   |   |   |
| Compression Strength               | Rebound Hammer<br>Schmidt Hammer   | 16    | <b>SilverSchmidt \$2,600 (EN EM)<br/>Calibration certificate \$170</b>                                | Proceq N ¥93,312<br>Proceq NR ¥177,120<br>Sanyo NS-2 ¥117,720<br>Digi Shimidt ND ¥ 585,000<br>Kamekura Seiki D-7000 ¥105,800    |
|                                    | Test Anvil   | 1     | <b>SilverSchmidt \$1,700 (EN EM)</b>  | Test Anvil ¥240,840<br>Kamekura Seiki KH-80 ¥84,200   |
| Crack Depth                        | Elastic Wave (ultrasonic, impact, hitting)<br>Sonic Testing<br>PUNDIT-LAB Ultrasonic System          | 1     | Pundit PL-200 \$7,760<br>Pundit PL-200PE \$20,300<br><b>Pundit Lab+ \$6,000</b><br>Pundit Lab \$5,300 | Pundit PL-200 ¥1,404,000<br>Pundit PL-200PE ¥2,160,000<br>Pundit Lab+ ¥1,080,000<br>Pundit Lab ¥1,026,000<br>Elsonic ¥1,250,000 |
| Rebar Arrangement                  | Electromagnetic Wave Radar<br>Ground Penetrating Rader   | 1     | Hilti PS1000 Rp.7,091,983+GST<br>Profoscope+ \$3,420<br>Profometer PM-650 \$8,620                     | <b>Hilti PS1000 ¥3,974,400</b>  |
| Rebar, Cover                       | Electromagnetic Induction<br>Profoscope/Profometer   | 1     | Hilti PS250 Rs.4,237,746+GST  | <b>Hilti PS250 ¥1,987,200</b>   |
| Carbonization                      |  | 16    | Deep Purple \$1,900   | ¥46600/Kit<br>¥3500/500ml bottle  |
| Rebar Corrosion                    | Natural Electric Potential (ASTM)<br>Corrosion Analyzing Instrument (CANIN)<br>(Half Cell Potential) | 1     | <b>Profometer Corrosion \$10,965</b>  | Giatec iCOR ¥3,348,000<br>Profometer Corrosion ¥2,500,000   |

Computers (Licensed Server and Terminals) will be kept in discussion after the specifications of Bridge Inspection Database and new BMS are fixed. Through discussion between Experts and C/P, the Computers are planned to be handed over by December 2017.



**(4) Training in Japan**

*Duration: January 15<sup>th</sup> to 27<sup>th</sup>, 2017.*

*Participants: Mr. Aftab Ullah Babar & Mr. Muhammad Asif Azam (2 persons).*

**1) January 16, Monday**

*Subject: Bridge and Maintenance in Japan*

*BMS in Japan*

*Transportation Infrastructures and Projects*

*Venue: PCKK HQ (13:00-18:00)*

*Attendees: Watanabe (Board of Member), Mori, Kamitani, Nakaai, Horii, Ishihara,*

*Suga, Yoneda, Fujimoto, Tomiyama, Igo*

- *Bridge Maintenance in Japan by Nakai*
- *BMS in Japan by Mori*
- *Discussion on Bridge Management plans in Pakistan*
- *Introduction of Road Technologies in Japan by Ishihara*



**Opinion Exchange**



**Group Photo**

**2) January 17, Tuesday**

*Subject: Technologies in Japan Highway Bridges*

*Bridge Maintenance in Japan Highway*

*Venue: NEXCO Research Institute (11:00-16:00)*

*Attendees: Mr. Hirose, Mr. Shirakawa, Igo*



**Lectures**



**Facility visit**



- *Bridge Situations and Countermeasures in NEXCO by Mr. Hirose*
- *BMS in NEXCO by Mr. Shirakawa*
- *Sound Diagnosis for Highway Bridges by Mr. Hirose*
- *Facility visit*

### **3) January 18, Wednesday**

*Subject: Repair Site Visit*

*Venue: Shingetsu Rikkyo Bridge (14:00-16:00)*

*Attendees: Mr. Nagahata, Mr. Endo from Nippon Liner*

*Mr. Matsuoka, Mr. Takagi, Mr. Akabae from MBS*

*Mr. Konuma, Ms. Kasahara, Igo from PCKK*

*This project is repair works for slab on the steel girders. Sectional repair by plastering and prevention for falling pieces by sheeting. This sheeting is special because it is transparent in order to watch concrete cracks.*



**Ride on Lift Car**



**Lift Car**

### **4) January 19, Thursday**

*Subject: License System of Road Bridge Inspectors*

*Venue: Japan Bridge Engineering Center (J-BEC) (9:30-11:30)*

*Attendees: Mr. Yoshida, Igo, Yoneda*



**Lecture**



**Q & A**

*This is the only organization to licentiate for road bridge inspectors. It carries out both in-office and on-site lectures and examination. This license is required especially in MLIT inspection and maintenance projects.*

**5) January 19, Thursday**

*Subject: Concrete Test Facilities and Equipment*

*Venue: Taiheiyo Consultant (14:30-17:00)*

*Attendees: Mr. Kobayashi, Mr. Shirai, Ms. Tsukamoto, Mr. Tanaka, Igo*

- *Facilities of Taiheiyo Group*
- *Analysis Equipment*
- *Non-Destructive Test Equipment with operative experience*



**Lecture**



**NDT operation**

*Taiheiyo consultant is one of subsidiaries of Taiheiyo Cement which is one of the biggest cement manufacturers in Japan and also has some subsidiaries and branches world widely.*

**6) January 20, Friday**

*Subject: N2U-BRIDGE*

*Venue: Nagoya University (14:00-16:00)*

*Attendees: Mr. Imai, Tomiyama, Mutou, Igo*



**Lecture**



**Facility**

*This research facility for bridge maintenance was established in Nagoya University Campus in 2010. This facility comprises 4 deteriorated bridges, which were removed from NEXCO sites; then reassembled at Nagoya University Campus. At the site of this facility, Inspection Training Model Panels with various defects and conditions such as ASR aggregate and voids were furthermore built for training inspectors as well as research. Owing the above-mentioned unique figures, N2U-BRIDGE become a facility original worldwide in the field of education and training for engineers, whose works are regarding bridge maintenance since its establishment. N2U-BRIDGE is currently operated by the committee including Nagoya University, Nexco-Central (Central Nippon Expressway) and Engineering Nagoya.*

**7) January 23, Monday**

*Subject: BMS in Municipality*

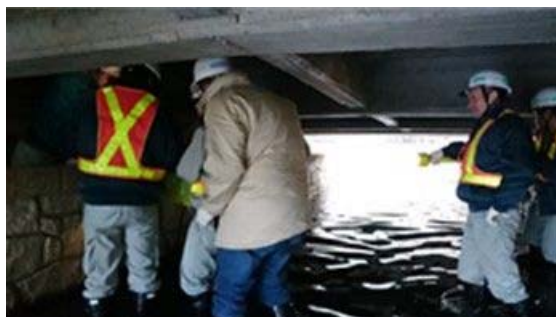
*Venue: Yao City (13:00-17:30)*

*Attendees: Mr. Tanaka (Mayor), Mr. Matsui, Mr. Miyata, Mr. Nishio, Mr. Kaneko, Mr. Ooyama, Mr. Noguchi, Mr. Kaku, Mr. Kuri Igo, Tomiyama, Tomi*

- *Operation and Maintenance of Bridge in Municipality*
- *On-site demonstration*



**Lecture**



**on-site visit**

**8) January 24, Tuesday**

*Subject: Bridge Inspection Site*

*Venue: Tomami Viaduct (14:00-16:00)*

*Attendees: Mr. Matsumoto (MLIT), Igo, Tomiyama, Kyo, M.Mori*

- *Bridge Inspection Site Visit*
- *Trial operation of NDT*





**Ride on Bridge Inspection Car**



**NDT Equipment**

**9) January 25, Wednesday**

*Subject: Seismic Upgrading Work Site*

*Venue: Nijo Bridge (14:00-16:30)*

*Attendees: Mr. Hirano, Mr. Ito, Mr. Inoue from Kyoto City*

*Igo, Tomiyama, Nakata from PCKK*

➤ *Seismic Upgrading Work Site Visit*



**Site Visit**



**Group Photo**

**10) January 26, Thursday**

*Subject: Bridge Management in Urban Highways*

*Venue: Hanshin Expressway (10:30-17:00)*

*Attendees: Ms. Kawakami, Mr. Tamagawa from Hanshin Expressway*

*Igo, Tomiyama, Miyamoto, Kyoku from PCKK*

*Mr. Kuge (JICA, joining in the afternoon)*

➤ *Bridge Management in Urban Highways*

➤ *Visit Earthquake Disaster Museum*



**Lecture**



**Earthquake Disaster Museum**

**11) January 27, Friday**

*Subject: Bridge Repair Work Site Visit*

*Venue: Terada Viaduct (10:00-12:00)*

*Attendees: Mr. Konishi (MILT)*

*Mr. Nakaya, Mr. Okabe, Mr.Kida from Shobond Construction*

*Igo, Tomiyama, Tomi, Nagata, Yaguchi from PCKK*

*Mr. Kuge*

➤ *Bridge Repair Work Site Visit*



**Explanation on Application Methods Explanation on constituent Materials**

**(5) In-country Training**

**Subject: the 1<sup>st</sup> Master Trainers' Training**

**Venue: Highway Research and Training Center (HRTC), Burhan**

**Attendees: Total 65 trainees**

➤ **1<sup>st</sup> batch (Feb 27 - Mar 3) 16 trainees**

➤ **2<sup>nd</sup> batch (Mar 6 - Mar 10) 20 trainees**

➤ **3<sup>rd</sup> batch (Mar 13 - Mar 17) 29 trainees**

**Materials:**

➤ **Bridge Inspection Manual (1<sup>st</sup> Edition)**

➤ **Bridge Repair Manual (1<sup>st</sup> Edition)**

➤ **Handout (printout of PowerPoint slides)**

➤ **Stationery (a set of bag, file, notebook and 3 color erasable ballpoint pen)**

➤ **Bridge/Culvert Inspection Sheet (Excel file)**

1) 1<sup>st</sup> batch



Lecture



Indus River Bridge



Shahia Bridge



Examination



Wah Garden Bridge



Certification



2) 2<sup>nd</sup> batch



Lecture



Indus River Bridge



Shahia Bridge



Examination



Wah Garden Bridge



Certification



**3) 3<sup>rd</sup> batch**



**Lecture**



**Indus River Bridge**



**Shahia Bridge**



**Examination**



**Wah Garden Bridge**



**Certification**

## **1-2 Progress of Activities**

**Activity 1-1. Develop 3 types of draft manuals i.e. (1) bridge/culvert inspection, (2) bridge repair method selection and (3) data input to Database.**

- *(1) and (2) were completed on schedule.*
- *(3) will be drafted along with Activity 1-3*

**Activity 1-2. Develop draft bridge/culvert inspection formats.**

- *Activity was completed on schedule.*

**Activity 1-3. Develop prototype Database & BMS.**

- *Bridge Inspection Database Prototype will be developed in July 2017 as version 1.0. From July to November 2017, inspection data of 100 bridges and 200 culverts will be collected by RAMS & Certified Master Trainers. The data will then be imported in Bridge Inspection Database Prototype for validation purpose. The BMS Software will be revised accordingly. (Refer to Minutes of JWG Meeting dated May 19th, 2017)*
- *The BMS Software shall be developed as network-based, with limited access to Master Trainers i.e., submit the updated bridge inspection/repair data to database. (Refer to Minutes of JWG Meeting dated May 19th, 2017)*
- *The Bridge Inspection Database should be developed in such a way that it can be integrated with Road Database and GIS. (Refer to Minutes of JWG Meeting dated May 19th, 2017)*
- *Master Trainers will be able to upload and gather information from bridge inspection data in their jurisdiction folder. (Refer to Minutes of JWG Meeting dated May 19th, 2017)*
- *Bridge Inspection Database Prototype with data input software as version 1.0 will be developed by the end of July 2017.*

**Activity 1-4. Develop 2 types of draft training materials for training i.e. (1) bridge/culvert inspection and (2) bridge repair method selection.**

- *Activity 1-4 was completed in time for the 1<sup>st</sup> MTT.*

**Activity 1-5. Review and finalize the above 3 types of manuals (Activity 1-1), inspection formats (Activity 1-2), prototypes (Activity 1-3) and 2 types of training materials (Activity 1-4).**

- *Activity 1-5 is still in progress with expected completion before 2<sup>nd</sup> MTT subject to validation of prototypes and input software through inspection data (December 2017)*

- *Current progress seems not to be sufficient. Inputs shall be re-considered.*

**Activity 2-1. Implement 3 types of master trainer's training for the staff of NHA's HQ and ROs at the target bridges (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database).**

- *According to NHA's request for basic education of bridge maintenance, NHA selected the 75 candidates and 65 attended to MTT (Activity 2-1-1).*
- *Shahia Bridge, Wah Garden Bridge and Indus River Bridge were selected for on-site training (Activity 2-1-2).*
- *A set of NDT equipment for on-site training (a test hammer, a crack scale and a helmet) was provided to each participant. A safety jacket was also provided by HRTC. The NDT equipment list with purposes and numbers has been prepared by Experts and waiting for C/P consensus (Activity 2-1-3) (Refer to 1 Progress, 1-1, (3) Equipment)*
- *Contents and syllabus of MTT was prepared (Activity 2-1-4).*
- *Questionnaire at the first stage was carried out (Activity 2-1-5).*
- *The 1<sup>st</sup> MTT was carried out in February and March (Activity 2-1-6).*
- *Data input to Database (Activity 2-1-7) will be carried out in the 2<sup>nd</sup> MTT (on schedule).*
- *The 1<sup>st</sup> training in Japan was carried out (Activity 2-1-8).*
- *"The Certificate of the 1<sup>st</sup> MTT" was granted to each participant without consideration of the results of examination (Activity 2-1-9).*
- *It was decided that (Certified) Master Trainers would be selected based both on the in-house examination at the end of MTT and on-site bridge inspection sheets after MTT which each candidate would inspect, fill out and submit by him/herself in his/her jurisdiction.*
- *Each candidate was requested to submit 10 sets of bridge inspection sheets if he/she belonged to MU or 3 sets if not by May 19<sup>th</sup> and to declare in advance his/her nominated bridge names by April 12<sup>th</sup>.*
- *It was decided in JWG Meeting dated May 19<sup>th</sup>, 2017 that based on the results of examination and inspection reports, 20-25 candidates would be shortlisted by JICA Experts and afterwards 10 - 15 candidates would be finalized as Certified Master Trainer jointly by JICA Experts & NHA*
- *Only 7 candidates submitted 26 sets of bridge inspection sheets by May 19<sup>th</sup>.*
- *Because of insufficient submission, the submission sets were reduced 2 and 5 respectively, and due date was postponed to June 16<sup>th</sup>, but totally 17 candidates submitted 58 sets.*
- *The definition of Certified Master Trainer (CMT), Master Trainer (MT), and participants of 2<sup>nd</sup> MTT shall be discussed.*

**Activity 2-2. Implement 3 types of OJT for the field staff by Master Trainers (trained in Activity 2-1), (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) inspection data input to Database.**

- *Master Trainers have not been selected.*
- *OJT implementation has not been confirmed.*
- *No MT has trained the field staff.*
- *Significant delay occurs.*

**Activity 2-3. Implement (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database for all the bridges/culverts, by field staff (trained in Activity 2-1 & 2-2).**

- *No progress has been confirmed.*
- *Significant delay occurs.*

**Activity 3-1. Implement training for NHA HQ regarding management of BMS (software and database).**

- *The activity will start subsequent to validation of BMS (software and database).*

**Activity 3-2. Monitor bridge data input by NHA staff (Activity 2-3) to Database, and data transfer to BMS by HQ RAMD (Road Asset Management Department) staff.**

- *No progress has been confirmed.*
- *Slight Delay is expected.*

**Activity 3-3. Prepare the annual bridge/culvert maintenance plan including estimated budget for 2019 based on the data transferred to BMS (Activity 3-2).**

- *No progress has been confirmed.*
- *Slight Delay is expected.*

### **1-3 Achievement of Output**

**Output 1-1. Draft manuals for (1) bridge/culvert inspection, (2) bridge repair method selection by [December, 2016] and draft manual for (3) data input to Database & BMS developed by [December, 2017].**

- *Bridge Inspection Manual and Bridge Repair Manual were drafted (2 of 3).*

**Output 1-2. Draft bridge/culvert inspection formats developed by [December, 2016].**

➤ *Completed.*

**Output 1-4. 2 types of draft training materials for the master trainers for (1) bridge/culvert inspection and (2) bridge repair method selection developed by [December, 2016].**

➤ *Both 1<sup>st</sup> Edition of Bridge Inspection Manual and Bridge Repair Manual were issued and delivered to the 1<sup>st</sup> MT training participants.*

**Output 2-1. 3 Master Trainers' training for (1) bridge/culvert inspection and (2) bridge repair method selection implemented by [March 2017], and (3) data input to Database implemented by [September, 2018].**

➤ *(1) and (2) were completed on schedule.*

**Output 2-2. 3 types of training (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database) implemented by Master Trainers (trained in Activity 2-1) to all field staff by [November, 2017]. “**

➤ *Implementation of training by Master Trainers to all field staff will be planned after selection of Certified Master Trainers.*

➤ *Neither MT nor CMT were not yet selected.*

**Output 2-3. Bridge/culvert inspection, bridge repair method selection, and data input to Database completed for all NHA bridges by [June, 2018].**

➤ *Only 58 bridges/culverts were inspected by 17 candidates while more than 5000 bridges and 16000 culverts (total 21000) will be inspected by June, 2018.*

➤ *Current progress percentage is less than 0.28%.*

**Output 2-4. 90% or more results of bridge repair method selection and data input to a bridge inspection database by the staff of MUs evaluated to be accurate by NHA's HO & JICA Experts by [October, 2018].**

➤ *No output has been confirmed.*

**Output 3-1. Training for management of BMS implemented by [December, 2017].**

➤ *No output has been confirmed.*

**Output 3-2. Data on all the bridges of National Highways in Pakistan input to Database by [October, 2018].**

➤ *No output has been confirmed.*

**Output 3-3. Cost estimate necessary for bridge maintenance in the fiscal year of 2019 based on BMS.**

➤ *No output has been confirmed.*

**1-4 Achievement of the Project Purpose**

➤ *No achievement so far.*

➤ *Need to pay attention to the way how to collect the “complete input data” and “Means of Verification”. (Refer to 2 Delay of Work Schedule and/or Problems.)*

**1-5 Changes of Risks and Actions for Mitigation**

**(1) Training Target**

*It was written in original R/D, appendix 2, “V. TARGET STAFF OF ACTIVITY 2-1 & 2-2”, “For Activity 2-1 and Activity 2-2, which is trainings for the staff of Maintenance Units by the master trainers of Regional Offices, the criteria for selection of participants in the trainings will be set up by the counterpart personnel at NHA’s Headquarters and the JICA Experts. The participants will be finally decided at the beginning of each activity through mutual consultations between the JICA experts and the counterpart personnel at NHA’s Headquarters. Upon successful completion of the master trainers’ trainings, JICA and NHA will grant a certificate to the participants”.*

*But, according to NHA’s request for basic education of bridge maintenance, there were 65 participants of the 1<sup>st</sup> MTT from HQ, RO, MU and Project Office.*

*As written in “Issues and countermeasures” in amended PDM (version 2), Standard Operation Procedures (SOP) related to bridge maintenance is requested to be built in order to clarify the training target.*

**(2) OJT for MU**

*Because Inspectors in MU actually inspect and fill up the bridge inspection sheets, the 1<sup>st</sup> MTT participants need to provide OJT for the Inspectors. But most of them seem not to have any time to share bridge inspection and OJT. It is necessary for Inspectors to have some training for bridge inspection.*

**1-6 Progress of Actions undertaken by JICA**

➤ *(None)*

**1-7 Progress of Actions undertaken by NHA**

- *As R/D Amendment of the 2<sup>nd</sup> JCC was signed on June 8<sup>th</sup>, 2017, Bridge Inspection Database and BMS can be started officially.*

**1-8 Progress of Environmental and Social Considerations (if applicable)**

- *(None)*

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

- *(None)*

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

**(1) Scholarship Program in Bridge Sector**

*JICA intends to grant scholarship for Doctor/Master Course in Japan on Bridge Asset/Maintenance Management. It is scheduled to start September 2018. The person(s) must be the prospective key person(s) of BMS in NHA.*

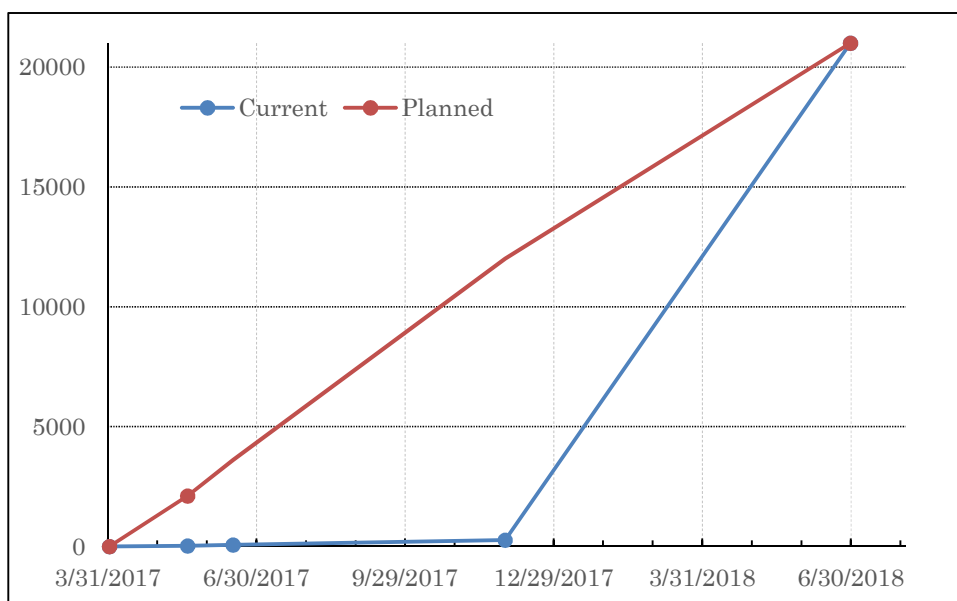
## 2 Delay of Work Schedule and/or Problems (if any)

### Data Collection

In order to achieve "Project Purpose", it is necessary to analyze the **complete** input data to BMS. Those data will be necessary by the end of June, 2018.

### 2-1 Detail

- Data collection started from April 2016 (after the 1<sup>st</sup> MTT), and more than 5000 bridges and 16000 culverts (total 21000) will be inspected by June, 2018 (duration 15 months).
- Only 58 bridges/culverts were inspected by 17 candidates by June 2017. Current progress percentage is less than 0.28%.
- 100 bridges and 200 culverts will be inspected by November, 2017(Refer to Minutes of JWG Meeting dated May 19th, 2017). The progress of November will be 1.70%.



**Figure Number of Inspected Bridges/Culverts**

- In order to accelerate the inspection progress, it is necessary to clarify who and how it will complete by the end of June, 2018.

### 2-2 Cause

- Insufficient human resources in MUs of NHA to allocate bridge maintenance work because there are so many new construction projects in NHA such as CPEC projects.
- Insufficient rewards for MTs and Inspectors for bridge maintenance because it is considered as an additional work by MUs without incentive/promotion.



- Shortage of C/P personnel in JWG (Assistant Project Coordinator in PDM Inputs).
- Characteristic differences from Pavement Maintenance System (PMS) which the Local Consultants (outsource) annually collect the new data and submit to NHA HQ (one-way basis), while it is compulsory for bridge inspection in BMS to compare with the past inspection and maintenance records (circulation basis).
- The Ex-bridge inventory was not fully utilized.

## **2-3 Action to be taken**

### **(1) 3 to 5 engineers involved/engaged in the Project**

Based on the in-house examination and on-site bridge inspection report, Experts will list the candidates. NHA will have no objection in selecting 3 - 5 near Islamabad who will be involved/engaged exclusively in working cooperatively with Experts to accelerate the progress, to prepare for the 2<sup>nd</sup> MTT. They may be called Certified Master Trainer in the future.

### **(2) JWG**

Adding abovementioned engineers into Technical WG or JWG, countermeasures and directions shall be discussed and decided with mutual consensus among C/P, Experts and JICA.

### **(3) 2nd Master Trainer Training**

The purpose, contents and participants of the 2nd MTT should be discussed in JWG.

*(NHA opinion)*

NHA will have no objection if only 3 – 5 engineers near Islamabad will be selected initially to support this project (or may be as CMT). They can be periodically called for meeting, sharing their views and other issues at RAMS office. However, it is not necessary to add them in JWG. It will be administratively difficult unless they are posted in RAMS or BMU is established in RAMS comprised of such engineers

## **2-4 Roles of Responsible Persons/Organization (JICA, NHA, etc.)**

Newly associated TWG or JWG must discuss and decide issues as follows;

- To accelerate the progress of bridge inspection by NHA.
- To define the organization in NHA for bridge maintenance by NHA.

### **3 Modification of the Project Implementation Plan**

#### **3-1 PO**

##### **(1) 2nd Training in Japan**

*Training in Japan is one of the most effective incentives for candidates to become CMT/MT. If the 2nd MTT is carried out after training in Japan, most of participants may lose their interest in bridge maintenance. And even the 17 candidates who have submitted bridge inspection reports seem not to have sufficient knowledge and skills in bridge maintenance and inspection.*

*Experts and Project Coordinator discussed and decided that the 2nd Training in Japan would be postponed to after April, 2018.*

#### **3-2 PDM**

*The green words in PDM mean that those become unsuitable for the current situations.*

#### **3-3 Other modifications on detailed implementation plan**

##### **(1) Inspection targets**

*Though all the bridges/culverts, total 21,000 are currently targeted in PDM, those should be limited in number according to the current situation of bridge maintenance in NHA.*

*The feasible numbers of targets shall be set with consideration sustainability of BMS in NHA. One of the practical countermeasures is to set the model areas/routes/jurisdictions and to transfer know-how with experience to other ones in sequence.*

##### **(2) Training targets**

*The Master Trainers' Training was initially targeted on Directors or Deputy Directors in Headquarters and Regional Office, but through the mutual discussion between C/P and Experts, it was changed on Deputy Directors, Project Directors and Assistant Directors in Maintenance Units and Project Office.*

#### **4 Preparation of NHA towards after completion of the Project**

*NHA seems to have insufficient human resources to share for bridge maintenance and to have few engineers who have sufficient capability with intention for bridge maintenance. Considering to achieve “Project Purpose” and “Overall Goal” (sustainability), utilization of outsources such as local consultants for bridge inspection is one of the Experts’ recommendation though NHA has an intention to allocate internally from the beginning of the Project.*

*(NHA opinion)*

*After accessing the current situation and 12 months progress in this project, it will be advisable for NHA to opt for engaging local consultant to collect inspection data of all bridges/culverts on NHA Network (for only once). The local consultant will directly submit the data to RAMS HQ (or CMT can be involved for training of consultant’s engineers, check the data and forward to RAMS by some arrangement). The CMT will get a lot of experience and knowledge during this exercise. It is envisaged that NHA will get all data before the end of 2018. Meanwhile, the JICA experts will continue for capacity building of NHA engineers in this project as per actual plan. Later NHA engineers will work continuously to update the inspection record.*

*Filling of initial inspection form (starting from scratch), detailed measurements and preparation of sketches seems to be a difficult task at the moment for NHA inspectors and is also one of the major reason of their lack of confidence and interest. Once NHA has complete inspection record, then the inspector will only have to update the inspection/repair data. While doing so, they will gradually improve both in experience and knowledge. Thereafter, NHA’s own human resource would be sufficient to run the BMS.*

## **II. Project Monitoring Sheet I & II as Attached**

*PM Form 1: PDM (Project Design Matrix)*

*PM Form 2: PO (Plan of Operation)*

Project Design Matrix

**Project Title: The Project for Technical Assistance on Implementation of Bridge Management System in NHA**

**Implementing Agency: National Highway Authority**

Version 3

Dated 12, July, 2017

**Target Group:**


**Period of Project: July, 2016 – January, 2019 (30 months)**

**Project Site: in/around Islamabad, Pakistan**

**Model Site:**

| Narrative Summary   |  | Objectively Verifiable Indicators   | Means of Verification  | Important Assumption  | Achievement | Remarks                              |
|---|--|---|--|---|-------------|--------------------------------------|
| <b>Overall Goal</b><br>Bridge maintenance status improved on the bridges of National Highways in Pakistan.  | Based on the bridge data, the number of bridge structures in the worst condition has decreased by one-third in [January, 2022] from the start of the Project.  | Output data of the BMS  | · Copyright of software (source code)<br>· Availability of optimum maintenance budget.<br>· Continuous update of bridge data   |   |             |                                      |
| <b>Project Purpose</b><br>Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of <i>entire</i> NHA Network. | Bridge maintenance budget document with breakdowns prepared by [September, 2018].  | Analysis of <b>complete</b> input data to BMS and bridge maintenance budget document (with anticipated budget requirement for forthcoming years)  | · NHA's road maintenance budget does not decrease from the start of the Project.<br>· Natural disasters with the risk of damages on bridges do not occur on National Highways in Pakistan. |   |             | Set the "Model Area" to promote BMS. |
| <b>Outputs</b><br>1. Manuals, Database and BMS developed for bridge inspection and bridge repair method selection                                 | 1-1. Draft manuals for (1) bridge/culvert inspection, (2) bridge repair method selection by [December, 2016] and draft manual for (3) data input to Database & BMS developed by [December, 2017].<br>1-2. Draft bridge/culvert inspection formats developed by [December, 2016].<br>1-3. Prototype Database developed by [July, 2017], and prototype BMS by [December, 2017].<br>1-4. 2 types of draft training materials for the master trainers for (1) bridge/culvert inspection and (2) bridge repair method selection developed by [December, 2016].<br>1-5. Manuals (1-1), formats (1-2), Database & BMS (1-3), and training materials (1-4) finalized by [September, 2018]. | 1-1. 3 types of draft manuals<br><br>1-2. Draft bridge/culvert inspection formats<br><br>1-3. Prototype Database & BMS<br><br>1-4. 2 types of draft training materials<br><br>1-5. 3 types of manuals, bridge/culvert inspection formats, Database & BMS, and 2 types of training materials | · BMS is continuously in use by NHA for preparation of bridge maintenance plan.  | (1) & (2) by Dec, 2016.<br><b>(3) is in progress</b><br><br>Completed<br><br><b>Still in progress</b><br><br><b>Completed</b> |             |                                      |

|  |   |   |   |   |
|--|---|---|---|---|
| <p>2. Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and bridge repair method selection of uniformed contents implemented on <b>all</b> the bridges of National Highways in Pakistan.</p> | <p>2-1. 3 Master Trainers' training for (1) bridge/culvert inspection and (2) bridge repair method selection implemented by [March 2017], and (3) data input to Database implemented by [September, 2018].<br/>2-2. 3 types of training (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database) <b>implemented by Master Trainers (trained in Activity 2-1) to all field staff</b> by [November, 2017].<br/>2-3. Bridge/culvert inspection, bridge repair method selection, and data input to Database completed for <b>all</b> NHA bridges by [June, 2018].<br/>2-4. <b>90% or more</b> results of bridge repair method selection and data input to a bridge inspection database by the staff of MUs evaluated to be accurate by NHA's HO &amp; JICA Experts by [October, 2018].<br/>2-5. <b>Certification of master trainers after training by JICA experts (scoring more than 80% in capacity test)</b>.</p> | <p>2-1. Training records and reports<br/><br/>2-2. Training records and reports<br/><br/>2-3. Completed bridge inspection formats and input data to a bridge inspection database<br/><br/>2-4. Input data to Database and its evaluation<br/><br/>2-5. Test records and reports</p> | <p>(1) &amp; (2) by Mar, 2017. 1st MTT participants increased up to 65 because NHA desired to improve capability of NHA staff. 17 of 65 candidates submitted 58 brideg/culvert reports.<br/><br/>Current progress percentage is less than 0.28%</p> <p>Not enough candidates of the 1st MTT met with capacity test.</p> | <p>3-5 engineers selected for BMS in Model Area. Inspection of 100 br+200cb led by them. Experience in Model Area need to prevail nationwide y.</p> <p>Trainees may be limited in HQ.</p> |
| <p>3. Data on <b>all</b> the bridges of National Highways in Pakistan input by MUs to Database available to NHA's HQ and ROs.</p>  | <p>3-1. Training for management of BMS implemented by [December, 2017].<br/>3-2. Data on <b>all</b> the bridges of National Highways in Pakistan input to Database by [October, 2018].<br/>3-3. Cost estimate necessary for bridge maintenance in the fiscal year of 2019 based on BMS.</p>   | <p>3-1. Training records and reports<br/>3-2. Input data to Database<br/>3-3. Bridge maintenance budget document with breakdown</p>   | <p>Not yet<br/>Not yet<br/>Not yet</p>  | <p>Not yet<br/>Not yet<br/>Not yet</p>  |

| Activities   | Inputs  | Pre-Conditions   |
|--|---|--|
| <p>1-1. Develop 3 types of draft manuals i.e. (1) bridge/culvert inspection, (2) bridge repair method selection and (3) data input to Database.</p> <p>1-2. Develop draft bridge/culvert inspection formats.</p> <p>1-3. Develop prototype Database &amp; BMS.</p> <p>1-4. Develop 2 types of draft training materials for training i.e. (1) bridge/culvert inspection and (2) bridge repair method selection.</p> <p>1-5. Review and finalize the above 3 types of manuals (Activity 1-1), inspection formats (Activity 1-2), prototypes (Activity 1-3) and 2 types of training materials (Activity 1-4).</p> <p>2-1. Implement 3 types of master trainers' s training for the staff of NHA's HQ and ROs at the target bridges (for (1) bridge /culvert inspection, (2) bridge repair method selection, and (3) data input to Database).</p> <p>2-2. <b>Implement 3 types of OJT for the field staff by Master Trainers (trained in Activity 2-1), (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) inspection data input to Database</b></p> <p>2-3. Implement (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database for <b>all the bridges/culverts, by field staff (trained in Activity 2-1 &amp; 2-2)</b>.</p> <p>3-1. Implement training for NHA HQ regarding management of BMS (software and database).</p> <p>3-2. Monitor bridge data input by NHA staff (Activity 2-3) to Database, and <b>data transfer to BMS</b> by HQ RAMD (Road Asset Management Department) staff.</p> | <p><b>The Japanese Side</b></p> <p>1. EXPERTS</p> <ul style="list-style-type: none"> <li>1) Bridge Inspection Expert</li> <li>2) Bridge Repair Expert</li> <li>3) BMS Expert</li> <li>4) Capacity Development Expert</li> <li>5) Project Monitoring Expert</li> <li>6) Local Coordinator (Pakistani)</li> </ul> <p>2. EQUIPMENT (subject to changes)</p> <p>Non-destructive testing equipment such as</p> <ul style="list-style-type: none"> <li>· Crack Scale &amp; Test Hammer</li> <li>· Concrete Compression Strength</li> <li>· Crack Depth</li> <li>· Rebar Arrangement</li> <li>· Rebar &amp; Cover</li> <li>· Rebar Corrosion</li> <li>· Carbonation</li> <li>· Server (and Terminals) for Database &amp; BMS</li> </ul> <p>(Numbers and specifications will be determined through mutual consultations between JICA and NHA during the implementation of the Project as necessary)</p> | <p><b>The Pakistani Side</b></p> <p>1. PERSONNEL</p> <p>Administrative Personnel</p> <ul style="list-style-type: none"> <li>1) Person in Charge: Member (Planning)</li> <li>2) Project Manager: General Manager (RAMD)</li> <li>3) Member Director (Design)</li> </ul> <p>Counterpart Personnel</p> <ul style="list-style-type: none"> <li>1) Project Coordinator: Deputy Director (BMS)</li> <li>2) <b>Assistant Project Coordinator: Assistant Director (BMS)</b></li> </ul> <p>2. OFFICE &amp; FACILITIES</p> <ul style="list-style-type: none"> <li>· Office for JICA Experts in NHA's HQ Building with office furniture, internet and telephone.</li> </ul> <p>3. ARRANGEMENT</p> <ul style="list-style-type: none"> <li>· Training Arrangements</li> <li>· Transportation for the field trips of JICA Experts in/around Islamabad.</li> </ul> <p>4. BUDGET ALLOCATION</p> <p>Budget for traveling and accommodation expenses of the training participants.</p> |
|  |   | <p>· The participants for training by JICA experts (Activity 2-1) must have at least 15 years of remaining service period in NHA.</p> <ul style="list-style-type: none"> <li>· Pakistan, especially Islamabad and Lahore, is continuously safe enough for JICA Experts to implement the activities.</li> </ul> <p style="text-align: center;"></p> <p><b>&lt;Issues and countermeasures&gt;</b></p> <p>Crack Scale and Test Hammer shall be prepared for MT Training and OJT, while other non destructive test equipment and computers (Licensed Database with Server and Terminals) will be discussed after the 1st MT Training (April, 2017)</p> <p>Standard Operation Procedure (SOP) related to bridge maintenance is need to be built</p>  |

3-3. Prepare the annual bridge/culvert maintenance plan including estimated budget for 2019 based on *the data transferred to BMS* (Activity 3-2).

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|





| Activity   | 2017   |      | 2018   |      | 2019   |      | Status   |
|--|--------|------|--------|------|--------|------|--|
|  | 1st    | 2nd  | 1st    | 2nd  | 1st    | 2nd  |  |
| 1-1-2 Draft a manual for bridge repair method selection based on the findings of Activity 0-1 & 0-3.   | Actual | Plan | Actual | Plan | Actual | Plan | Done   |
| 1-1-3 Draft a manual for data input to Database developed in Activity 1-3.   | Actual | Plan | Actual | Plan | Actual | Plan | Done   |
| 1-2 Develop draft bridge/culvert inspection formats.   | Actual | Plan | Actual | Plan | Actual | Plan | Done   |
| 1-3 Develop Prototype Database & BMS.  | Actual | Plan | Actual | Plan | Actual | Plan | Done   |
| 1-3-1 Study the current IT environment of ROs and MUs including the number of PCs  | Actual | Plan | Actual | Plan | Actual | Plan | Done   |
| 1-3-2 Consider the specification of Database & BMS.  | Actual | Plan | Actual | Plan | Actual | Plan | Done   |
| 1-3-3 Develop Prototype of Bridge Inspection Database & BMS.   | Actual | Plan | Actual | Plan | Actual | Plan | Still in progress  |
| 1-4 Develop 2 types of draft training materials for training i.e. (1) bridge/culvert inspection and (2) bridge repair method selection.                                | Actual | Plan | Actual | Plan | Actual | Plan | Done   |
| 1-4-1 Develop bridge inspection training materials for MT training (basic & advance).  | Actual | Plan | Actual | Plan | Actual | Plan | Done   |
| 1-4-2 Develop bridge repair method selection manuals for MT training (basic & advanced).   | Actual | Plan | Actual | Plan | Actual | Plan | Done   |
| 1-5 Review and finalize the above 3 types of manuals, inspection formats, prototypes and 2 types of training materials.  | Actual | Plan | Actual | Plan | Actual | Plan | Done   |
| 1-5-1 Review the lessons learned from Activity 2-1, 2-2 & 2-3.   | Actual | Plan | Actual | Plan | Actual | Plan | Done   |
| 1-5-2 Revise the manuals, a format, a database and training materials referring to the   | Actual | Plan | Actual | Plan | Actual | Plan | Still in progress  |
| 1-5-3 Re-review the lessons learned from Activity 2-1, 2-2 & 2-3.  | Actual | Plan | Actual | Plan | Actual | Plan | Still in progress  |
| 1-5-4 Finalize the manuals, a format, a database and training materials referring to the lessons reviewed in Activity 1-5-3.   | Actual | Plan | Actual | Plan | Actual | Plan | Still in progress  |
| <b>Output 2: Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and bridge</b>                        |        |      |        |      |        |      |  |
| 2-1 Implement 3 types of training for capacity building of NHA i.e. (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database. | Actual | Plan | Actual | Plan | Actual | Plan | Done   |
| 2-1-1 Set up a criteria for selection of participants in MT training. Decide the participants in MT training from NHA's HQ, ROs and MUs.                               | Actual | Plan | Actual | Plan | Actual | Plan | 65 trainees selected. Selection of 2nd MTT participants. |
| 2-1-2 Decide the target bridges of MT training (about 5 bridges in/around Islamabad).  | Actual | Plan | Actual | Plan | Actual | Plan | 2+1 bridges  |
| 2-1-3 Set up a criteria for the equipment to be provided for non-destructive bridge testing.   | Actual | Plan | Actual | Plan | Actual | Plan | Still in progress  |
| 2-1-4 Prepare the contents and syllabus of MT training.  | Actual | Plan | Actual | Plan | Actual | Plan | Preparation for the 2nd MTT.                             |
| 2-1-5 Carry out a questionnaire for the participants of MT training (at beginning  | Actual | Plan | Actual | Plan | Actual | Plan | Done   |

| Participating in the training (at beginning, interim, and final stages). | Progress |  |  |  |  |  |  |  |  |  |  |  | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | 9th | 10th | 11th | 12th | 13th | 14th | 15th | 16th | 17th | 18th | 19th | 20th | 21st | 22nd | 23rd | 24th | 25th | 26th | 27th | 28th | 29th | 30th | 31st | 32nd | 33rd | 34th | 35th | 36th | 37th | 38th | 39th | 40th | 41st | 42nd | 43rd | 44th | 45th | 46th | 47th | 48th | 49th | 50th | 51st | 52nd | 53rd | 54th | 55th | 56th | 57th | 58th | 59th | 60th | 61st | 62nd | 63rd | 64th | 65th | 66th | 67th | 68th | 69th | 70th | 71st | 72nd | 73rd | 74th | 75th | 76th | 77th | 78th | 79th | 80th | 81st | 82nd | 83rd | 84th | 85th | 86th | 87th | 88th | 89th | 90th | 91st | 92nd | 93rd | 94th | 95th | 96th | 97th | 98th | 99th | 100th | 101st | 102nd | 103rd | 104th | 105th | 106th | 107th | 108th | 109th | 110th | 111st | 112nd | 113rd | 114th | 115th | 116th | 117th | 118th | 119th | 120th | 121st | 122nd | 123rd | 124th | 125th | 126th | 127th | 128th | 129th | 130th | 131st | 132nd | 133rd | 134th | 135th | 136th | 137th | 138th | 139th | 140th | 141st | 142nd | 143rd | 144th | 145th | 146th | 147th | 148th | 149th | 150th | 151st | 152nd | 153rd | 154th | 155th | 156th | 157th | 158th | 159th | 160th | 161st | 162nd | 163rd | 164th | 165th | 166th | 167th | 168th | 169th | 170th | 171st | 172nd | 173rd | 174th | 175th | 176th | 177th | 178th | 179th | 180th | 181st | 182nd | 183rd | 184th | 185th | 186th | 187th | 188th | 189th | 190th | 191st | 192nd | 193rd | 194th | 195th | 196th | 197th | 198th | 199th | 200th | 201st | 202nd | 203rd | 204th | 205th | 206th | 207th | 208th | 209th | 210th | 211st | 212nd | 213rd | 214th | 215th | 216th | 217th | 218th | 219th | 220th | 221st | 222nd | 223rd | 224th | 225th | 226th | 227th | 228th | 229th | 230th | 231st | 232nd | 233rd | 234th | 235th | 236th | 237th | 238th | 239th | 240th | 241st | 242nd | 243rd | 244th | 245th | 246th | 247th | 248th | 249th | 250th | 251st | 252nd | 253rd | 254th | 255th | 256th | 257th | 258th | 259th | 260th | 261st | 262nd | 263rd | 264th | 265th | 266th | 267th | 268th | 269th | 270th | 271st | 272nd | 273rd | 274th | 275th | 276th | 277th | 278th | 279th | 280th | 281st | 282nd | 283rd | 284th | 285th | 286th | 287th | 288th | 289th | 290th | 291st | 292nd | 293rd | 294th | 295th | 296th | 297th | 298th | 299th | 300th | 301st | 302nd | 303rd | 304th | 305th | 306th | 307th | 308th | 309th | 310th | 311st | 312nd | 313rd | 314th | 315th | 316th | 317th | 318th | 319th | 320th | 321st | 322nd | 323rd | 324th | 325th | 326th | 327th | 328th | 329th | 330th | 331st | 332nd | 333rd | 334th | 335th | 336th | 337th | 338th | 339th | 340th | 341st | 342nd | 343rd | 344th | 345th | 346th | 347th | 348th | 349th | 350th | 351st | 352nd | 353rd | 354th | 355th | 356th | 357th | 358th | 359th | 360th | 361st | 362nd | 363rd | 364th | 365th | 366th | 367th | 368th | 369th | 370th | 371st | 372nd | 373rd | 374th | 375th | 376th | 377th | 378th | 379th | 380th | 381st | 382nd | 383rd | 384th | 385th | 386th | 387th | 388th | 389th | 390th | 391st | 392nd | 393rd | 394th | 395th | 396th | 397th | 398th | 399th | 400th | 401st | 402nd | 403rd | 404th | 405th | 406th | 407th | 408th | 409th | 410th | 411st | 412nd | 413rd | 414th | 415th | 416th | 417th | 418th | 419th | 420th | 421st | 422nd | 423rd | 424th | 425th | 426th | 427th | 428th | 429th | 430th | 431st | 432nd | 433rd | 434th | 435th | 436th | 437th | 438th | 439th | 440th | 441st | 442nd | 443rd | 444th | 445th | 446th | 447th | 448th | 449th | 450th | 451st | 452nd | 453rd | 454th | 455th | 456th | 457th | 458th | 459th | 460th | 461st | 462nd | 463rd | 464th | 465th | 466th | 467th | 468th | 469th | 470th | 471st | 472nd | 473rd | 474th | 475th | 476th | 477th | 478th | 479th | 480th | 481st | 482nd | 483rd | 484th | 485th | 486th | 487th | 488th | 489th | 490th | 491st | 492nd | 493rd | 494th | 495th | 496th | 497th | 498th | 499th | 500th | 501st | 502nd | 503rd | 504th | 505th | 506th | 507th | 508th | 509th | 510th | 511st | 512nd | 513rd | 514th | 515th | 516th | 517th | 518th | 519th | 520th | 521st | 522nd | 523rd | 524th | 525th | 526th | 527th | 528th | 529th | 530th | 531st | 532nd | 533rd | 534th | 535th | 536th | 537th | 538th | 539th | 540th | 541st | 542nd | 543rd | 544th | 545th | 546th | 547th | 548th | 549th | 550th | 551st | 552nd | 553rd | 554th | 555th | 556th | 557th | 558th | 559th | 560th | 561st | 562nd | 563rd | 564th | 565th | 566th | 567th | 568th | 569th | 570th | 571st | 572nd | 573rd | 574th | 575th | 576th | 577th | 578th | 579th | 580th | 581st | 582nd | 583rd | 584th | 585th | 586th | 587th | 588th | 589th | 590th | 591st | 592nd | 593rd | 594th | 595th | 596th | 597th | 598th | 599th | 600th | 601st | 602nd | 603rd | 604th | 605th | 606th | 607th | 608th | 609th | 610th | 611st | 612nd | 613rd | 614th | 615th | 616th | 617th | 618th | 619th | 620th | 621st | 622nd | 623rd | 624th | 625th | 626th | 627th | 628th | 629th | 630th | 631st | 632nd | 633rd | 634th | 635th | 636th | 637th | 638th | 639th | 640th | 641st | 642nd | 643rd | 644th | 645th | 646th | 647th | 648th | 649th | 650th | 651st | 652nd | 653rd | 654th | 655th | 656th | 657th | 658th | 659th | 660th | 661st | 662nd | 663rd | 664th | 665th | 666th | 667th | 668th | 669th | 670th | 671st | 672nd | 673rd | 674th | 675th | 676th | 677th | 678th | 679th | 680th | 681st | 682nd | 683rd | 684th | 685th | 686th | 687th | 688th | 689th | 690th | 691st | 692nd | 693rd | 694th | 695th | 696th | 697th | 698th | 699th | 700th | 701st | 702nd | 703rd | 704th | 705th | 706th | 707th | 708th | 709th | 710th | 711st | 712nd | 713rd | 714th | 715th | 716th | 717th | 718th | 719th | 720th | 721st | 722nd | 723rd | 724th | 725th | 726th | 727th | 728th | 729th | 730th | 731st | 732nd | 733rd | 734th | 735th | 736th | 737th | 738th | 739th | 740th | 741st | 742nd | 743rd | 744th | 745th | 746th | 747th | 748th | 749th | 750th | 751st | 752nd | 753rd | 754th | 755th | 756th | 757th | 758th | 759th | 760th | 761st | 762nd | 763rd | 764th | 765th | 766th | 767th | 768th | 769th | 770th | 771st | 772nd | 773rd | 774th | 775th | 776th | 777th | 778th | 779th | 780th | 781st | 782nd | 783rd | 784th | 785th | 786th | 787th | 788th | 789th | 790th | 791st | 792nd | 793rd | 794th | 795th | 796th | 797th | 798th | 799th | 800th | 801st | 802nd | 803rd | 804th | 805th | 806th | 807th | 808th | 809th | 810th | 811st | 812nd | 813rd | 814th | 815th | 816th | 817th | 818th | 819th | 820th | 821st | 822nd | 823rd | 824th | 825th | 826th | 827th | 828th | 829th | 830th | 831st | 832nd | 833rd | 834th | 835th | 836th | 837th | 838th | 839th | 840th | 841st | 842nd | 843rd | 844th | 845th | 846th | 847th | 848th | 849th | 850th | 851st | 852nd | 853rd | 854th | 855th | 856th | 857th | 858th | 859th | 860th | 861st | 862nd | 863rd | 864th | 865th | 866th | 867th | 868th | 869th | 870th | 871st | 872nd | 873rd | 874th | 875th | 876th | 877th | 878th | 879th | 880th | 881st | 882nd | 883rd | 884th | 885th | 886th | 887th | 888th | 889th | 890th | 891st | 892nd | 893rd | 894th | 895th | 896th | 897th | 898th | 899th | 900th | 901st | 902nd | 903rd | 904th | 905th | 906th | 907th | 908th | 909th | 910th | 911st | 912nd | 913rd | 914th | 915th | 916th | 917th | 918th | 919th | 920th | 921st | 922nd | 923rd | 924th | 925th | 926th | 927th | 928th | 929th | 930th | 931st | 932nd | 933rd | 934th | 935th | 936th | 937th | 938th | 939th | 940th | 941st | 942nd | 943rd | 944th | 945th | 946th | 947th | 948th | 949th | 950th | 951st | 952nd |
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| 3-2 Monitor bridge data input by NHA staff (Activity 2-3) to Database, and data transfer to BMS by HQ RAMD staff.                               |        | 2nd    |        | 1st |     | 3rd Year |    | 4th Year |    | Remarks | Issue | Solution |
|---|--------|--------|--------|-----|-----|----------|----|----------|----|---------|-------|----------|
|   |        | 2nd    | 1st    | 2nd | 1st | I        | II | III      | IV |         |       |          |
| 3-2-1 Trial of transferring the sample data from a bridge inspection database input by the staff of MUs to the BMS.                             | Plan   |        |        |     |     |          |    |          |    |         |       |          |
|   | Actual |        |        |     |     |          |    |          |    |         |       |          |
| 3-2-2 Transfer all the data from a bridge inspection database input by the staff of MUs to the BMS.   | Plan   |        |        |     |     |          |    |          |    |         |       |          |
|   | Actual |        |        |     |     |          |    |          |    |         |       |          |
| 3-3 Prepare the annual bridge/culvert maintenance plan including estimated budget for 2019 based on the data transferred to BMS (Activity 3-2). | Plan   |        |        |     |     |          |    |          |    |         |       |          |
|   | Actual |        |        |     |     |          |    |          |    |         |       |          |
| Duration / Phasing  |        | Plan   | Actual |     |     |          |    |          |    |         |       |          |
| Monitoring Plan   |        | Year   |        |     |     |          |    |          |    |         |       |          |
| Monitoring  |        |        |        |     |     |          |    |          |    |         |       |          |
| Joint Coordination Committee  |        | Plan   |        |     |     |          |    |          |    |         |       |          |
| Set-up the Detailed Plan of Operation   |        | Actual |        |     |     |          |    |          |    |         |       |          |
| Submission of Monitoring Sheet  |        | Plan   |        |     |     |          |    |          |    |         |       |          |
| Monitoring Mission from Japan   |        | Actual |        |     |     |          |    |          |    |         |       |          |
| Joint Monitoring  |        | Plan   |        |     |     |          |    |          |    |         |       |          |
| Post Monitoring   |        | Actual |        |     |     |          |    |          |    |         |       |          |
| Reports/Documents   |        | Plan   |        |     |     |          |    |          |    |         |       |          |
| Project Completion Report   |        | Actual |        |     |     |          |    |          |    |         |       |          |
| Public Relations  |        | Plan   |        |     |     |          |    |          |    |         |       |          |
|   |        | Actual |        |     |     |          |    |          |    |         |       |          |

The project for technical assistance  
on implementation of  
Bridge Management System in NHA

# JCC-3

## Joint Coordination Committee

July 12<sup>th</sup> 2017

At

Auditorium NHA HQ Islamabad



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## Agenda

### 0. Introduction

1. Progress of the Project in the past 6 months
2. Prospective Progress in the coming 6 months
3. Delay Risks and/or Problems and/or Solutions
4. Modification of the Project Implementation Plan
5. Others

# Agenda

0. Introduction

1. Progress of the Project in the past 6 months

2. Prospective Progress in the coming 6 months

3. Delay Risks and/or Problems and/or Solutions

4. Modification of the Project Implementation Plan

5. Others



## The Project for Technical Assistance on Implementation of Bridge Management System in NHA

### Project Monitoring Report



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T H E F U T U R E

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2. Progress of Activities
3. Achievement of Output
4. Achievement of the Project Purpose
5. Changes of Risks and Actions for Mitigation

PRODUCING  
THE FUTURE  
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THE FUTURE

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## 1. Progress of Inputs

### a) Experts

Experts for Training were input as planned.

Expert for BMS was input less than planned because of the new BMS.

### b) Counterpart

1) Project Coordinator (Deputy Director (BMS)) was input

2) Assistant Project Coordinator (Assistant Director (BMS)) has hardly been input since the Project started.

### c) Equipment

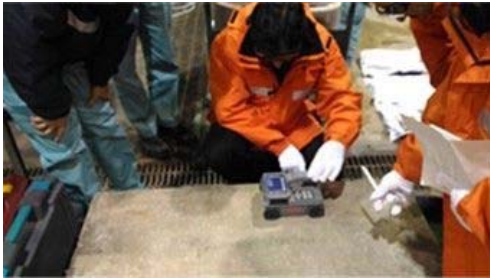
100 sets of Crack Scale, Test Hammer and Helmets from JICA

Safety vests for the 1<sup>st</sup> Master Trainers Training were provided by HRTC.

# 1. Progress of Inputs

## d) Training in Japan

- Duration: January 15<sup>th</sup> to 27<sup>th</sup>, 2017.
- Participants: Mr. Aftab Ullah Babar & Mr. Muhammad Asif Azam



• Steel bar detection machine



Lift car for bridge inspection

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# 1. Progress of Inputs

## Questionnaires after Training in Japan

### <About Finding and Learning In Japan>

- (Mr. Babar) The knowledge adopted will be shared within organization through lectures and discussions. The main obstacle is financial constraint and inadequate capacity of local engineers.
- (Mr. Asif) Japan is a technologically advanced country. The capacity of engineers, organizational strengths and financial situation in Japan is much better than Pakistan. The expertise of Japanese organizations in infrastructure development and management is second to none. The BMS in Japan can be adopted for Pakistan with customized and selective approach.

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# 1. Progress of Inputs

## e) In-Country Training

Subject: the 1st Master Trainers' Training

Venue: Highway Research and Training Center (HRTC) Burhan

**Attendees: Total**                      **65 trainees**

- 1st batch (Feb 27 - Mar 3)            16 trainees
- 2nd batch (Mar 6 - Mar 10)        20 trainees
- 3rd batch (Mar 13 - Mar 17)       29 trainees

### **Materials:**

- Bridge Inspection Manual (1st Edition)
- Bridge Repair Manual (1st Edition)
- Handout (printout of PowerPoint slides)
- Stationery (a set of bag, file, notebook and 3 color erasable ballpoint pen)
- Bridge/Culvert Inspection Sheet (Excel file)

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# 1. Progress of Inputs



**Lecture**



**Field Study**



**Examination**



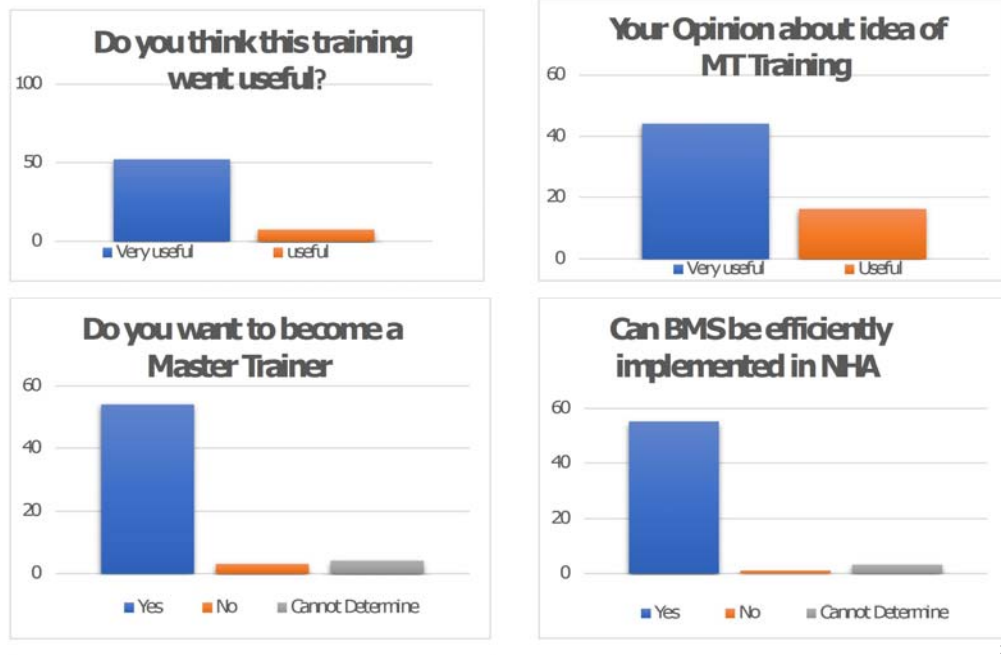
**Certification**

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# 1. Progress of Inputs

Questionnaire- 2 (After Master Trainer Training)



# 2. Progress of Activities

**Activity 1-1. Develop 3 types of draft manuals i.e. (1) bridge/culvert inspection, (2) bridge repair method selection and (3) data input to Database.**

- (1) and (2) were completed on schedule.
- (3) will be drafted along with Activity 1-3

**Activity 1-2. Develop draft bridge/culvert inspection formats.**

- Activity was completed on schedule.

**Activity 1-3. Develop prototype Database & BMS.**

- Bridge Inspection Database Prototype will be developed in July 2017 as version 1.0. from July to November 2017,

**Activity 1-4. Develop 2 types of draft training materials for training i.e. (1) bridge/culvert inspection and (2) bridge repair method selection.**

- Activity 1-4 was completed in time for the 1<sup>st</sup> MTT.

## 2. Progress of Activities

### **Activity 2-1. Implement 3 types of master trainer's training for the staff of NHA's HQ and ROs at the target**

- The 1<sup>st</sup> MTT was held at HRTC.
- It was decided that (Certified) Master Trainers would be selected based both on the in-house examination at the end of MTT and on-site bridge inspection sheets after MTT which each candidate would inspect, fill out and submit by him/herself in his/her jurisdiction.
- Each candidate was requested to submit 10 sets of bridge inspection sheets if he/she belongs to MU or 3 sets if not by May 19<sup>th</sup>.
- Only 7 candidates submitted 26 sets of bridge inspection sheets by May 19<sup>th</sup>.
- Due date was postponed to June 16<sup>th</sup>, but totally 17 candidates submitted 58 sets.

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## 2. Progress of Activities

### **Activity 2-2. Implement 3 types of OJT for the field staff by Master Trainers**

- It was decided in JWG Meeting dated May 19<sup>th</sup>, 2017 that based on the results of examination and inspection reports, 20-25 candidates will be shortlisted by JICA Experts and afterwards 10 - 15 candidates will be finalized as Certified Master Trainer jointly by JICA Experts & NHA
- Master Trainers have not been selected. Because totally 17 candidates submitted inspection reports.
- OJT has not been carried out.
- No field staff has been trained.
- Significant delay occurs.

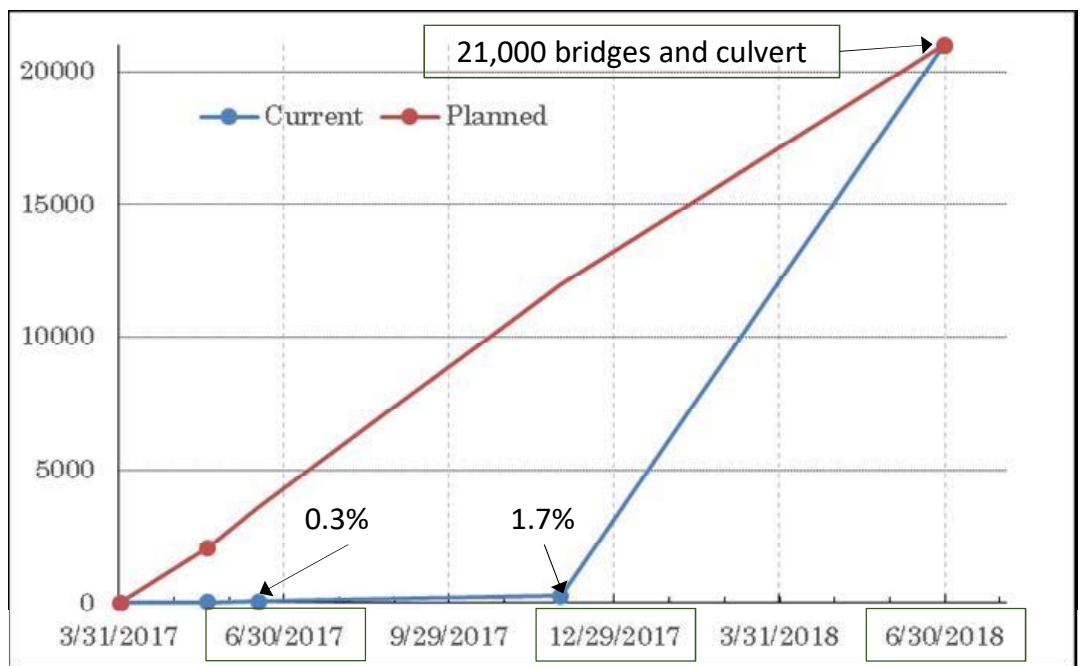
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### 3. Achievement of Output

- Bridge Inspection Manual and Bridge Repair Manual were drafted.
- Draft bridge/culvert inspection formats were developed.
- Master Trainers’ training for (1) bridge/culvert inspection and (2) bridge repair method selection implemented on schedule.
- Implementation of training by Master Trainers (Certified Master Trainers) to all field staff was not carried out.
- Only 58 bridges/culverts were inspected by 17 candidates while more than 5000 bridges and 16000 culverts (total 21000) will be inspected by June, 2018.
- Current progress percentage is less than 0.3%.
- 100 bridges and 200 culverts will be inspected by November, 2017(Refer to Minutes of JWG Meeting dated May 19th, 2017). The progress of November will be 1.70%.

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### 3. Achievement of Output



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## 4. Achievement of the Project Purpose

### **Project Purpose:**

Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of **entire** NHA network.

### **Means of Verification:**

Analysis of **complete input data** to BMS and bridge maintenance budget document (with anticipated budget requirement for forthcoming years).

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## 5. Changes of Risks and Actions for Mitigation

### **(1) Training Target**

- According to NHA's request for basic education of bridge maintenance, there were 65 participants of the 1<sup>st</sup> MTT from HQ, RO, MU and Project Office.
- Roles and responsibility (SOP) related to bridge maintenance is required to be built in order to clarify the training target.

### **(2) OJT for MU**

- Most of the 1<sup>st</sup> MTT participants seem not to have any time to share bridge inspection and OJT.
- It is necessary for Inspectors to have some training for bridge inspection.

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## Problems in Data Collection

- *Insufficient human resources in MUs.*
- *Insufficient rewards for MTs and Inspectors for bridge.*
- *Shortage of C/P personnel in JWG (Assistant Project Coordinator)*
- *Characteristic differences from Pavement Maintenance System (PMS) and BMS (Bridge Management System).*
- *Ex-bridge inventory was not fully utilized.*

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## Target Bridges (and Culverts)

- *The concept of a model area instead of entire NHA network.*
- *The model area may contain at least 100 bridges and 200 culverts in order to try Prototype BIDB and to check Prototype BMS functions.*
- *Its location may be rather close to Islamabad with consideration of Experts' accessibility.*
- *The details to be discussed and decided in JWG level after JCC.*

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## Framework

- *3 to 5 engineers' engagement in the Project.*
  - 1) Inspection of 100 bridges + 200 culverts for validation.
  - 2) Participate in 2nd MTT to give lectures
  - 3) Implement training for field inspectors of MUs
  
- *Bridge Maintenance Unit (BMU) in HQ.*

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## Who will fill the forms?

- *MUs or Outsource (Local Consultants).*
  - Partially or entirely?
  - One-time or Permanently?
  
- *Budgetary issues.*
  
- *Time frame with sustainability.*
  - One-time or Permanently?

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## DECISIONS SOLICITED

- Collection of inspection data of 100 bridges and 200 culverts before December 2017 for validation of BMS prototype software
- Procedure for inspection and collection of data for all bridges/culverts on NHA Network before June 2018 (by NHA Engineers or outsourcing)
- Non Destructive Testing Equipment for inspection of bridges
- Establishment of Bridge Management Unit in RAMS NHA
- Scholarship / Training program for NHA engineers in Bridge Asset Management in Japan
- Approval of Certified Master Trainers based on results of 1<sup>st</sup> MTT
- Arrangement of 2<sup>nd</sup> MTT for new candidates in December 2017
- Training of CMTs in Japan in April 2018

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## Agenda

### 0. Introduction

1. Progress of the Project in the past 6 months

2. Prospective Progress in the coming 6 months

3. Delay Risks and/or Problems and/or Solutions

4. Modification of the Project Implementation Plan

5. Others



## Project Design Matrix (1)

| Narrative Summary   | Objectively Verifiable Indicators  | Means of Verification   | Important Assumptions   |
|---|--|---|---|
| <p><u>Overall Goal</u><br/>Bridge maintenance status improved on the bridges of National Highways in Pakistan.</p>  | Based on the bridge data, the number of bridge structures in the worst condition has decreased by one-third in <b>[January, 2022]</b> from the start of the Project. | Output data of the BMS  | <ul style="list-style-type: none"> <li>• Copyright of software (source code)</li> <li>• Availability of optimum maintenance budget.</li> <li>• Continuous update of bridge data</li> </ul>                        |
| <p><u>Project Purpose</u><br/>Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of <b>entire</b> NHA network.</p> | Bridge maintenance budget document with breakdowns prepared in <b>[September, 2018]</b> .  | Analysis of <b>complete</b> input data to BMS and bridge maintenance budget document (with anticipated budget requirement for forthcoming years). | <ul style="list-style-type: none"> <li>• NHA's road maintenance budget does not decrease from the start of the Project.</li> <li>• Natural disasters with the risk of damages on bridges do not occur.</li> </ul> |

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## Project Design Matrix (2)

| Narrative Summary  | Objectively Verifiable Indicators   | Means of Verification   | Important Assumptions   |
|--|---|---|---|
| <p><u>Outputs</u><br/>1. Manuals, Database and BMS developed for bridge inspection and bridge repair method selection.</p> | <p>1-1. Draft manuals for (1) bridge/culvert inspection, (2) bridge repair method selection) by <b>[December, 2016]</b> and draft manual for (3) data input to Database &amp; BMS developed by <b>[December, 2017]</b>.</p> <p>1-2. Draft bridge/culvert inspection formats developed by <b>[December, 2016]</b>.</p> <p>1-3. Prototype Database developed by <b>[July, 2017]</b>, and prototype BMS by <b>[December, 2017]</b>.</p> <p>1-4. 2 types of draft training materials for the master trainers for (1) bridge/culvert inspection and (2) bridge repair method selection developed by <b>[December, 2016]</b>.</p> <p>1-5. Manuals (1-1), formats (1-2), Database &amp; BMS (1-3), and training materials (1-4) finalized by <b>[September, 2018]</b>.</p> | <p>1-1. 3 types of draft manuals</p> <p>1-2. Draft bridge/culvert inspection formats</p> <p>1-3. Prototype Database &amp; BMS</p> <p>1-4. 2 types of draft training materials</p> <p>1-5. 3 types of manuals, a bridge/culvert inspection formats, Database &amp; BMS and 2 types of training materials</p> | <ul style="list-style-type: none"> <li>• BMS is continuously in use by NHA for preparation of bridge maintenance plan.</li> </ul> |

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## Project Design Matrix (3)

| Narrative Summary  | Objectively Verifiable Indicators   | Means of Verification   | Important Assumptions |
|--|---|---|-----------------------|
| <p><u>Outputs</u></p> <p>2. Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and bridge repair method selection of uniformed contents implemented on <b>all</b> the bridges of National Highways in Pakistan.</p> | <p>2-1. 3 Master Trainers' training for (1) bridge/culvert inspection, (2) bridge repair method selection implemented by <b>[March, 2017]</b>, and (3) data input to Database implemented by <b>[September, 2018]</b>.</p> <p>2-2. 3 types of training (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database) <b>implemented by Master Trainers (trained in Activity 2-1) at all field staff</b> by <b>[November, 2017]</b>.</p> <p>2-3. Bridge/culvert inspection, bridge repair method selection, and data input to Database completed for <b>all</b> NHA bridges by <b>[June, 2018]</b>.</p> <p>2-4. <b>90% or more</b> results of bridge repair method selection and data input to Database by the field staff evaluated to be accurate by NHA's HO &amp; JICA Experts by <b>[October, 2018]</b>.</p> <p>2-5. <b>Certification of Master Trainers after training by JICA Experts (scoring more than 80% in capacity test).</b></p> | <p>2-1. Training records and reports</p> <p>2-2. Training records and reports</p> <p>2-3. Completed bridge inspection formats and input data to Database</p> <p>2-4. Input data to Database and its evaluation</p> <p>2-5. Test records and reports</p> |                       |

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## Project Design Matrix (4)

| Narrative Summary   | Objectively Verifiable Indicators  | Means of Verification   | Important Assumptions |
|---|--|---|-----------------------|
| <p><u>Outputs</u></p> <p>3. Data on <b>all</b> the bridges of National Highways in Pakistan input by MUs to Database available to NHA's HQ and ROs.</p> | <p>3-1. Training for management of BMS implemented by <b>[December, 2017]</b>.</p> <p>3-2. Data on <b>all</b> the bridges of National Highways in Pakistan input to Database by <b>[October, 2018]</b>.</p> <p>3-3. Cost estimate necessary for bridge maintenance in the fiscal year of <b>2019</b> based on BMS.</p> | <p>3-1. Training records and report</p> <p>3-2. Input data to Database</p> <p>3-3. Bridge maintenance budget document with breakdowns</p> |                       |

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## Project Design Matrix (5)

| Activities  | Input   |   | Important Assumptions   |
|---|---|---|---|
|   | Japanese side   | Pakistani side  |   |
| <p>1-1. Develop 3 types of draft manuals i.e. (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database.</p> <p>1-2. Develop draft bridge/culvert inspection formats.</p> <p>1-3. Develop prototype of Database and.</p> <p>1-4. Develop 2 types of draft training materials i.e. (1) bridge/culvert inspection and (2) bridge repair method selection.</p> <p>1-5. Review and finalize the above 3 types of manuals (Activity 1-1), inspection formats (Activity 1-2), prototypes (Activity 1-3) and 2 types of training materials (Activity 1-4).</p> | <p>1. EXPERTS</p> <p>1) Bridge Inspection Expert<br/>2) Bridge Repair Expert<br/>3) BMS Expert<br/>4) Capacity Development Expert<br/>5) Project Monitoring<br/>6) Local Coordinator (Pakistani)</p> <p>2. EQUIPMENT</p> <p>Non-destructive testing equipment such as</p> <ul style="list-style-type: none"> <li>· Ground Penetrating Radar</li> <li>· Electrochemical Polarization Corrosion Measurement</li> <li>· Measurement by Sonic Testing</li> <li>· Schmidt Hammer</li> <li>· Carbonation Depth Measurement Kit</li> <li>· Crack Scale</li> <li>· Test Hammer</li> <li>· Licensed Database with Server and Terminals</li> </ul> <p>(Numbers and specifications will be determined through mutual consultations between JICA and NHA during the implementation of the Project as necessary)</p> | <p>1. PERSONNEL</p> <p>Administrative Personnel</p> <p>1) Person in Charge: Member (Planning)</p> <p>2) Project Manager: General Manager (RAMD)</p> <p>3) Member: Director (Design)</p> <p>Counterpart Personnel</p> <p>1) Project Coordinator: Deputy Director (BMS)</p> <p>2) <b>Assistant Project Coordinator: Assistant Director (BMS)</b></p> <p>2. OFFICE &amp; FACILITIES</p> <ul style="list-style-type: none"> <li>· Office for JICA Experts in NHA's HQ Building with office furniture, internet and telephone.</li> </ul> <p>3. ARRANGEMENT</p> <ul style="list-style-type: none"> <li>· Training Arrangements.</li> <li>· Transportation for the field trips of JICA Experts in/around Islamabad.</li> </ul> <p>4. BUDGET ALLOCATION</p> <p>Budget for traveling and accommodation expenses of the training participants.</p> | <p>The participants for training by JICA Experts (Activity 2-1) must have at least 15 years of remaining service period in NHA.</p> <div style="border: 1px solid black; background-color: #0056b3; color: white; padding: 5px; text-align: center; margin: 10px 0;"><b>Preconditions</b></div> <p>Pakistan, especially Islamabad and Lahore, is continuously safe enough for JICA Experts to implement the activities.</p> |

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## Project Design Matrix (6)

| Activities  | Input         |                | Important Assumptions |
|---|---------------|----------------|-----------------------|
|   | Japanese side | Pakistani side |                       |
| <p>2-1. Implement 3 types of master trainer's training for the staff of NHA's HQ and ROs at the target bridges (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database).</p> <p>2-2. <b>Implement 3 types of OJT for the field staff by Master Trainers (trained in Activity 2-1), (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database.</b></p> <p>2-3. Implement (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database for <b>all the bridges/culverts, by field staff (trained in Activity 2-1 &amp; 2-2).</b></p> <p>3-1. Implement training for NHA HQ regarding management of BMS (software and database).</p> <p>3-2. Monitor bridge data input by NHA staff (Activity 2-3) to Database, and <b>data transfer to BMS</b> by HQ RAMD (Road Asset Management Division) Staff..</p> <p>3-3. Prepare the annual bridge/culvert maintenance plan including estimated budget for 2019 based on <b>the data transferred to BMS</b> ( Activity 3-2).</p> |               |                |                       |

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# Agenda

0. Introduction

1. Progress of the Project in the past 6 months

2. Prospective Progress in the coming 6 months

3. Delay Risks and/or Problems and/or Solutions

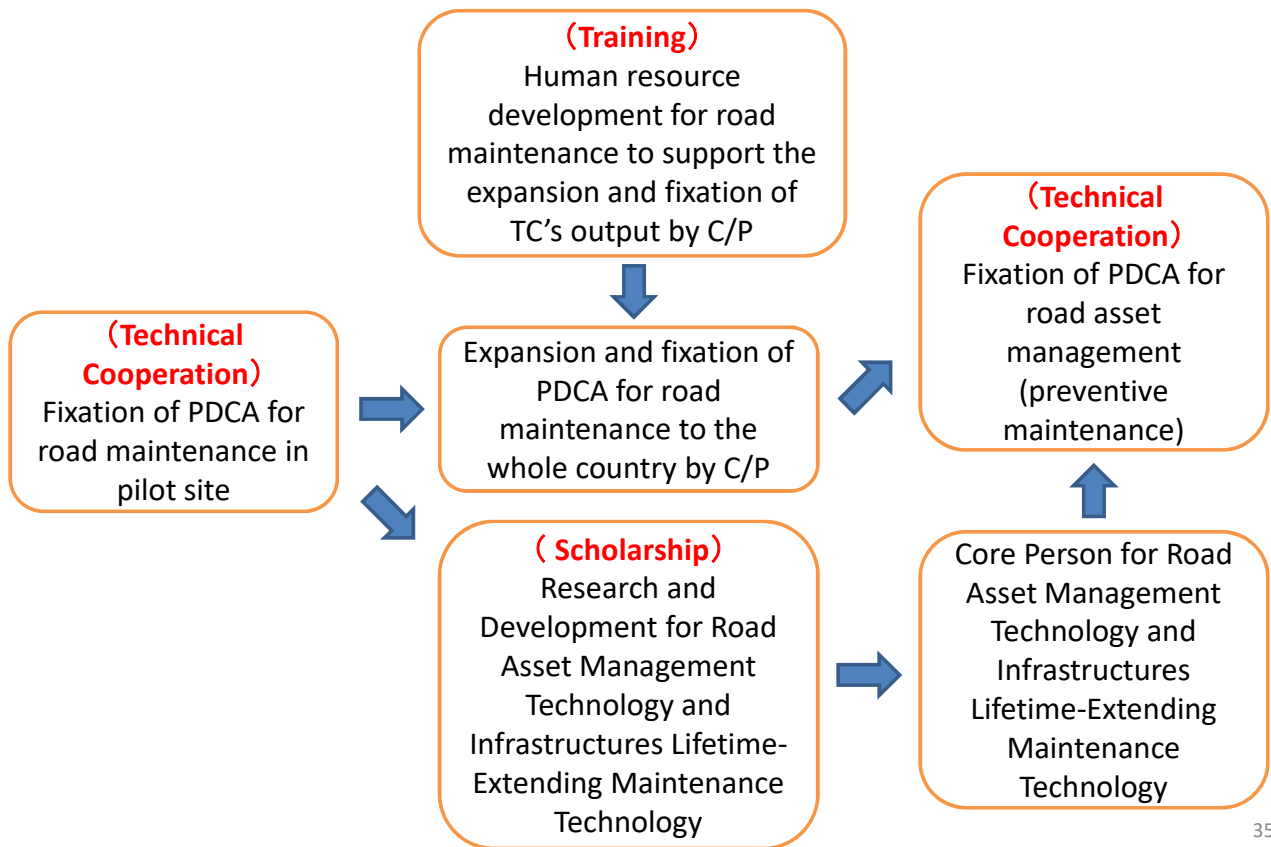
4. Modification of the Project Implementation Plan

5. Others

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## 4. JICA's Strategic Plan for Road Asset Management



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## 4. JICA's Strategic Plan for Road Asset Management

Collaboration with **Hokkaido Univ. & Institute of Industrial Science, Univ. of Tokyo**, conducting comprehensive research on development of road infrastructure management cycle and its application in Japan and abroad under Japanese national project "SIP"

- Research and Development for Road Asset Management Technology  
(Customization considering regional situations etc.)
- Training for Road Asset Management

Collaboration with **Infrastructures Lifetime-Extending Maintenance Research Center, Nagasaki Univ.**, conducting Human Resource Development "Michi-Mori (Road Maintenance Engineer)" project with Nagasaki Pref., Japanese local government

- Research and Development for Infrastructures Lifetime-Extending Maintenance Technology (Inspection and Repair Work etc.)
- Training for Road/Bridge Maintenance

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## 5. Human Resource Development for Road Asset Management Technology

New Activities for JFY 2017 (tentative plan)

### ▪ Scholarship Program

| Research Field  | Road Asset Management Technology  | Infrastructures Lifetime-Extending Maintenance Technology |
|-----------------|---|---|
| Acceptance      | Univ. of Tokyo / Hokkaido Univ. / Nagasaki Univ.  |   |
| Program         | Master's course / Doctoral course   |   |
| Country         | Cambodia / Lao PDR / <del>Vietnam</del> (Trial Case)  |   |
| Commencing Time | October, 2017 (or April, 2018)  |   |
| Number          | 1~2 persons / Univ.   |   |
| Target Person   | C/P of TC or High Level Political Officer for Road Policy or High Level Engineer for Road Maintenance |   |

### ▪ Training Program

Country Focused Training for Road Asset Management Technology in Vietnam to support the expansion and fixation of TC's output by C/P after TC in cooperation with Japanese SIP project (Trial Case).

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## 5. Human Resource Development for Road Asset Management Technology

Future Plan after JFY 2017

|                                 | JFY 2017   | After JFY 2017  |
|---------------------------------|--|---|
| Scholarship Program             | Cambodia, Laos, <del>Vietnam</del> (=JFY2018)  | Cambodia, Laos, Vietnam + <u>Philippines, Bangladesh, Pakistan, Ethiopia, Egypt, Mongol (under consideration)</u> |
| Country Focused Training        | Vietnam (Trial Case)   | Depending on a request for Individual Training Project  |
| Group & Region Focused Training | New Training course " Road Asset Management Technology" will be considered from JFY 2019 |   |
| Acceptance                      | Univ. of Tokyo, Hokkaido Univ., Nagasaki Univ.   | Univ. of Tokyo, Hokkaido Univ., Nagasaki Univ. + <u>Kyoto Univ., Osaka Univ. (under consideration)</u>            |

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## 5. Human Resource Development for Road Asset Management Technology

### Application Process for October, 2017 Entrance

|                             | Contents  |                                       |
|-----------------------------|---|---------------------------------------|
| End of March                | Information of Candidate (CV, Research Content, English Proficiency documents (TOEFL, TOEIC or IELTS) etc.) | Project Team => JICA HQ => Each Univ. |
| ~ Mid. of April             | Pre-Selection   | Each Professor                        |
| Mid. of April               | 【Univ. of Tokyo】 Submission of Draft Application Form (PDF)   | Professor, Univ. of Tokyo             |
| Mid. of April ~             | Consultation (Pre-Interview) by Skype, etc.   | Each Professor Candidate              |
| End of April                | 【Univ. of Tokyo】 Submission of Original Application Form (Announcement of Success after submission)         | Univ. of Tokyo                        |
| End of May                  | 【Hokkaido Univ.】 Deadline of Submission of Application Form   | Hokkaido Univ.                        |
| End of May to First of June | 【Nagasaki Univ.】 Submission of Application Form (October 2016 Entrance: 30 May to 3 June)                   | Nagasaki Univ.                        |

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## 5. Human Resource Development for Road Asset Management Technology

### Application Process for October, 2017 Entrance

|                       | Contents  |                        |
|-----------------------|---|------------------------|
| End of June           | 【Nagasaki Univ.】 Official Selection Process: Interview and oral examination (October 2016 Entrance: 23 June to 30 June) | Nagasaki Univ.         |
| End of June           | Submission of Draft A2A3 form (JICA training form)  | JICA office => JICA HA |
| End of July           | 【Nagasaki Univ.】 Announcement of Success (October 2016 Entrance: 22 July)   | Nagasaki Univ.         |
| End of July           | 【Hokkaido Univ.】 Announcement of Success (October 2016 Entrance: 29 July)   | Hokkaido Univ.         |
| End of July           | 【After Announcement of Success】 Submission of A2A3 form (JICA training form)  | JICA office => JICA HA |
| End of July to August | Arrangement and Preparation for Entrance and Accommodations, etc.   | Each Univ. Candidate   |
| September             | Briefing for living in Japan at JICA overseas office  | Candidate              |
| First of October      | Start a Research and Development at Univ.   | Candidate              |

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# Brochure

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- Implementation of BMS in Pakistan
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  - ii. JBEC
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  - iv. Training at HRTC
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- Project Schedule
- Our Commitment

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## A project for Technical Assistance on implementation of Bridge Management System in NHA



Japan International Cooperation Agency



National Highway Authority

### JICA in Pakistan

Japan started Official Development Assistance (ODA) to Pakistan in 1954 by providing technical training in line with Colombo Plan, while the first Japanese ODA was extended in 1961 and grant aid was extended in 1970. Since its beginning in 1970, the accumulated amount of grant aid to Pakistan sums up to 173 billion Yen by year 2015. Japan has supported development of infrastructure in Pakistan through Japanese ODA Loans in areas of transportation and energy. This project is also a technical cooperation project which is expected to serve as a milestone in area of Bridge Management in Pakistan.

Technical Cooperation concentrates on capacity development. Japanese specialists are dispatched to Pakistan for the exchange of Japanese information and experience to individuals of Pakistan. This training is conducted for Government officials of Pakistan. Technical Cooperation ventures are outlined so as to empower individuals to end up becoming self-reliant and solving the problems they encounter, by themselves.

### Background

Pakistan has an existing road network of about 263,000km, accounting for 92% passenger traffic and 94% freight traffic. Almost 80% of the road users rely on national highways. NHA is responsible for the management, operation and maintenance of 12,131km which is 4.6% of the total road network of Pakistan. So, in addition to road and pavement maintenance, bridge and culvert maintenance is also important which is not yet standardized under a formal plan despite the high risk of damage caused by increased traffic volume, over-loading, poor design and construction.



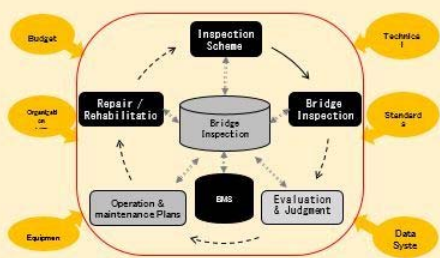
### Our Mission

To transfer the technical knowledge of bridge and culvert inspection and repair method selection under the unified content by developing standard manuals and sheets. The estimate of bridge maintenance cost for each fiscal year is required to be implemented to improve the transportation infrastructure in Pakistan.

### What is Bridge Management System?

For NHA, it is essential to implement the operation and maintenance cycle efficiently. The framework of BMS comprises a "Bridge Inspection Database" at center, consisting of "Inspection Scheme", "Bridge Inspection", "Evaluation and judgement", "Operation and Maintenance" and "Repair and Rehabilitation Works" as illustrated below.

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Illustrative diagram of BMS

So, BMS is a systemized procedure for evaluation, inspection, recording, maintenance and repair of bridge and culverts. Under the BMS System, the bridges managed and operated by National Highway Authority will be regularly inspected following a standardized procedure and the evaluation will be inputted into a customized BMS software.

### Implementation of BMS in Pakistan

The following forms of technical assistance are provided by JICA. A team of BMS experts from Japan to Pakistan was dispatched. The expert team is working in 3 major areas.

| Manuals & Sheets  | Capacity Development  | BMS Software  |
|---|---|---|
| <ul style="list-style-type: none"> <li>Manual for Bridge/Culvert inspection</li> <li>Manual for Bridge/Culvert Repair Method selection</li> </ul> | <ul style="list-style-type: none"> <li>Providing technical Trainings to NHA Engineers</li> <li>E-learning</li> <li>Non-destructive Testing Equipment</li> </ul> | <ul style="list-style-type: none"> <li>Bridge Inspection database and BMS Software for NHA operated bridges.</li> </ul> |

The already existing standards for bridge maintenance are scrutinized and the improved bridge and culvert inspection and repair method selection manuals are prepared. These documents will serve as standard guideline for bridge evaluation and maintenance. A standard format of bridge inspection sheet for recording data of bridge

evaluation is also provided by expert team. The bridge inspection sheet will be used to register and compile data and diagnosis result in bridge inspection database.

To foster the leadership to carry out the bridge inspection and repair method selection, workshops are convened which helped in smooth transfer of technology in bridge inspection, diagnosis, BMS, repair and rehabilitation.

The first training given to two NHA officers was held at Japan. Demonstration of working of bridge management system in Japan was given. Following visits were made during the training to get a know-how of functioning of BMS in Japan.

#### NEXCO Research Institute

NEXCO is a highway company which owns a road maintenance system in Japan by its 3 sub companies distributed region wise as NEXCO West, NEXCO Central and NEXCO East.

The NEXCO RI receives the bridge data from its three sub companies now now, heading to make its own BMS System.



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**Japan Bridge Engineering Center**  
 JBEC is a government owned organization that focusses on Bridge Inspectors License, renders trainings and after testing their knowledge and experience provides inspection license to the bridge inspectors.

**NEXCO Central and Nagoya University Bridge (NZU Bridge)**

Nagoya University holds training programs related to bridge maintenance techniques for bridge maintenance engineers. NZU Bridge is a facility provided by NEXCO and Nagoya University for holding trainings for Bridge Maintenance Engineers. NZU Bridge is comprised of reassembled deteriorated concrete and steel bridge members.

**Highway Research and Training Center**

The Master Trainers' Training sessions were held in Highway Research and Training Center. The sessions concentrated on bridge inspection, soundness diagnosis and bridge maintenance and repair method selection.



2nd Batch for 1st MT Training



Visit to Indus River Bridge



Site Visit (Shahia Bridge)

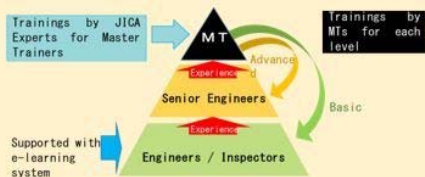


Engineers filling inspection sheet



Group photo at site

The forthcoming trainings will focus on the selection of Certified Master Trainers (MTs) for set up and functioning of Bridge Management System of NHA. These Certified Master Trainers, on the basis of acquired knowledge will carry out the trainings and play a supportive role for NHA's Maintenance Unit staff to implement bridge inspection, bridge repair method selection and input to bridge inspection database. The hierarchy of transfer of knowledge is shown below.



Non-destructive Testing (NDT) Equipment is a primary resource for carrying out inspection work. JICA, through this technical assistance project, is providing NDT equipment which includes: Rebound Hammers, Ultrasonic testing equipment, electromagnetic wave radar, profiler, crack and corrosion analyzing equipment



Rebar detector



Feroscanner



Test Hammer



Crack scale

**Project Schedule**

| Item              | Time | 2016 |   |   |    | 2017 |   |   |   | 2018 |   |   |   |
|-------------------|------|------|---|---|----|------|---|---|---|------|---|---|---|
|                   |      | 6    | 7 | 8 | 11 | 1    | 2 | 3 | 4 | 5    | 6 | 7 | 8 |
| Preparation       |      |      |   |   |    |      |   |   |   |      |   |   |   |
| Manual and Format |      |      |   |   |    |      |   |   |   |      |   |   |   |
| Database & EMS    |      |      |   |   |    |      |   |   |   |      |   |   |   |
| MT Trainings      |      |      |   |   |    |      |   |   |   |      |   |   |   |
| MT Trainings      |      |      |   |   |    |      |   |   |   |      |   |   |   |
| Bridge Inspection |      |      |   |   |    |      |   |   |   |      |   |   |   |
| Evaluation        |      |      |   |   |    |      |   |   |   |      |   |   |   |
| EMS               |      |      |   |   |    |      |   |   |   |      |   |   |   |
| Remarks           |      |      |   |   |    |      |   |   |   |      |   |   |   |

**Our Commitment**

- Providing qualified and trained individuals for EMS
- Customizing EMS Software according to local needs and capabilities
- Providing NDT equipment for detailed inspection of superstructure and substructure of bridge

(4) Version 4 (13 December 2017)

## TO CR of JICA Pakistan OFFICE

## PROJECT MONITORING SHEET

**Project Title: The Project for Technical Assistance on Implementation of Bridge Management System in NHA**

**Version of the Sheet: Ver.4 (Term: June, 2017 - November, 2017)**

**Name: Kenichi TOMI**

**Title: Project Monitoring Expert**

**Name: Muhammad Asif Azam**

**Title: Project Coordinator, DD (BMS)**

**Name: Yukio IGO**

**Title: Project Manager/Bridge Inspection**

**Submission Date: 13<sup>th</sup> December, 2017**

## I. Summary

## 1 Progress

## 1-1 Progress of Inputs

## (1) Experts

Duration: from June 1, 2017 to November 30, 2017

Unit: Days

|                          |          | Plan        |                 |       | Actual      |                 |       | Actual / Plan |
|--------------------------|----------|-------------|-----------------|-------|-------------|-----------------|-------|---------------|
|                          |          | by previous | during 6 months | total | by previous | during 6 months | total |               |
| Bridge Inspection        | Pakistan | 126         | 95              | 221   | 135         | 57              | 192   | 87%           |
|                          | Japan    | 15          | 7               | 22    | 40          | 20              | 60    | 273%          |
| Bridge Repair            | Pakistan | 71          | 37              | 108   | 103         | 0               | 103   | 95%           |
|                          | Japan    | 12          | 6               | 18    | 16          | 0               | 16    | 89%           |
| Bridge Man. System       | Pakistan | 36          | 12              | 48    | 22          | 11              | 33    | 69%           |
|                          | Japan    | 27          | 15              | 42    | 24          | 26              | 50    | 119%          |
| Bridge Man. A-System     | Pakistan | 0           | 0               | 0     | 0           | 0               | 0     |               |
|                          | Japan    | 0           | 6               | 6     | 0           | 6               | 6     | 100%          |
| Capacity Development     | Pakistan | 114         | 80              | 194   | 111         | 36              | 147   | 76%           |
|                          | Japan    | 6           | 4               | 10    | 11          | 4               | 15    | 150%          |
| Project Monitoring       | Pakistan | 50          | 0               | 50    | 27          | 18              | 45    | 90%           |
|                          | Japan    | 0           | 0               | 0     | 0           | 0               | 0     |               |
| Bridge Man. Spec. Logic  | Pakistan | 0           | 18              | 18    | 0           | 18              | 18    | 100%          |
|                          | Japan    | 0           | 2               | 2     | 0           | 8               | 8     | 400%          |
| Bridge Man. A-Spec. Log. | Pakistan | 0           | 18              | 18    | 0           | 18              | 18    | 100%          |
|                          | Japan    | 0           | 1               | 1     | 0           | 0               | 0     | 0%            |

The main activities of JICA Expert Team of this period is as follows;

- 1) Discussion about NHA organization for Bridge Management System

JICA Expert Team proposed organization which includes Bridge Management Unit (BMU) at JWG held on July 21, and made a presentation to Chairman on September 15, 2017.

At the meeting with Chairman which was held at JICA headquarters on November 10, we agreed on the following points;

- 3 engineers for BMU at NHA HQ and 12 Inspectors will be assigned on December 1, 2017.
- Bridge inspection will start in the model area (Punjab North)

As of December 2, 3 engineers who work exclusively for BMU were decided.

As for the Inspectors, 12 people are chosen by an interview, and the Inventory Survey Training is going to be carried out by December 20, 2017.

2) Development of Bridge Inspection Database (BIDB) and Bridge Management System (BMS)

Prototype of BIDB which has input function was distributed in July, and Prototype of BMS is provided in December.

Since NHA's human resource are short, bridge inspection and training of inspectors have not been progressed for past 6 months.

The revision of manuals and training materials is done by JICA Expert Team only, so exchange of opinions and agreement with NHA side has not been confirmed yet.

JICA Expert Team summarized "Patterning of bridges controlled by NHA in Pakistan" and reached the following conclusions.

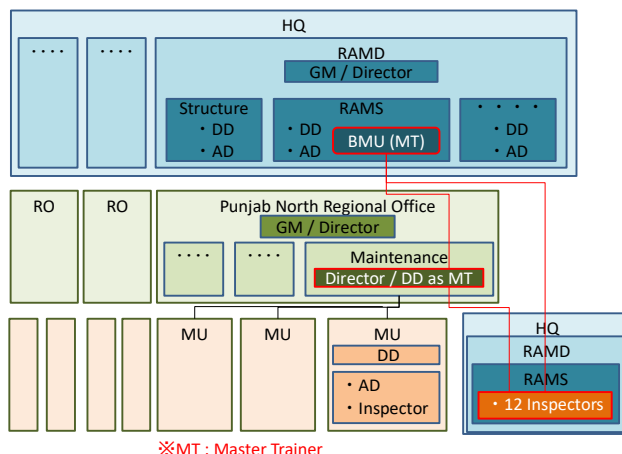
- 1) The purpose of the training can be accomplished by doing bridge inspection and evaluation of representative bridges only, instead of all the bridges.
- 2) Punjab North is most suitable for training.

**(2) Counterpart**

1) Project Coordinator: Deputy Director (BMS) and Project Coordinator; Assistant Director (BMS) were required to join the Project, but, since the start of project, the latter hardly joined the project.

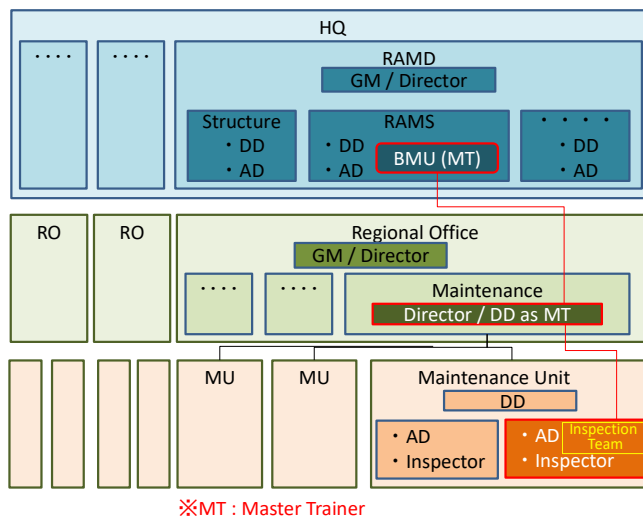
Necessity of BMU that was proposed at JCC-3 was understood, and NHA made an effort to establish BMU. As a result, BMU is about to be constructed.

**■ Short-term vision for starting BMS**





■ Long-term vision for national-wide



(3) Equipment

Equipment for bridge maintenance is almost handed over to NHA, but specifications and quantity of non-destructive testing (NDT) equipment are not consulted as NHA has not yet confirmed the staff in charge of NDT equipment.

| Purpose                            | Equipment  | Total | Price in Pakistan  | Price in Japan  |
|------------------------------------|--|-------|--|---|
| Safety                             | Helmet   | 100   |  |   |
| Crack Width<br>Spalling, Honeycomb | Crack Scale  | 100   |  |   |
|                                    | Test Hammer  | 100   |  |   |
| Compression Strength               | Rebound Hammer<br>Schmidt Hammer   | 16    | SilverSchmidt \$2,600 (EN EM)<br>Calibration certificate \$170                                 | Proceq N ¥93,312<br>Proceq NR ¥177,120<br>Sanyo NS-2 ¥117,720<br>Digi Shimidt ND ¥ 585,000<br>Kamekura Seiki D-7000 ¥105,800    |
|                                    | Test Anvil   | 1     | SilverSchmidt \$1,700 (EN EM)  | Test Anvil ¥240,840<br>Kamekura Seiki KH-80 ¥84,200   |
| Crack Depth                        | Elastic Wave (ultrasonic, impact, hitting)<br>Sonic Testing<br>PUNDIT-LAB Ultrasonic System          | 1     | Pundit PL-200 \$7,760<br>Pundit PL-200PE \$20,300<br>Pundit Lab+ \$6,000<br>Pundit Lab \$5,300 | Pundit PL-200 ¥1,404,000<br>Pundit PL-200PE ¥2,160,000<br>Pundit Lab+ ¥1,080,000<br>Pundit Lab ¥1,026,000<br>Elsonic ¥1,250,000 |
| Rebar Arrangement                  | Electromagnetic Wave Radar<br>Ground Penetrating Rader   | 1     | Hilti PS1000 Rp.7,091,983+GST<br>Profoscope+ \$3,420<br>Profometer PM-650 \$8,620              | Hilti PS1000 ¥3,974,400   |
| Rebar, Cover                       | Electromagnetic Induction<br>Profoscope/Profometer   | 1     | Hilti PS250 Rs.4,237,746+GST   | Hilti PS250 ¥1,987,200  |
| Carbonization                      |  | 16    | Deep Purple \$1,900  | ¥46600/Kit<br>¥3500/500ml bottle  |
| Rebar Corrosion                    | Natural Electric Potential (ASTM)<br>Corrosion Analyzing Instrument (CANIN)<br>(Half Cell Potential) | 1     | Profometer Corrosion \$10,965  | Gatec iCOR ¥3,348,000<br>Profometer Corrosion ¥2,500,000  |

Equipment for BIDB and BMS will be delivered after NHA arranges the space for keeping equipment and people using that equipment are decided. Software will be released in July, 2018.

#### **(4) Training in Japan**

The 2<sup>nd</sup> training in Japan formerly planned in September 2017, has been postponed. After establishment of organization of BMS, it is necessary to discuss the candidates and purpose of the training in Japan to analyze whether it is necessary or not.

#### **(5) In-country Training**

##### **1) Extra Training**

Additional feedback training was given on July 25, 2017, to candidates of Master Trainers (MT) who submitted Inspection Sheets. In the training, JICA Expert Team showed indication standards and reviewed inspection sheets prepared by the participants.

The participants were as follows;

|                            |                          |
|----------------------------|--------------------------|
| <i>Muhammad Asif Azam</i>  | <i>DD (BMS/RAMS)</i>     |
| <i>Aftab Ullah Babar</i>   | <i>DD (Structures)</i>   |
| <i>Muhammad Zahir Khan</i> | <i>DD (Construction)</i> |
| <i>Javed Akhtar</i>        | <i>DD (Inspection)</i>   |
| <i>Liaqat Ali</i>          | <i>DD (P &amp; CA)</i>   |
| <i>Arshad Mehmood</i>      | <i>AD (NBBIA)</i>        |

In this training, participants used their own Inspection Sheet as a learning material, so it was a great opportunity for them to enhance their understanding.

As organization for BMS was not established, the candidates of 1<sup>st</sup> MT Training did not apprehend the importance of bridge management. As a result, only a few candidates participated in extra training.

JICA Expert Team hopes that understanding of the importance of bridge maintenance will spread by organizing BMS.



## 2) Revision of Bridge/Culvert Inspection and Repair Manuals

To hear opinions and suggestions about the inspection manual and the repair manual, an interactive session was held with some candidates of MT on July 31, 2017.

In both manuals, it is essential to define the type of repair work actually used in Pakistan, and JICA Expert Team suggested the repair works. As BMU was not established at that time, decision from NHA regarding type of repair work is still pending.

The participants were as follows;

|                                  |                          |
|----------------------------------|--------------------------|
| <i>Syed M. Zaier Abbas Zaidi</i> | <i>DD (M-2)</i>          |
| <i>Sohaib Mansoor</i>            | <i>DD (M-2)</i>          |
| <i>Tariq Riaz</i>                | <i>DD (P&amp;CA)</i>     |
| <i>Muhammad Zahir Khan</i>       | <i>DD (Construction)</i> |

At the above mentioned meeting, it was agreed that participants will prepare a repair method list as suggestion from NHA side by August 8, 2017. The draft list was shown on August 9, 2017. JICA Expert Team edited the list and requested Mr. Asif to complete it by defining technical terms and filling in the “adoption frequency” column of each method in the list.

## 3) Bridge Inspection Database Training



Summary of BIDB under development and an operation method were explained to 4 engineers of NHA and opinions were exchanged.

The suggestion from the engineers was considered and incorporated in prototype



## 1-2 Progress of Activities

### **Activity 1-1. Develop 3 types of draft manuals i.e. (1) bridge/culvert inspection, (2) bridge repair method selection and (3) data input to Database.**

- (1) and (2) are completed as planned.
- Draft of (3) was completed by Experts and it is planned to revise while trying.

### **Activity 1-2. Develop draft bridge/culvert inspection formats.**

- Completed as planned.

### **Activity 1-3. Develop prototype Database & BMS.**

- Network based BMS software was developed by JICA Expert Team (Sending updated data of bridge inspection / repair is limited by MT). However, a part of the function is unfinished because the authorization of the organization of BMS are undetermined.
- Prototype version 1.0 of BIDB which has input function was given by JICA Expert Team and 4 NHA engineers carried out a pilot test in July.
- It was planned that RAMS & Certified Master Trainers will collect inspection data for 100 bridges and 200 culverts during July to November 2017. The collected data would be entered for validation of prototype BIDB, and BMS software will be revised, but inspection data has not been collected yet. Therefore, the inspection data of 55 bridges and culverts submitted by Master Trainer training participants is entered to BIDB.
- JICA Expert Team converted and transferred the old inventory data from Smart Bridge to the BIDB. As a result, it was necessary to update data and conduct inventory survey again.

### **Activity 1-4. Develop 2 types of draft training materials for training i.e. (1) bridge/culvert inspection and (2) bridge repair method selection.**

- Activity 1-4 is completed in the first MT training.

### **Activity 1-5. Review and finalize the above 3 types of manuals (Activity 1-1), inspection formats (Activity 1-2), prototypes (Activity 1-3) and 2 types of training materials (Activity 1-4).**

- Activity 1-5 is not completed as BMU that was supposed to work in cooperation with the JICA Expert Team has not been established yet.
- Revision is planned by the cooperation work with BMU which established for the next Bridge Inspection Training.

**Activity 2-1. Implement 3 types of master trainer's training for the staff of NHA's HQ and ROs at the target bridges (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database).**

- The 1st MT's Training was conducted for 65 participants at HTRC from February to March.
- The definitions of Certified Master Trainer (CMT), MT, Director of RO and their SOP are required to be discussed and decided.
- It is necessary to discuss about necessity and purpose of training for Inspector and MT with members of BMU

**Activity 2-2. Implement 3 types of OJT for the field staff by Master Trainers (trained in Activity 2-1), (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) inspection data input to Database.**

- OJT has not been implemented because organization of BMS was not sufficient and Master Trainers could not be selected.
- JICA Expert Team will support OJT for MT selected in the future.

**Activity 2-3. Implement (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database for all the bridges/culverts, by field staff (trained in Activity 2-1 & 2-2).**

- There is no progress.
- In this project, JICA Expert Team suggests to start implementation of (1), (2) and (3) not from all bridges/culverts but from the model area.

**Activity 3-1. Implement training for NHA HQ regarding management of BMS (software and database).**

- Activity start after validating BMS.
- JICA Expert Team would like to discuss the target persons of training.

**Activity 3-2. Monitor bridge data input by NHA staff (Activity 2-3) to Database, and data transfer to BMS by HQ RAMD (Road Asset Management Department) staff.**

- There is no progress.
- JICA Expert Team would like to discuss data input methods with BMU members.

**Activity 3-3. Prepare the annual bridge/culvert maintenance plan including estimated budget for 2019 based on the data transferred to BMS (Activity 3-2).**

- There is no progress.
- JICA Expert Team would like to discuss utilization of data and estimation of budget with BMU members.

➤ **1-3 Achievement of Output**

**Output 1-1. Draft manuals for (1) bridge/culvert inspection, (2) bridge repair method selection by [December, 2016] and draft manual for (3) data input to Database & BMS developed by [December, 2017].**

- (1) and (2) were completed.
- Draft manual for Database and BMS are being prepared.

**Output 1-2. Draft bridge/culvert inspection formats developed by [December, 2016].**

- Completed.

**Output 1-3. Prototype Database developed by [July, 2017], and prototype BMS by [December, 2017].**

- Prototype BIDB has been completed in July, 2017.
- JICA Expert Team is making prototype BMS.

**Output 1-4. 2 types of draft training materials for the master trainers for (1) bridge/culvert inspection and (2) bridge repair method selection developed by [December, 2016].**

- Completed.

**Output 1-5. Manuals (1-1), formats (1-2), Database & BMS (1-3), and training materials (1-4) finalized by [September, 2018].**

- JICA Expert Team are planning to finalize the manuals with BMU members.

**Output 2-1. 3 Master Trainers' training for (1) bridge/culvert inspection and (2) bridge repair method selection implemented by [March 2017], and (3) data input to Database implemented by [September, 2018].**

- JICA Expert Team would like to discuss the subjects of training with members of the BMU.

**Output 2-2. 3 types of training (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database) implemented by Master Trainers (trained in Activity 2-1) to all field staff by [November, 2017]. “**

- Training for all field staff by Master Trainers has not been implemented yet. They will be trained by BMU members and Director / DD of RO assigned as Master Trainer in the future.

**Output 2-3. Bridge/culvert inspection, bridge repair method selection, and data input to Database completed for all NHA bridges by [June, 2018].**

- 5,000 bridges and 16,000 culverts (total 21,000) were planned to be inspected by June 2018, but only 55 bridges / culverts were evaluated by 17 candidates.
- JICA Expert Team plans to select 36 representative bridges and 5 culverts in the model area (Punjab North), and to preferentially complete their inspection, repair method selection and data input to Database.

**Output 2-4. 90% or more results of bridge repair method selection and data input to a bridge inspection database by the staff of MUs evaluated to be accurate by NHA's HQ & JICA Expert Team by [October, 2018].**

- There are no results.

**Output 2-5. Certification of master trainers after training by JICA Expert Team (scoring more than 80% in capacity test).**

- It was planned to select Master Trainers from the examination carried out at the 1st Master Trainers' Training and the submission results of the Inspection Sheets afterwards. As only 17 people submitted Inspection Sheets, selection of Master Trainers has not been done.

**Output 3-1. Training for management of BMS implemented by [December, 2017].**

- There are no result.

**Output 3-2. Data on all the bridges of National Highways in Pakistan input to Database by [October, 2018].**

- There are no results.

**Output 3-3. Cost estimate necessary for bridge maintenance in the fiscal year of 2019 based on BMS.**

- There are no results.

**1-4 Achievement of the Project Purpose**

**Project Purpose: Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of entire NHA Network.**

- There are no results.
- It is necessary to pay attention to the collection method and verification means of "inspection data of whole NHA Network" (See "2 Delay of Work Schedule and/or Problem (if any)).

## 1-5 Changes of Risks and Actions for Mitigation

### (1) JWG meeting for Institution/Organization for BMU held on July 21<sup>st</sup>, 2017

JICA Expert Team suggested about BMS organization of NHA as follows;

- In order to collect inspection data of all bridges and culverts once in every five years, NHA needs 178 inspectors as estimated by JICA Expert Team, based on Japanese BMS experience.
- Considering the current situation, it is impossible for NHA to inspect all 21,000 bridges and culverts in this project period, so the first step is to set a model area of the bridge inspection and the model area of the bridge inventory survey, and on next step, NHA may gradually expand the experience of bridge maintenance gained there to other areas.
- The proposal of JICA Expert Team at this point is to progressively develop in the following 3 stages;
  - (1) Establish BMU (place 3 CMTs) in HQ and place 1 CMT in HRTC and 1 in Punjab North RO. After these 5 CMTs train newly hired inspectors, inventory survey and bridge inspection will be carried out in Punjab North as the model area. Concurrently, CMTs are placed in 2 local RO and carry out the inventory survey using existing Inspectors.
  - (2) Following bridge inspection at Punjab North, proceed from priority evaluation to repair design/construction cycle. In 2 RO which carried out the inventory survey in advance, it proceeded to bridge inspection. Proceed in the same way in other RO as well.
  - (3) In Punjab North, go on to the second round and try to establish BMS cycle. Proceed in the same way in other ROs as well.
- In response to this, Member (Planning) said that it is necessary to create an organization that expands BMS across Pakistan, and designated Mr. Asif to create an organization plan.

### (2) Presentation for Chairman NHA held on September 15<sup>th</sup>, 2017

Presentation was given to Chairman NHA about NHA's BMS organization created by Mr. Asif under the direction of Mr. Raja, and Mr. Igo emphasized the following points;

- The project faced shortage of human resource. For sustainable BMS at NHA, all BMS staff (3 engineers at HQ, 12 directors for each RO, 1 DD for each MU, 1 AD and 2 bridge Inspectors) are required.
- Alternatively, if NHA started bridge inspection from the model area, it needs 3 engineers and 12 inspectors at HQ.
- At present, NHA is only enrolled in one third of the planned number of staff

Chairman did not agree with the concept of the model area. However, Member (Planning) suggested that it is better to start from the model area, and it was decided to discuss various possibilities at the meeting between Chairman and NHA Management at 14:00 pm on September 18, 2017.

As a result, Chairman agreed to assign 3 engineers to BMU, 49 ADs and 49 Inspectors to MU. But Director allocation to RO was suspended, DD allocation to MU was disagreed.

At this point, the Board of Directors was unapproved and the timing of staffing was unknown.

**(3) Letters to Chairman NHA and Member (Planning)**

In order to confirm the Chairman's intention, JICA Expert Team issued a letter to Chairman, and also to Member (Planning) separately. Main questions and confirmation items are as follows. Please refer to the attached documents in detail.

- When to form BMS organization
- Possibility of timely establishment of BMU
- Possibility of gradual increase in BMS organization
- Requesting agreement to starting BMS from model area

**(4) Meeting with Chairman NHA and others at JICA Headquarters (2017/11/10)**

Meeting with Chairman NHA and others was held at JICA Headquarters on November 10, 2017, Chairman NHA agreed and confirmed about BMS organization with the following contents. The main agreement contents are as follows. Details are shown in the attached minutes.

- BMU by three engineers will be established and 12 Inspectors will be allocated for BMS on December 1, 2017.
- Bridge Inspection will start from Punjab North which is decided as the model area.
- Number of the AD and Inspectors will increase as soon as they can be employed by NHA.

**1-6 Progress of Actions undertaken by JICA**

- JICA suggested to JICA Expert Team to convince NHA to build an organization of bridge maintenance.
- In response to this, JICA Expert Team suggested it to NHA based on the current situation.
- JICA recommended that the JICA expert team investigates representative bridges by region.
- Experts Team summarized "Patterning of bridges controlled by NHA in Pakistan" and reached the following conclusions.
  - 1) The purpose of the training can be accomplished by doing bridge inspection and evaluation in not all the bridges, but the representative bridges.
  - 2) Punjab North is most suitable for training.

**1-7 Progress of Actions undertaken by NHA**

Chairman agreed to start bridge maintenance from Punjab North as a model area, and directed to assign 3 engineers and 12 Inspectors in BMU.

**1-8 Progress of Environmental and Social Considerations (if applicable)**

- (None)

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

➤ (None)

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

**(1) Scholarship Program in Bridge Sector**

JICA is considering Japanese doctoral / master's program scholarships on Bridge Asset / Maintenance Management. Initially planned for September 2018 intake, but was postponed to April 2019 considering the progress of the project.

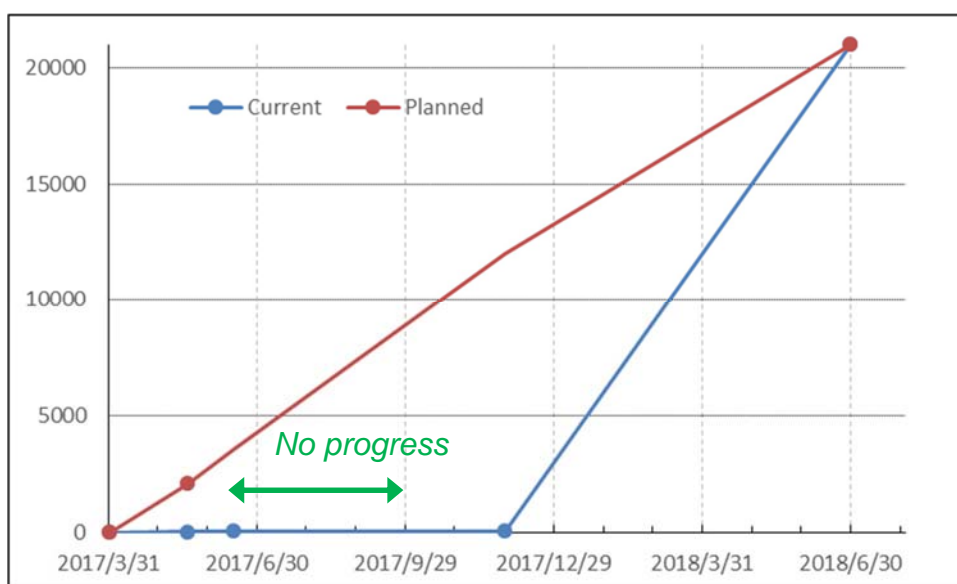
## 2 Delay of Work Schedule and/or Problems (if any)

### Data Collection

In order to achieve "project purpose", it is necessary to analyze the whole input data by BMS. These data are required by the end of June 2018.

### 2-1 Detail

- 5,000 bridges and 16,000 culverts (total 21,000) were planned to be inspected from April (after the first MT training) to June 2018 (15 month), for data collection.
- Only 55 bridges / culverts were checked by 17 candidates. Progress rate is less than 0.28%.
- It was supposed to inspect 100 bridges and 200 culverts by November 2017 (see JWG's minutes of meeting, May 19, 2017), but there is no progress so far.



**Figure Number of Inspected Bridges/Culverts**

### 2-2 Cause

- Shortage of NHA's human resource.
- Vacancy of JWG personnel as written in PDM.

### Problems:

#### Inventory Data

- The Expert team converted and transferred the old inventory data from Smart Bridge to the BIDB. As a result, the necessity of conduct inventory survey again was turned out, and also it need to start from data update.



**2-3 Action to be taken****(1) Establishment of BMU (Bridge Management Unit) at HQ**

- The first priority is to install BMU (bridge management unit) comprised of three engineers (BMS, bridge check, bridge repair) making exclusive duty for bridge maintenance of NHA in HQ.
- Now they are in the process of personnel shift, but arrival at post in few days is settled. Active activity is going to be carried out in future.
- BMU will cooperate with JICA Expert Team to plan and implement inventory survey and bridge inspection. Also, maintain manuals and prepare training materials.
- IT engineers who manage software and hardware are needed.

**(2) Inventory data**

- MU and JICA Expert Team cooperatively prepared training materials for inventory survey and plan to carry out the training for 12 Inspectors who are in charge of the model area (Punjab North). Director or DD who will play the role of MT at Punjab North RO, must also participate to this training.
- Before implementing the inventory survey, BMU and MT of Punjab North RO will formulate the plan under the support of the JICA Expert Team.
- Inventory survey in Punjab North will be started after the above training and will be checked and confirmed by BMU and MT of Punjab North RO appropriately. JICA Expert Team will support this.
- For other areas, inventory survey training by BMU will be started from RO where Inspector and MT assignment has been completed, then inventory survey will be started. As in Punjab North, these areas will also undergo checks and confirmations by BMU and MT of RO. JICA Expert Team will support this.

**(3) Bridge inspection training**

- BMU and JICA Expert Team will cooperate to revise manuals and training materials for bridge inspection.
- Bridge inspection training at Punjab North will be conducted after completion of the inventory survey (assuming April 2018). 3 engineers of BMU serve as lecturers, and the JICA expert team will support this.
- In other areas, bridge inspection training which carried out by MU will be conducted in turn from RO who finished the inventory survey, and the JICA expert team will support this.

**(4) Bridge inspection**

- BMU and MT of Punjab North RO will formulate a plan under the support of JICA expert team before conducting bridge inspection. At this time, select the 36 representative bridges and 5 representative culverts to conduct inspections with priority.

- In Punjab North, after conducting bridge inspection training, carry out bridge inspection according to the bridge inspection plan and input the result to BIDB. BMU and MT of Punjab North RO checks and modifies them, and the BMU registers them with the BMS.
- Other areas go through the same procedure, too.
- In Punjab North, JICA Expert Team confirms the data registered by BMU and visits the site as necessary.
- In other areas, the BMU members will check the registered data by themselves, and JICA Expert Team checks on request (without onsite visit).

#### **(5) JWG**

Finalization of the manuals (i.e. Inspection Manual) and specifications of BMS software must be decided hereinafter. BMU will be involved in JWG, and discuss on countermeasures and directions of BMS development. These outcomes must be agreed and approved by C/P, JICA Expert Team and JICA.

#### **(6) JICA Expert Team's opinions**

In order to ensure the sustainability of NHA's bridge management system, it is necessary to prepare enough people. JICA Expert Team thinks as follows;

- As a first step, it is reasonable to build a bridge management system in the model area, and then expand it nationwide as the second stage.
- Organization of NHA's bridge management system should be aligned with existing organizations such as HQ, RO, and MU.
- It is necessary to clarify the division of duties (Standard Operation Procedure) that clearly describes the roles and responsibilities of RO's Director / DD, MU's DD, AD, and Inspector.
- It is necessary to discuss and decide the new definition of MT / CMT.

#### **2-4 Roles of Responsible Persons/Organization (JICA, NHA, etc.)**

##### **[NHA]**

- Composition of personnel exclusively in charge of bridge management system in NHA.
- Implementation of bridge inspection.

##### **[JICA]**

- Revise R/D and PDM and discuss with each other for mutual agreement.

##### **[JICA Expert Team]**

- Prepare BMS software.
- Support NHA to conduct bridge inspection and BMS.

### **3 Modification of the Project Implementation Plan**

#### **3-1 PO**

- Current situation of NHA is different from the time when R/D and PDM were created, so discussion on Project is necessary.

#### **3-2 PDM**

In order to achieve sustainable BMS in NHA, it is necessary to discuss the problems with consideration of the current situation of the NHA and the Project.

#### **3-3 Other modifications on detailed implementation plan**

(None)

### **4 Preparation of NHA towards after completion of the Project**

NHA needs to establish BMS organization in NHA to promote bridge maintenance system. At the beginning of the establishment, at least HQ's BMU and MU's Inspector must start bridge inspection with a representative type of bridges in the model area. In addition, NHA's future nationwide deployment plan is also necessary.

## **II. Project Monitoring Sheet I & II as Attached**

PM Form 1: PDM (Project Design Matrix)

PM Form 2: PO (Plan of Operation)

Project Design Matrix

**Project Title: The Project for Technical Assistance on Implementation of Bridge Management System in NHA**

**Implementing Agency: National Highway Authority**

**Target Group:**

**Period of Project: July, 2016 – January, 2019 (30 months)**

**Project Site: in/around Islamabad, Pakistan**

Version 4

Dated 13, December, 2017

| Narrative Summary   |   | Model Site:  |  | Important Assumption   | Achievement   | Remarks |
|---|---|--|--|--|---|---------|
| Overall Goal  | Objectively Verifiable Indicators   | Means of Verification  |  |  |   |         |
| <p><b>Project Purpose</b><br/>Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of <b>entire</b> NHA Network.</p> | <p>Based on the bridge data, the number of bridge structures in the worst condition has decreased by one-third in [January, 2022] from the start of the Project.</p>  | <p>Output data of the BMS</p>  | <ul style="list-style-type: none"> <li>· Copyright of software (source code)</li> <li>· Availability of optimum maintenance budget.</li> <li>· Continuous update of bridge data</li> </ul> | <ul style="list-style-type: none"> <li>· NHA's road maintenance budget does not decrease from the start of the Project.</li> <li>· Natural disasters with the risk of damages on bridges do not occur on National Highways in Pakistan.</li> </ul> | <p><b>Begin with Pujab North as the model area.</b></p> |         |
| <p><b>Outputs</b><br/>1. Manuals, Database and BMS developed for bridge inspection and bridge repair method selection</p>                                 | <p>1-1. Draft manuals for (1) bridge/culvert inspection, (2) bridge repair method selection by [December, 2016] and draft manual for (3) data input to Database &amp; BMS developed by [December, 2017].<br/>1-2. Draft bridge/culvert inspection formats developed by [December, 2016].<br/>1-3. Prototype Database developed by [July, 2017], and prototype BMS by [December, 2017].<br/>1-4. 2 types of draft training materials for the master trainers for (1) bridge/culvert inspection and (2) bridge repair method selection developed by [December, 2016].<br/>1-5. Manuals (1-1), formats (1-2), Database &amp; BMS (1-3), and training materials (1-4) finalized by [September, 2018].</p> | <p>1-1. 3 types of draft manuals<br/><br/>1-2. Draft bridge/culvert inspection formats<br/><br/>1-3. Prototype Database &amp; BMS<br/><br/>1-4. 2 types of draft training materials<br/><br/>1-5. 3 types of manuals, bridge/culvert inspection formats, Database &amp; BMS, and 2 types of training materials</p> | <ul style="list-style-type: none"> <li>· BMS is continuously in use by NHA for preparation of bridge maintenance plan.</li> </ul>  | <p>(1) &amp; (2) completed<br/><b>(3) in Dec, 2017.</b><br/><b>Server is necessary.</b></p> <p>Completed</p> <p><b>Database in July, 2017.</b><br/><b>BMS in December, 2017</b></p> <p>Completed</p> <p><b>Currently drafted</b></p>               |   |         |

|  |   |   |   |   |
|--|---|---|---|---|
| <p>2. Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and bridge repair method selection of uniformed contents implemented on <b>all</b> the bridges of National Highways in Pakistan.</p> | <p>2-1. 3 Master Trainers' training for (1) bridge/culvert inspection and (2) bridge repair method selection implemented by [March 2017], and (3) data input to Database implemented by [September, 2018].<br/>                 2-2. 3 types of training (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database) <b>implemented by Master Trainers (trained in Activity 2-1) to all field staff</b> by [November, 2017].<br/>                 2-3. Bridge/culvert inspection, bridge repair method selection, and data input to Database completed for <b>all</b> NHA bridges by [June, 2018].<br/>                 2-4. <b>90% or more</b> results of bridge repair method selection and data input to a bridge inspection database by the staff of MUs evaluated to be accurate by NHA's HO &amp; JICA Experts by [October, 2018].<br/>                 2-5. <b>Certification of master trainers after training by JICA experts (scoring more than 80% in capacity test)</b>.</p> | <p>2-1. Training records and reports<br/><br/>                 2-2. Training records and reports<br/><br/>                 2-3. Completed bridge inspection formats and input data to a bridge inspection database<br/><br/>                 2-4. Input data to Database and its evaluation<br/><br/>                 2-5. Test records and reports</p> | <p>(1) &amp; (2) completed<br/><br/>                 Not yet<br/><br/>                 No progress in 6 months<br/><br/>                 Still 0.28%<br/><br/>                 Not enough candidates of the 1st MTT met with capacity test (report submission).<br/><br/>                 Not yet<br/>                 Not yet<br/>                 Not yet</p> | <p>Definition of Master Trainer / Certified Master Trainer / Bridge Management Unit (BMU) / Directors in RO.<br/><br/>                 Trainees may be limited in HQ.</p> |
| <p>3. Data on <b>all</b> the bridges of National Highways in Pakistan input by MUs to Database available to NHA's HQ and ROs.</p>  | <p>3-1. Training for management of BMS implemented by [December, 2017].<br/>                 3-2. Data on <b>all</b> the bridges of National Highways in Pakistan input to Database by [October, 2018].<br/>                 3-3. Cost estimate necessary for bridge maintenance in the fiscal year of 2019 based on BMS.</p>   | <p>3-1. Training records and reports<br/>                 3-2. Input data to Database<br/>                 3-3. Bridge maintenance budget document with breakdown</p>   | <p>Not yet<br/>                 Not yet<br/>                 Not yet</p>  | <p>Trainees may be limited in HQ.</p>   |

| Activities  | Inputs<br>The Japanese Side  | The Pakistani Side   | Pre-Conditions  |
|---|--|--|---|
| <p>1-1. Develop 3 types of draft manuals i.e. (1) bridge/culvert inspection, (2) bridge repair method selection and (3) data input to Database.<br/>1-2. Develop draft bridge/culvert inspection formats.<br/>1-3. Develop prototype Database &amp; BMS.<br/>1-4. Develop 2 types of draft training materials for training i.e. (1) bridge/culvert inspection and (2) bridge repair method selection.<br/>1-5. Review and finalize the above 3 types of manuals (Activity 1-1), inspection formats (Activity 1-2), prototypes (Activity 1-3) and 2 types of training materials (Activity 1-4).<br/>2-1. Implement 3 types of master trainers' s training for the staff of NHA's HQ and ROs at the target bridges (for (1) bridge /culvert inspection, (2) bridge repair method selection, and (3) data input to Database).<br/>2-2. <b>Implement 3 types of OJT for the field staff by Master Trainers (trained in Activity 2-1), (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) inspection data input to</b><br/>2-3. Implement (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database for <b>all the bridges/culverts, by field staff (trained in Activity 2-1 &amp; 2-2)</b>.<br/>3-1. Implement training for NHA HQ regarding management of BMS (software and database).<br/>3-2. Monitor bridge data input by NHA staff (Activity 2-3) to Database, and <b>data transfer to BMS by HQ RAMD</b> (Road Asset Management Department)</p> | <p><b>1. EXPERTS</b><br/>1) Bridge Inspection Expert<br/>2) Bridge Repair Expert<br/>3) BMS Expert<br/>4) Capacity Development Expert<br/>5) Project Monitoring Expert<br/>6) Local Coordinator (Pakistani)</p> <p><b>2. EQUIPMENT</b> (subject to changes)<br/>Non-destructive testing equipment such as<br/>· Crack Scale &amp; Test Hammer<br/>· Concrete Compression Strength<br/>· Crack Depth<br/>· Rebar Arrangement<br/>· Rebar &amp; Cover<br/>· Rebar Corrosion<br/>· Carbonation<br/>· Server (and Terminals) for Database &amp; BMS<br/><br/>(Numbers and specifications will be determined through mutual consultations between JICA and NHA during the implementation of the Project as necessary)</p> | <p><b>1. PERSONNEL</b><br/>Administrative Personnel<br/>1) Person in Charge: Member (Planning)<br/>2) Project Manager: General Manager (RAMD)<br/>3) Member Director (Design)<br/>Counterpart Personnel<br/>1) Project Coordinator: Deputy Director (BMS)<br/>2) <b>Assistant Project Coordinator: Assistant Director (BMS)</b></p> <p><b>2. OFFICE &amp; FACILITIES</b><br/>· Office for JICA Experts in NHA's HQ Building with office furniture, internet and telephone.<br/><br/><b>3. ARRANGEMENT</b><br/>· Training Arrangements<br/>· Transportation for the field trips of JICA Experts in/around Islamabad.<br/><br/><b>4. BUDGET ALLOCATION</b><br/>Budget for traveling and accommodation expenses of the training participants.</p> | <p>· The participants for training by JICA experts (Activity 2-1) must have at least 15 years of remaining service period in NHA.<br/>· Pakistan, especially Islamabad and Lahore, is continuously safe enough for JICA Experts to implement the activities.</p> <p style="text-align: center;"></p> <p><b>&lt;Issues and countermeasures&gt;</b></p> <p>Crack Scale and Test Hammer shall be prepared for MT Training and OJT, while other non destructive test equipment and computers (Licensed Database with Server and Terminals) will be discussed after the 1st MT Training (April, 2017)</p> <p>Standard Operation Procedure (SOP) related to bridge maintenance is need to be built</p> |

3-3. Prepare the annual bridge/culvert maintenance plan including estimated budget for 2019 based on *the data transferred to BMS* (Activity 3-2).

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|







# The project for technical assistance on implementation of Bridge Management System in NHA

## JCC-4

### Joint Coordination Committee

December 13<sup>th</sup> 2017

at

Auditorium NHA HQ Islamabad



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#### History of JCC Meetings

Pacific  
Consultants

##### **a) 1<sup>st</sup> JCC Meeting**

Date: July 29<sup>th</sup> ,2016

- JICA Experts presented the whole plan of executing the project.
- Project Design Matrix (PDM) and Plan of Operation (PO) was approved.

##### **b) 2<sup>nd</sup> JCC Meeting**

Date: December 9<sup>th</sup> , 2016

- Decision about new BMS Software was approved.
- List of NDT Equipment was presented.
- 1<sup>st</sup> MT Training schedule and contents were discussed
- PDM related to new BMS was revised

##### **c) 3<sup>rd</sup> JCC Meeting**

Date: July 12<sup>th</sup> , 2017

- Causes of delay and risks and their solutions were discussed.
- The main reason was shortage of human resources.



The 1<sup>st</sup> JCC Meeting



The 2<sup>nd</sup> JCC Meeting

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# Opening Remarks

3

## Contents

1-Progress of Activities

2-Challenges for BMS in NHA

3-Long-term and Short-term Vision

4-Establishment of BMU

5-Selection of Trainee Engineers for Model Area

6-Selection and Inspection Scope of Model Area

7-Introduction to BMS Software

8-Others

4

# 1-Progress of Activities

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## 1-1.Progress of Inputs

### a)Experts

- After JCC, we suggested organization which includes BMU during the JWG meeting held on July 21.
- We gave presentation to Chairman on September 15
- Meeting with the Chairman was held at JICA Headquarters on November 10. The following things were discussed;
  - 3 engineers at BMU in HQ and 12 inspectors will be assigned on 1<sup>st</sup> December,
  - They start the bridge inspection in the model area(Punjab North)

The situation as of December 12:

- Three engineers of BMU were decided
- 12 inspectors are chosen by an interview
- Inventory Survey Training is going to be carried out by December 20

### b)Counterpart

We appreciate having understood the necessity of BMS in NHA and organizing it.

### c)Equipment

Equipment for bridge maintenance is almost handed to NHA, but specifications and quantities of non-destructive testing (NDT) equipment are not consulted because NHA's staff in charge (of NDT equipment) is still unknown.

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## 1-1. Progress of Inputs

### d) In-country Training

#### 1) Extra Training

- Duration: July 25<sup>th</sup>, 2017.
- Participants : 6
- Additional feedback training was held on July 25<sup>th</sup>, for candidates of Master Trainers (MT) who submitted Inspection Sheets. In the training, JICA Expert Team showed indication standards and reviewed inspection sheets prepared by the participants, in order to deepen their understanding.



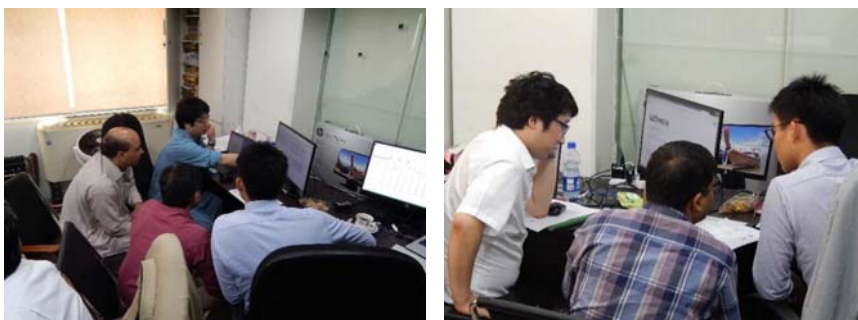
Extra Training for MT Candidates

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## 1-1. Progress of Inputs

### 2) Bridge Inspection Database Training

- Duration: July 20<sup>th</sup> - 25<sup>th</sup>, 2017.
- Participants : 4
- Summary of BIDB under development and an operation method were explained to 4 engineers of NHA and opinions were exchanged.
- The suggestion from the engineers was reflected to prototypic completion.



BIDB Prototype testing by NHA Engineers

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## **1-2. Progress of Activities**

**Output 1:** Manuals and a database developed for bridge inspection and bridge repair method selection

**Output 2:** Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and bridge repair method selection of uniformed contents implemented on all the bridges of National Highways in Pakistan.

**Output 3:** Data of Bridges on National Highways in Pakistan input by MUs to the existing BMS (Smart Bridge) available to NHA's HQ.

**Most of the above work has not been done for the past half year. This is because discussions on the establishment of the organization for BMS within the NHA were conducted.**

**If organization for BMS is built within this month and engineers are assigned, we hope that the project will progress dramatically.**

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## **1-3. Achievement of Output**

### **1) BMS software**

- BMS software has been prepared in Japan.
- We are planning to conduct training for people assigned to BMU and to enhance their understanding about BMS.

### **2) Inventory Survey Training**

- Before conducting bridge inspection, it is necessary to collect inventory data.
- The training materials for inventory survey which is required for bridge inspection were prepared.
- Inventory Survey Training will be carried out by December 20.

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## 1-4. Achievement of the Project Purpose

### Project Purpose:

Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of **entire** NHA network.

- Considering the current situation, it is impossible for the NHA to inspect all 21,000 bridges and culverts in this project period.
- As the first step, it is reasonable to build a bridge management system in the model area, and then expand it nationwide as the second step.
- Situation of NHA is far from the time when R/D and PDM were created, so discussion on the Project is necessary.
- In order to achieve sustainable BMS in NHA, it is necessary to discuss the problems with consideration of the current situation of NHA and the Project.

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## 1-5. Changes of Risks and Actions for Mitigation

### 1) Organization for BMU

JICA Expert Team suggested about BMS organization of NHA as follows;

- Based on the requirement of collection of inspection data once in every five years, NHA needs at least **178 inspectors**. This figure is based on Japanese BMS Experience.
- Considering the current situation, it is impossible for NHA to inspect all 21,000 bridges and culverts in this project period.
- So, the first step is to set the model area for bridge inspection and the model area for bridge inventory survey, and on next step, gradually expand the experience of bridge maintenance gained there to other areas.

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## 1-5. Changes of Risks and Actions for Mitigation

### 2) Agreement with Chairman about BMS organization

JICA, JICA Expert Team and Chairman agreed on the following contents after consultation.

- 3 exclusive engineers in Bridge Management Unit(BMU) will be assigned on December 1<sup>st</sup>, 2017
- Moreover, 12 Bridge Inspectors (Trainee Engineers) will be assigned on the same date.
- Bridge inspection will be started from “Punjab North” which is decided as the model area.
- Number of the Assistant Directors and Inspectors will increase as soon as they can be employed by NHA.

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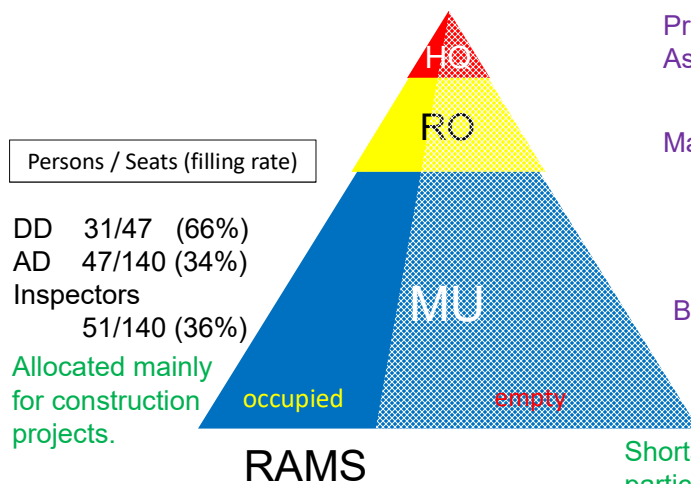
## 2-Challenges for BMS in NHA

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NHA has insufficient human resources for carrying out bridge inspection.

### Current Situation

*In whole NHA*



### For BMS Project

|                     |                 |
|---------------------|-----------------|
| Project Coordinator | 1/1             |
| Assistant P/C       | 0/1             |
| Master Trainers     | ??/12 (not yet) |
| Bridge Insp.        | (none)          |

Shortage of Human Resources, particularly for the Field Works.

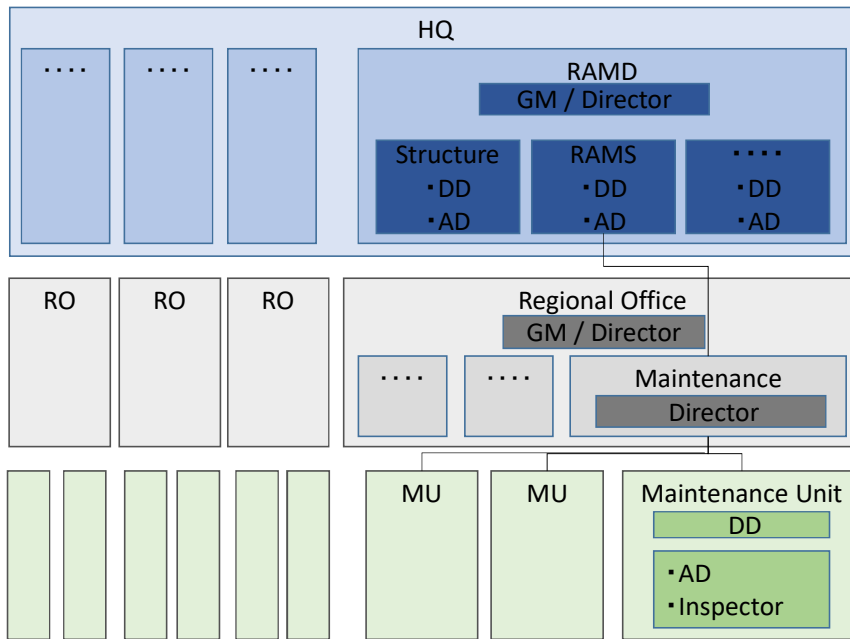
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## 2-Challenges for BMS in NHA

### ■ Current NHA Organization



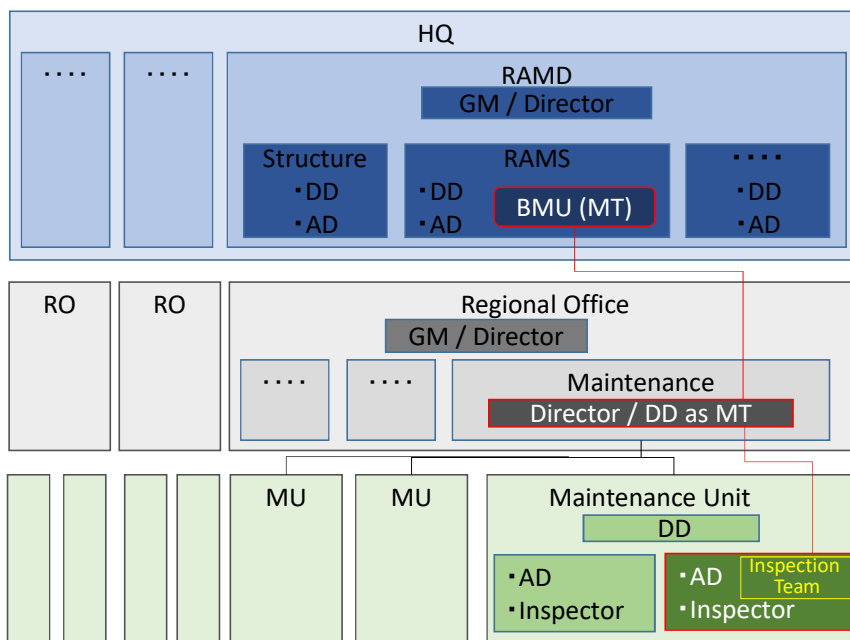
BMS Organization

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## 3-Proposal with Long-Term Vision

### ■ BMS organization in NHA (Long-term, national-wide)



BMS Organization

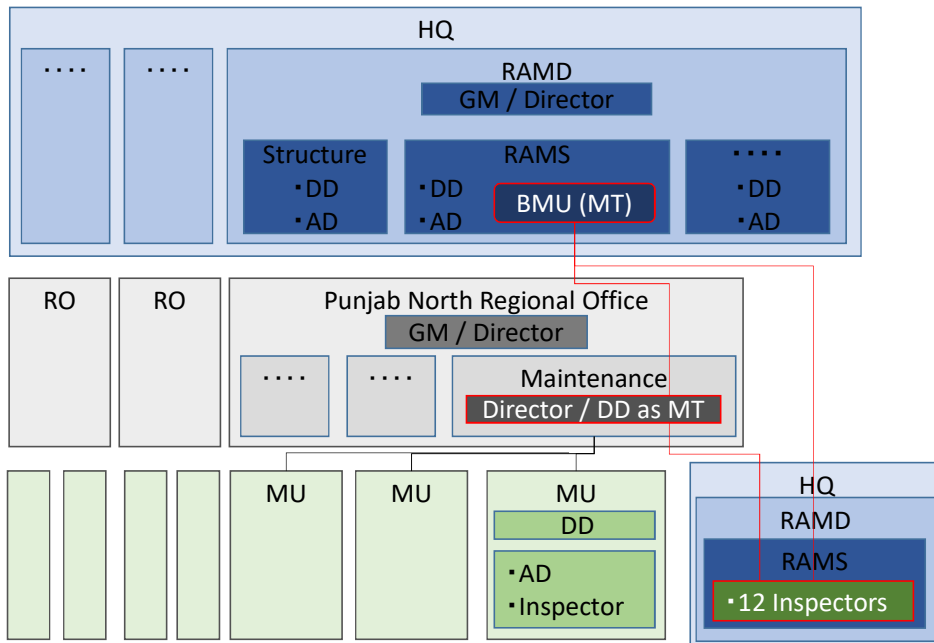
※ MT : Master Trainer

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### 3-Proposal with Short-Term Vision

- NHA arrangement according Chairman's approval



BMS Organization

※ MT : Master Trainer

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### Estimated Schedule

| Items  | 2017 |    | 2018 |   |   |   |   |   |   |   |   |    |    |    | 2019 |   |   |   |   |   |   |   |   |    |    |    |   |   |
|--|------|----|------|---|---|---|---|---|---|---|---|----|----|----|------|---|---|---|---|---|---|---|---|----|----|----|---|---|
|  | 11   | 12 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |   |   |
| <b>Inventory Survey</b>                      |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Training Materials                           |      | █  |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Training                                     |      | █  |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Inventory Survey                             |      |    | █    | █ | █ | █ | █ | █ | █ | █ | █ | █  | █  | █  | █    | █ | █ | █ | █ | █ | █ | █ | █ | █  | █  | █  | █ | █ |
| Checking Inventory Data                      |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| <b>Bridge Inspection</b>                     |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Manuals (Inspection, Repair, and Data Input) |      | █  | █    | █ | █ | █ | █ | █ | █ | █ | █ | █  | █  | █  | █    | █ | █ | █ | █ | █ | █ | █ | █ | █  | █  | █  | █ | █ |
| Training Materials                           |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Selection of Typical Bridges / Culverts      |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Bridge Inspection Planning                   |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Bridge Inspection Training                   |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Bridge Inspection                            |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Bridge Inspection Checking and Evaluation    |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Checking Bridge Inspection Report            |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| <b>BMS</b>                                   |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Input and Run BMS (Prioritization)           |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Budget Allocation                            |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Repair Planning and Design                   |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |
| Repair Works                                 |      |    |      |   |   |   |   |   |   |   |   |    |    |    |      |   |   |   |   |   |   |   |   |    |    |    |   |   |

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**Roles and Responsibilities**

| Position                          | Role and Responsibility  |
|-----------------------------------|--|
| Inspector [MU]                    | Actually, inspects on site and fills out inspection sheets, decides classified evaluation, bridge/culvert soundness, damage level of each member and suggests remedial measures. |
| Master Trainer [RO]               | Supervises inspection, reviews evaluation by inspector and confirms remedial measure.  |
| BMU (Bridge Management Unit) [HQ] | Random checking of inspection data, decides remedial measure, makes maintenance plan according to inspection data and planning for special inspection program.                   |

**Types of Inspection**

| Type of Inspection    | Purpose   | Frequency   |
|-----------------------|---|---|
| Periodical Inspection | Collection of inventory and condition data of all bridges and culverts on NHA network on the prescribed inspection sheets developed for BMS.  | Once in five years  |
| Routine Inspection    | Inspection to record damages during regular road maintenance confirming that there is no irregularity against safe and smooth traffic   | Twice in a year   |
| Special Inspection    | Collection of accurate inspection data, analysis, repair planning and tendering process.<br>Inspection after extraordinary affairs/disaster (such as earthquake, flood, fire, accident etc.) or for structures with known weakness. | During repair planning of priority structures in a particular year.<br>Immediately following and event. |
| Initial Inspection    | Determine and record the initial condition of structures  | After completion of construction or major repair works  |

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**4-Establishment of BMU  
5-Selection of Trainee Engineers for Model Area**

- Referring to Minutes of Meeting on 10<sup>th</sup> Nov at JICA HQ, it was agreed that BMU will be established and 12 Trainee Engineers will be allocated for BMS till December 1<sup>st</sup>,2017
- The Chairman NHA has accorded the in-principle approval for establishment of Bridge Management Unit (BMU) with following configuration:

|                         |         |
|-------------------------|---------|
| Director (BMS)          | 01 Nos. |
| Deputy Director (BMS)   | 01 Nos. |
| Assistant Director(BMS) | 01 Nos. |

- NHA administration has still not issued posting/transfer orders of the nominated officers accordingly.
- RAMD NHA is selecting 12 Trainee Engineers for inventory and inspection survey of model area.
- JICA experts will start training of trainee engineers once they are available with BMU so that inventory/inspection of structures in model area can be started without further delay.

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## 6-Selection of Model Area

- “Punjab North” is the best Regional Office to start bridge inspection. It is not only the nearest office from HQ of NHA but also has many varieties of bridges.
- Punjab North has maximum bridges of “Main Construction Type” category, which is the fundamental selection criteria for inspection.
- It covers many “Passage Type” and “Main Material Type (Superstructure/Abutment/Pier)” bridges.
- “Big/Special Bridge” should be selected as many as possible.

“Punjab North” has ;

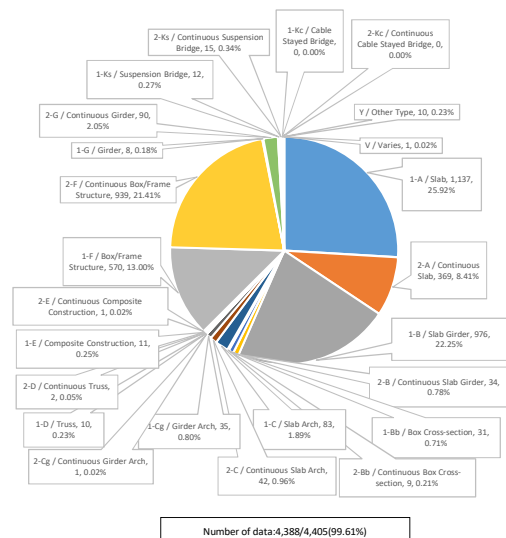
- 6 “Big Bridges” that have “Total Length” of more than 500 meters.
- most kinds of “Main Material Type” and “Main Construction Type” that are categorized to “Special Bridge”.
- 1 bridge that is categorized to “Special Bridge” of which "Max Span Length" is more than 50 meters .
- 4 bridges that are categorized to “Special Bridge” of which "Clear Height" is more than 50 meters .

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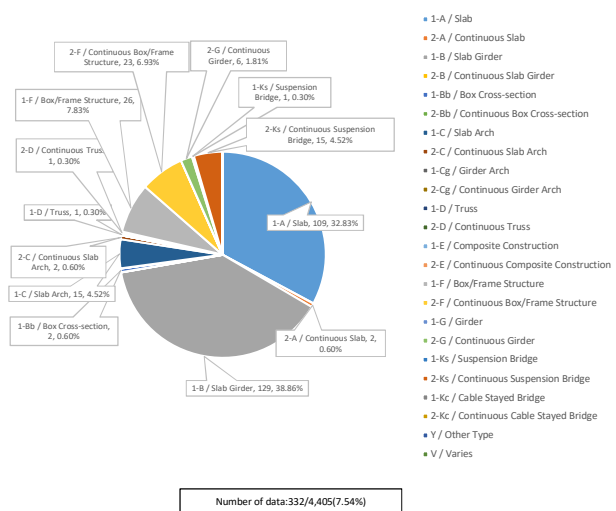
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### a) Superiority of “Punjab North” as model area for inspection (Main Construction Type (Bridge))

Main Construction Type (Bridge) [Whole NHA]



Main Construction Type (Bridge) [Punjab North]



“Main Construction Type (Bridge)” in NHA is categorized to 24 types.  
“Punjab North” has 13 kinds of “Main Construction Type (Bridge)”.

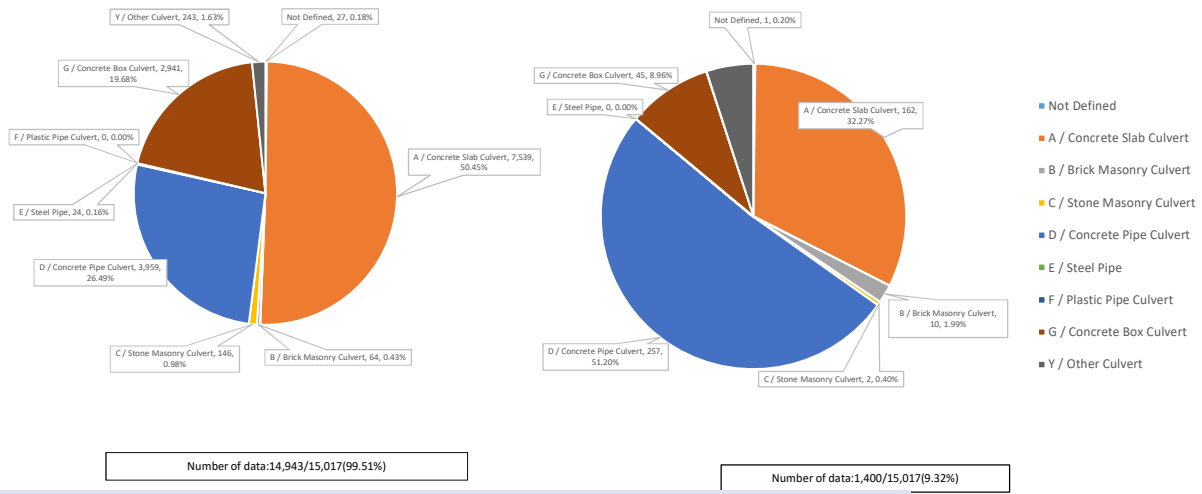
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**b) Superiority of "Punjab North" as model area for inspection  
(Main Construction Type (Culvert))**

Main Construction Type (Culvert) [Whole NHA]

Main Construction Type (Culvert) [Punjab North]



- "Main Construction Type (Culvert)" in NHA is categorized to 8 types.
- "Punjab North" has 6 kinds of "Main Construction Type (Culvert)" except for "Steel Pipe" and "Plastic Pipe Culvert".



◆ Number of Bridges to be Inspected in "Punjab North"

- Basically select the target bridges according to "Main Construction Type".
- As it is considered that "Main Construction Type" cover other categories, the number of bridges to be inspected is estimated 36.

| Category                            | Number     | Number to inspect | Remarks         |
|-------------------------------------|------------|-------------------|-----------------|
| Main Construction Type              | 332        | 36                |                 |
| Passage Type                        | 332        | 9                 |                 |
| Main Material Type (Superstructure) | 332        | 7                 |                 |
| Main Material Type (Abutment)       | 332        | 5                 |                 |
| Main Material Type (Pier)           | 226        | 6                 |                 |
| Total Length > 500m                 | 6          | 1                 |                 |
| Max Span Length > 50m               | 1          | 1                 |                 |
| Clear Height > 50m                  | 4          | 1                 |                 |
| <b>Total</b>                        | <b>332</b> | <b>36</b>         | <b>At least</b> |

※ "Punjab North" has 2 roads "N-5" and "N-80". Bridges on "N-5" that is one of the most important roads in Pakistan should be given to priority to be selected.

◆ Proposal of culvert selection

- Basically select the target culverts according to “Main Construction Type”. “Punjab North” has most kinds of “Main Construction Type (Culvert)”.
- Select the culverts that has more than 2 meters “Clear Opening/Diameter”. All Types have ones that have more than 2 meters “Clear Opening/Diameter”.
- The number of culverts to be inspected will be 5.

| Passage Type              | Number     | CO/D>2m   | Number to inspect | Remarks         |
|---------------------------|------------|-----------|-------------------|-----------------|
| Not Defined               | 1          | 0         | 0                 |                 |
| A / Concrete Slab Culvert | 162        | 19        | 1                 |                 |
| B / Brick Masonry Culvert | 10         | 2         | 1                 |                 |
| C / Stone Masonry Culvert | 2          | 1         | 1                 |                 |
| D / Concrete Pipe Culvert | 257        | 1         | 1                 |                 |
| E / Steel Pipe            | 0          | 0         | 0                 |                 |
| F / Plastic Pipe Culvert  | 0          | 0         | 0                 |                 |
| G / Concrete Box Culvert  | 45         | 4         | 1                 |                 |
| Y / Other Culvert         | 25         | 0         | 0                 |                 |
| <b>Total</b>              | <b>502</b> | <b>27</b> | <b>5</b>          | <b>At least</b> |

⊗ Culverts on “N-5” that is one of the most important roads in Pakistan should be given to priority to be selected.

## 7-Introduction to BMS Software

**Bridge Management System : BMS Server system**

Bridge Management System

Data store

Calculation

- To store and refer **all bridge data**
- To create **inspection plan list**
- To calculate **repair priority** and **repair plan list\***
- Mainly used by HQ staffs through a web browser

*\*repair prioritization is now under-design.*

**Bridge Inspection Database : BIDB**

Bridge Inspection System

Input

Upload

- To input or update **inventory data**
- To input **inspection results data**
- To input **repair and construction job results data**
- Mainly used by Inspectors and MTs on the PC

Bridge Data Exchange

- i. Confirmation of establishment of BMU is still pending.
- ii. Minutes of Meeting held on 10<sup>th</sup> November 2017 at JICA Headquarters were submitted to NHA but not signed from NHA's side.
- iii. Computer hardware
  - Network (RO, MU)
  - BMS Server (placement, room etc.)
  - Computers for Data Input (who, where, how)
- iv. Time required by NHA for assigning Trainee Engineers to project
- v. Expenditures for mobility of trainee engineers from office to site.
- vi. Finalization of NDT equipment type.
- vii. Comments on Poster/Brochure from representatives of JICA and NHA.

(5) Version 5 (11 April 2018)



## TO CR of JICA Pakistan OFFICE

## PROJECT MONITORING SHEET

**Project Title: The Project for Technical Assistance on Implementation of Bridge Management System in NHA**

**Version of the Sheet: Ver.5 (Term: December, 2017 - March, 2018.)**

**Name: Kenichi TOMI**

**Title: Project Monitoring Expert**

**Name: Ikramus Saqlain Haider**

**Title: Project Director, GM (RAMD)**

**Name: Yukio IGO**

**Title: Project Manager/Bridge Inspection**

**Submission Date: 11<sup>th</sup> April, 2018**

## I. Summary

## 1 Progress

## 1-1 Progress of Inputs

## (1) Experts

Duration: from December 1, 2017 to March 31, 2018

Unit: Days

|                          |          | Plan        |                 |       | Actual      |                 |       | Actual / Plan |
|--------------------------|----------|-------------|-----------------|-------|-------------|-----------------|-------|---------------|
|                          |          | by previous | during 4 months | total | by previous | during 4 months | total |               |
| Bridge Inspection        | Pakistan | 235         | 59              | 294   | 192         | 49              | 241   | 82%           |
|                          | Japan    | 32          | 6               | 38    | 60          | 3               | 63    | 166%          |
| Bridge Repair            | Pakistan | 128         | 0               | 128   | 103         | 0               | 103   | 80%           |
|                          | Japan    | 25          | 5               | 30    | 16          | 0               | 16    | 53%           |
| Bridge Man. System       | Pakistan | 48          | 17              | 65    | 33          | 16              | 49    | 75%           |
|                          | Japan    | 58          | 11              | 69    | 50          | 13              | 63    | 91%           |
| Bridge Man. A-System     | Pakistan | 0           | 0               | 0     | 0           | 0               | 0     |               |
|                          | Japan    | 8           | 3               | 11    | 6           | 4               | 10    | 91%           |
| Capacity Development     | Pakistan | 219         | 25              | 244   | 147         | 62              | 209   | 86%           |
|                          | Japan    | 14          | 3               | 17    | 15          | 3               | 18    | 106%          |
| Project Monitoring       | Pakistan | 50          | 19              | 69    | 45          | 11              | 56    | 81%           |
|                          | Japan    | 0           | 0               | 0     | 0           | 0               | 0     |               |
| Bridge Man. Spec. Logic  | Pakistan | 18          | 0               | 18    | 18          | 0               | 18    | 100%          |
|                          | Japan    | 19          | 7               | 26    | 8           | 4               | 12    | 46%           |
| Bridge Man. A-Spec. Log. | Pakistan | 18          | 13              | 31    | 18          | 13              | 31    | 100%          |
|                          | Japan    | 11          | 4               | 15    | 0           | 6               | 6     | 40%           |

**(2) Counterpart**

1) Organizing BMU

Mr. Ghulam Murtaza Simair has been on duty since January 1<sup>st</sup>.

Mr. Sohaib Mansoor has been on duty since January 16<sup>th</sup>.

Mr. Muhammad Asif Azam has been on duty.

2 BMUs have been collaborating with JICA Expert Team in the project room (317) since January 16<sup>th</sup>.

2) Bridge Inspector

For 10 Trainee Engineers and MU staff,

Inventory Survey Training was held on February 1<sup>st</sup>, and

Inventory Survey on-site Training was held on February 2<sup>nd</sup>.

Supplementary Inventory Survey Training was held on February 14<sup>th</sup>.

Inventory Survey started on February 23<sup>rd</sup>.

Delay occurred due to official approval of Trainee Engineers, equipment procurement, and transportation arrangement.

**(3) Equipment**

Regarding depth of concrete cracks, degree of steel corrosion and detection of rebar location, bridge repair prioritization and budgetary estimation can go without equipment for those measurements. Furthermore, since BMU does not have enough staff and the plan of equipment usage and user have not been confirmed yet in NHA, it can be thought that NHA hardly utilize the special equipment for the time being.

Pertaining to the equipment to be provided, it is proposed as follows;

For Bridge Inspectors, (1) helmet, (2) crack scale and (3) test hammer

For BMU, (4) carbonization (phenolphthalein) and (5) Schmidt Hammer

The conditions for the abovementioned grants are not limited to (1) official establishment of exclusive BMS organization in NHA, (2) confirmation of timeline for national-wide implementation of BMS, and (3) measures to implement the abovementioned activities.

**(4) Sever and Terminal Computers**

It was planned initially that the existing server (Smart Bridge) was working and 13 terminal computers were provide for each Regional Office.

However, considering the current situations, the new server and 3 terminal computers may be provided for BMU in HQ. The conditions for the abovementioned grants are not limited to (1) official establishment of exclusive BMS organization in NHA, (2) confirmation of timeline for national-wide implementation of BMS, and (3) measures to implement the abovementioned activities.

| Purpose                            | Equipment  | Quantity | Remarks          |
|------------------------------------|--|----------|------------------|
| Safety                             | Helmet   | 100      | Done             |
| Crack Width<br>Spalling, Honeycomb | Crack Scale  | 100      | Done             |
|                                    | Test Hammer  | 100      | Done             |
| Compression Strength               | Rebound Hammer<br>Schmidt Hammer                               | 2        | To be determined |
| Carbonization                      | Phenolphthalein  | 2        | To be determined |
| Rebar Arrangement                  | Electromagnetic Wave Radar<br>Ground Penetrating Rader         | 0        | To be determined |
| Rebar, Cover                       | Electromagnetic Induction<br>Profoscope/Profometer             | 0        | To be determined |
| Rebar Corrosion                    | Half Cell Potential<br>Natural Electric Potential (ASTM)       | 0        | To be determined |
| Crack Depth                        | Sonic Testing<br>Elastic Wave (ultrasonic)                     | 0        | To be determined |
| Sever for BMS                      | Only for Bridge Inventory Database &<br>Bridge Inspection Data | 1        | To be determined |
| Client PC                          | Only connection to BMS Server<br>Only for BMS HQ (BMU),        | 3        | To be determined |

**(4) Training in Japan**

The first training in Japan is carried out for the 2 engineers in RAMD in January, 2017.

The second one was planned for 10 engineers in June 2017. However, it is canceled because of no eligible person (candidate).

**(5) In-country Training**

**1) Inventory Survey Training**

In office training on February 1<sup>st</sup>

On-site training on February 2<sup>nd</sup>

[Attendees]

Counterpart side: Member (Planning) 1 person, BMU 3 persons

JICA Expert Team side: 2 persons

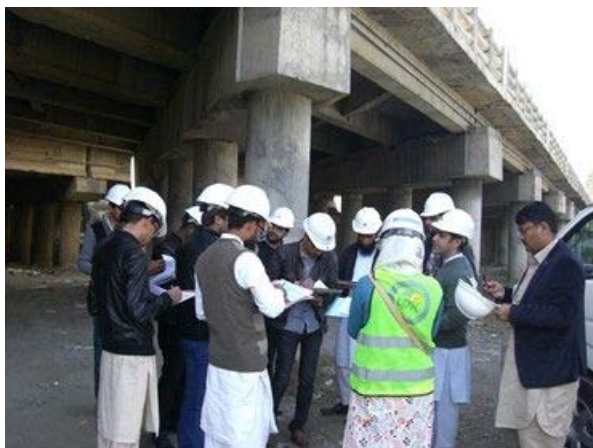
Trainee Engineers: 11 persons, MU: Wazirabad 4 persons, Rawalpindi 2 persons, others: 1 person

Total: 24 persons

1. Asim Amin / Member (Planning)
2. M. Asif Azam / DD (BMU)
3. Sohaib Mansoor / DD (BMU)
4. Ghulam Murtaza Simair / DD (BMU)
5. Haruo Tomiyama / JICA Expert Team
6. Momina Rauf / JICA Expert Team
- (1) M. Ali Atif / Trainee Engineer
- (2) Imran Shabbir / Trainee Engineer
- (3) Shahzeb Saleem / Trainee Engineer
- (4) M. Shahwaiz / Trainee Engineer
- (5) M. Safwan Naeem / Trainee Engineer
- (6) Hussain Ahmed Abbas / Trainee Engineer
- (7) Obaid Shahid Mir / Trainee Engineer
- (8) Ashar Tariq / Trainee Engineer
- (9) Shahzaib Farooq / Trainee Engineer
- (10) Abdul Rahman / Trainee Engineer
- (11) Jawwad Naeem Bhatti / Trainee Engineer
- (12) Javed Ali / DD Maintenance (Wazirabad)
- (13) M. Ismail / Inspector (MU Wazirabad)
- (14) Mazhar Rafique / Inspector (MU Wazirabad)
- (15) Naeem Shahzad / Inspector (MU Wazirabad)
- (16) M. Arshad Abbas Malik / DD Maintenance (Rwp)
- (17) M. Naeem / AD Maintenance (Rwp)
- (18) M Saeed / Sub Engineer



Figures: Inventory Survey Training (in office)



Figures: Inventory Survey Training (on site)

## 2) Supplementary Inventory Survey Training

In office training on February 14<sup>th</sup>, for 20 minutes

Mr. Murtaza (BMU) made supplementary explanation on dimension measurement, skewed angle, etc.

Counterpart side: BMU 1 person, JICA Expert Team side: 2 persons

Trainee Engineers: 7 persons

Total: 10 persons

[Attendees]

1. Ghulam Murtaza Simair / DD (BMU)
2. Yukio Igo / JICA Expert Team
3. Momina Rauf / JICA Expert Team
- (1) Hussain Ahmed Abbas / Trainee Engineer
- (2) Walli Ahmed / Trainee Engineer
- (3) Obaid Shahid Mir / Trainee Engineer



- (4) Shahzeb Saleem / Trainee Engineer
- (5) Shahzaib Farooq / Trainee Engineer
- (6) Abdur Rahman / Trainee Engineer
- (7) M. Rizwan / Trainee Engineer



Figures: Supplementary Inventory Survey Training (in office)

### 3) OJT of Inventory Survey

Inventory Survey on site from February 14th to April 12th (ongoing)

After Inventory Survey Training, 10 Trainee Engineers (3 Teams) started OJT of inventory survey on site.

BMU has formulated an survey plan and instructed Trainee engineers

We expect Trainee Engineers to survey 255 Bridges and 261 Culverts (516 structures) in the model area.

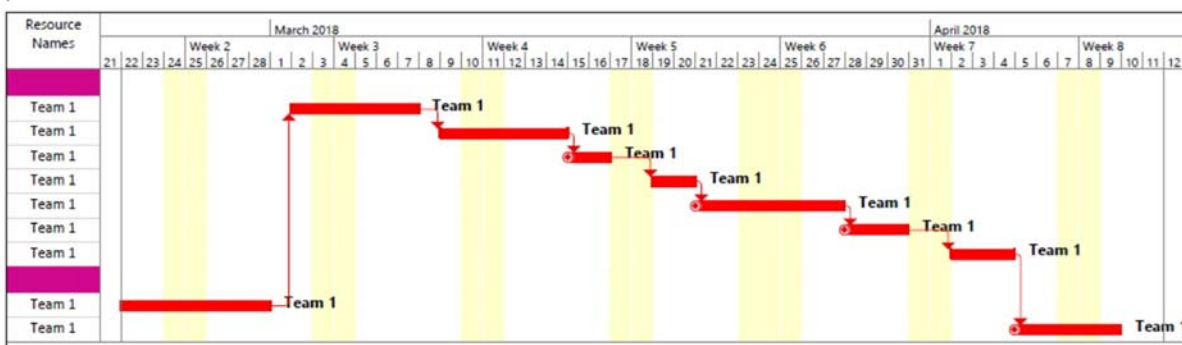
As the end of March, they finished 165 bridges and 157 culverts (322 structures, 62%) of inventory survey in the model area. JICA Expert Team thinks Inventory Survey in the model area is in smooth process on schedule.



Figures: Inventory Survey (on site)

PM Form 3-1 Monitoring Sheet Summary

| ID | Task Mode | Task Name   | Bridges    | Culverts   | Duration | Start       | Finish      | Predecessors |
|----|-----------|---|------------|------------|----------|-------------|-------------|--------------|
| 1  |           | <b>WAZIRABAD MAINTENANCE UNIT</b>                             | <b>151</b> | <b>85</b>  |          |             |             |              |
| 2  |           | WZD-1: Narang Mandi More - Kala Shah Kaku (N5/M2 Interchange) | 14         | 0          | 4 days   | Fri 3/2/18  | Wed 3/7/18  | 18FS+1 day   |
| 3  |           | WZD-2: Kala Shah Kaku (N5/M2 Interchange) - Muridke           | 12         | 7          | 4 days   | Fri 3/9/18  | Wed 3/14/18 | 2FS+1 day    |
| 6  |           | WZD-5: Gujranwala Bypass                                      | 4          | 13         | 2 days   | Thu 3/15/18 | Fri 3/16/18 | 3            |
| 9  |           | WZD-8: Gujrat Bypass (End) - Lala musa                        | 6          | 7          | 2 days   | Mon 3/19/18 | Tue 3/20/18 | 6            |
| 10 |           | WZD-9: Lala musa - Kharian                                    | 14         | 4          | 4 days   | Wed 3/21/18 | Tue 3/27/18 | 9            |
| 11 |           | WZD-10: Kharian - Dina  | 11         | 2          | 3 days   | Wed 3/28/18 | Fri 3/30/18 | 10           |
| 12 |           | WZD-11: Dina - Missa Kassowal                                 | 12         | 0          | 3 days   | Mon 4/2/18  | Wed 4/4/18  | 11           |
| 13 |           | <b>RAWALPINDI MAINTENANCE UNIT</b>                            | <b>104</b> | <b>176</b> |          |             |             |              |
| 18 |           | RWD-5: Tarnol - Taxila  | 10         | 21         | 5 days   | Thu 2/22/18 | Wed 2/28/18 |              |
| 26 |           | RWD-13: Khunda More - Jand                                    | 3          | 22         | 3 days   | Thu 4/5/18  | Mon 4/9/18  | 12           |



Figures: Inventory Survey Plan for Team 1 (made by BMU)

Table: Progress of Inventory Survey (as of the end of March)

|               | Team 1     |           |             | Team 2     |           |             | Team 3                   |           |             |
|---------------|------------|-----------|-------------|------------|-----------|-------------|--------------------------|-----------|-------------|
|               | Bridge     | Culvert   | Score       | Bridge     | Culvert   | Score       | Bridge                   | Culvert   | Score       |
| 23-Feb        | 4          | 2         | 1.20        | 3          | 6         | 1.35        | 6                        | 0         | 1.50        |
| 26-Feb        | 2          | 6         | 1.10        | 1          | 3         | 0.55        | 2                        | 5         | 1.00        |
| 27-Feb        | 5          | 0         | 1.25        | 1          | 3         | 0.55        | Data Entry               |           |             |
| 28-Feb        | 0          | 5         | 0.50        | Data Entry |           |             | 4                        | 0         | 1.00        |
| 1-Mar         | Data Entry |           |             | 0          | 0         | 0.00        | nil/vehicle out of order |           |             |
| 2-Mar         | 0          | 0         | 0.00        | 2          | 6         | 1.10        | 2                        | 5         | 1.00        |
| 5-Mar         | 8          | 0         | 2.00        | 3          | 0         | 0.75        | 0                        | 2         | 0.20        |
| 6-Mar         | 6          | 0         | 1.50        | 2          | 3         | 0.80        | Data Entry               |           |             |
| 7-Mar         | 1          | 0         | 0.25        | 4          | 1         | 1.10        | 5                        | 3         | 1.55        |
| 8-Mar         | Data Entry |           |             | 2          | 1         | 0.6         | 6                        | 1         | 1.60        |
| 9-Mar         | 0          | 0         | 0.00        | 12         | 10        | 4.00        | 0                        | 3         | 0.30        |
| 12-Mar        | 6          | 0         | 1.50        | Data Entry |           |             | 4                        | 2         | 1.2         |
| 13-Mar        | 1          | 6         | 0.85        |            | 1         | 2.00        | 2                        | 4         | 0.9         |
| 14-Mar        | 6          | 1         | 1.60        | 2          | 6         | 1.10        | 3                        | 2         | 0.95        |
| 15-Mar        | Seminar    |           |             |            | 7         | 0.70        | Seminar                  |           |             |
| 16-Mar        | Data Entry |           |             | 3          | 5         | 1.25        | 1                        | 7         | 0.95        |
| 19-Mar        | 6          | 0         | 1.50        | Data Entry |           |             | 3                        | 6         | 1.35        |
| 20-Mar        |            |           | 0.00        |            |           | 0.00        | 3                        | 3         | 1.05        |
| 21-Mar        | 4          | 0         | 1.00        | 3          | 1         | 0.85        | 2                        | 3         | 0.8         |
| 22-Mar        | 7          | 0         | 1.75        | 3          | 5         | 1.25        | e-counted structure no   |           |             |
| 23-Mar        |            |           | 0.00        |            | 8         | 0.80        |                          |           | 0           |
| 26-Mar        | 6          | 0         | 1.50        | 0          | 8         | 0.80        | nil/vehicle out of order |           |             |
| 27-Mar        | 7          | 0         | 1.75        | 4          | 5         | 1.50        | 2                        | 4         | 0.9         |
| 28-Mar        | Data Entry |           |             | 0          | 6         | 0.60        | 4                        | 2         | 1.2         |
| 29-Mar        |            |           |             | Data Entry |           |             | 2                        | 0         | 0.5         |
| 30-Mar        |            |           |             |            |           |             |                          |           |             |
| <b>Tot al</b> | <b>69</b>  | <b>20</b> | <b>1.01</b> | <b>45</b>  | <b>85</b> | <b>1.03</b> | <b>51</b>                | <b>52</b> | <b>0.94</b> |
| <b>Tot al</b> | <b>86</b>  | <b>76</b> |             | <b>85</b>  | <b>95</b> |             | <b>84</b>                | <b>90</b> |             |
|               | <b>162</b> |           |             | <b>180</b> |           |             | <b>174</b>               |           |             |

## 1-2 Progress of Activities

### Activity 1-1

[Before]

Develop 3 types of draft manuals i.e. (1) bridge/culvert inspection, (2) bridge repair method selection and (3) data input to Database.

[Amendment]

**JICA Expert Team develops draft manuals for (1) bridge inspection, (2) bridge repair and (3) data input.**

- (1) and (2) were completed as planned in December 2016.
- (3) was completed as planned in December 2017.

### Activity 1-2

[Before]

Develop draft bridge/culvert inspection formats.

[Amendment]

**JICA Expert Team develops draft bridge/culvert inspection formats.**

- Completed as planned in December 2016.

### Activity 1-3

[Before]

Activity 1-3. Develop prototype Database & BMS.

[Amendment]

**JICA Expert Team develops Prototype Bridge Inspection Database & BMS.**

#### **【BIDB data input software】**

- JICA Expert Team developed Network based BIDB software in July, 2017.
- However, a part of its function is unfinished because the access privilege in BMS organization is not determined.
- NHA needs to establish SOP (Standard Operating Procedures) related with BMS.
- Trainee Engineers started to use BIDB data input software since February, 2018.

#### **【BMS Software】**

- JICA Expert Team developed Prototype BMS software (Excel based) in December, 2017.
- The prioritization concept was confirmed by Project Coordinator with 57 dummy bridge inspection data in December, 2017.
- BMS programming has started since late March without actual bridge inspection data in order to finish before August, 2018.



- BMS program logic for prioritization can hardly be modified while weights and scores can be varied with flexibility.

#### **Activity 1-4**

[Before]

Develop 2 types of draft training materials for training i.e. (1) bridge/culvert inspection and (2) bridge repair method selection.

[Amendment]

**JICA Expert Team develops draft training materials for (1) bridge inspection and (2) bridge repair.**

- JICA Expert Team finished in February, 2017.

#### **Activity 1-5**

[Before]

Review and finalize the above 3 types of manuals (Activity 1-1), inspection formats (Activity 1-2), prototypes (Activity 1-3) and 2 types of training materials (Activity 1-4).

[Amendment]

**BMU reviews and finalizes the above manuals, inspection formats, prototype and training materials.**

- BMU is revising/localizing in cooperation with JICA Expert Team will finish it in April, 2018.

#### **Activity 2-1**

[Before]

Implement 3 types of master trainer's training for the staff of NHA's HQ and ROs at the target bridges (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database).

[Amendment]

**JICA Expert Team provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.**

**【BMU establishment】**

- The 1st Training was conducted for 65 participants at HTRC from February to March, 2017.
- JICA Expert Team listed the candidates for BMU (Bridge Management Unit) in July, 2017.
- NHA has established BMU of 3 engineers but no IT engineer yet.

- NHA is required to decide the definitions of BMS Organization and BMS staff (HQ, RO and MU), and their SOP are required to be discussed and decided.

**【OJT for BMU】**

- JICA Expert Team provided OJT of Inventory Survey Training (February 2018) to BMU through planning, preparation and implementation.
- JICA Expert Team provides OJT of Bridge Inspection Training and Data Input Training to BMU through planning and preparation to implement in April 2018.

**Activity 2-2**

[Before]

Implement 3 types of OJT for the field staff by Master Trainers (trained in Activity 2-1), (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) inspection data input to Database.

[Amendment]

**BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training).**

- BMU conducted Inventory Survey Training for 11 Trainee Engineers and 6 MU staffs in February 2018 with support of JICA Expert Team.
- BMU will conduct Bridge Inspection Training (1 week) between April 16th and 20th with support of JICA Expert Team.

**Activity 2-3**

[Before]

Implement (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database for all the bridges/culverts, by field staff (trained in Activity 2-1 & 2-2).

[Amendment]

**Inventory Survey and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.**

- It was decided to start OJT from the model area (jurisdiction of Rawalpindi MU and Wazirabad MU in Punjab North).
- JICA Expert Team and BMU jointly implements Inventory Survey on OJT basis in the model area.
- JICA Expert Team and BMU will jointly select typical 36 bridges and 5 culverts in the model area on OJT basis, which will cover almost all types in NHA.
- JICA Expert Team and BMU will jointly implement BMS training on OJT basis with typical 36 bridges and 5 culverts.

- Due to the intense request from NHA, culverts are included in BMS in NHA. However, culverts with less than 2.0m clearance are excluded from Periodical Inspection.

#### **Activity 2-4**

##### **[Amendment]**

**JICA Expert Team reviews inspection results and ability, and advises BMU to enhance its capacity.**

- JICA Expert Team will review inspection results and ability, and will advise BMU through OJT.

#### **Activity 3-1**

##### **[Before]**

**Implement training for NHA HQ regarding management of BMS (software and database).**

##### **[Amendment]**

**JICA Expert Team implements BMS Software Training for BMU.**

- At least 36 bridges and 5 culverts will be utilized for BMS software training in October, 2018.
- The training target will be BMU of 3 civil engineers and 1 IT engineer.

#### **Activity 3-2**

##### **[Before]**

**Monitor bridge data input by NHA staff (Activity 2-3) to Database, and data transfer to BMS by HQ RAMD (Road Asset Management Department) staff.**

##### **[Amendment]**

**BMU analyzes Bridge Inspection Database (BIDB) with BMS Software.**

- It is planned in October, 2018.

#### **Activity 3-3**

##### **[Before]**

**Activity 3-3. Prepare the annual bridge/culvert maintenance plan including estimated budget for 2019 based on the data transferred to BMS (Activity 3-2).**

##### **[Amendment]**

**BMU prepares the annual bridge/culvert maintenance plan and schedule including budget estimation based on the analysis of registered data in Bridge Inspection Database.**

- It is planned in October, 2018.

### **1-3 Achievement of Output**

#### **Output 1-1**

**[Before]**

**Draft manuals for (1) bridge/culvert inspection, (2) bridge repair method selection by [December, 2016] and draft manual for (3) data input to Database & BMS developed by [December, 2017].**

**[Amendment]**

**Draft manuals for (1) bridge inspection by [December, 2016], for (2) bridge repair by [December, 2016] and for (3) data input by [December, 2017].**

➤ Completed.

#### **Output 1-2**

**Draft bridge/culvert inspection formats developed by [December, 2016].**

➤ Completed.

#### **Output 1-3**

**Prototype Database developed by [July, 2017], and prototype BMS by [December, 2017].**

- Prototype BIDD completed. (excluding access privilege under SOP).
- Prototype BMS (Excel based) completed. (without actual bridge inspection data).
- BMS Software will be delivered for BMS Software Training in August, 2018

#### **Output 1-4**

**[Before]**

**2 types of draft training materials for the master trainers for (1) bridge/culvert inspection and (2) bridge repair method selection developed by [December, 2016].**

**[Amendment]**

**2 types of draft training materials for (1) bridge/culvert inspection and (2) bridge repair developed by [December, 2016].**

➤ Completed in February, 2017.

#### **Output 1-5**

**Manuals (1-1), formats (1-2), Database & BMS (1-3), and training materials (1-4) finalized by [September, 2018].**

➤ As "Important Assumption" in PDM, BMU (Bridge Management Unit) is established in NHA headquarters.

- BMU is working to revise/localize by April, 2018 and will finalize by September, 2018.

### **Output 2-1**

[Before]

3 Master Trainers' training for (1) bridge/culvert inspection and (2) bridge repair method selection implemented by [March 2017], and (3) data input to Database implemented by [September, 2018].

[Amendment]

**On-the-job-training (OJT) which enables BMU to manage BMS training in NHA.**

- OJT of Inventory Survey Training was implemented in February 2018.
- OJT of Bridge Inspection Training will be implemented in April 2018.

### **Output 2-2**

[Before]

3 types of training (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database) implemented by Master Trainers (trained in Activity 2-1) to all field staff by [November, 2017].

[Amendment]

**BMS training (Inventory Survey Training and Bridge Inspection Training).**

- Inventory Survey Training was implemented in February 2018.
- Bridge Inspection Training and Data Input Training will be implemented in April 2018.

### **Output 2-3**

[Before]

Bridge/culvert inspection, bridge repair method selection, and data input to Database completed for all NHA bridges by [June, 2018].

[Amendment]

**Inventory Survey and Bridge Inspection on-the-job-training (OJT), [250] and [41] bridges and culverts are implemented respectively.**

- Inventory Survey OJT basis is in progress in the model area.
- BMS training on OJT basis will be conducted with typical 36 bridges and 5 culverts.

### **Output 2-4**

[Before]

90% or more results of bridge repair method selection and data input to a bridge inspection database by the staff of MUs evaluated to be accurate by NHA's HQ & JICA Expert Team by [October, 2018].

**[Amendment]**

**(Delete)**

**Output 2-5**

**[Before]**

Certification of master trainers after training by JICA Expert Team (scoring more than 80% in capacity test).

**[Amendment]**

**(Delete)**

**Output 3-1**

**[Before]**

Training for management of BMS implemented by [December, 2017].

**[Amendment]**

**BMS Software Training for BMU.**

➤ There are no result.

**Output 3-2**

**[Before]**

Data on all the bridges of National Highways in Pakistan input to Database by [October, 2018].

**[Amendment]**

**Analysis of Bridge Inspection Database (BIDB) with BMS Software.**

➤ There are no results.

**Output 3-3**

**[Before]**

Cost estimate necessary for bridge maintenance in the fiscal year of 2019 based on BMS.

**[Amendment]**

**Bridge maintenance plan with cost estimation and schedule for 41 bridges and culverts is formulated by [October, 2018].**

➤ There are no results.

**1-4 Achievement of the Project Purpose**

**[Before]**

**Project Purpose: Annual bridge maintenance plan prepared on the basis of the latest**

bridge inspection data of entire NHA Network.

**[Amendment]**

**Project Purpose: Capacity of NHA to inspect bridges and prepare maintenance plan with cost estimate is enhanced.**

- There are no results.
- In order to capacity development of NHA for sustainable BMS, JICA Expert Team now focuses on technical assistance to/through BMU with typical 36 bridges and 5 culverts in the model area.

**1-5 Changes of Risks and Actions for Mitigation**

**[Important Assumption]**

- BMS organization and BMS staff are established in NHA in a sustainable manner.
- Bridge inspection results and evaluations are registered in Bridge Inspection Database.

**[Issues and Countermeasures]**

- Standard Operation Procedures (SOP) related to bridge maintenance is need to be formulated.

**1-6 Progress of Actions undertaken by JICA**

- Considering the current situation of NHA, JICA has been discussing with NHA on Project Design Matrix amendment.

**1-7 Progress of Actions undertaken by NHA**

- Considering the current situation of NHA, JICA has been discussing with NHA on Project Design Matrix amendment.
- NHA has established BMU of 3 civil engineers, but 1 IT engineer has not been assigned yet.
- NHA has assigned 10 Trainee Engineers for bridge inspection and inventory survey of the model area.

**1-8 Progress of Environmental and Social Considerations (if applicable)**

- (None)

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

- (None)

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

**(1) Scholarship Program in Bridge Sector**

JICA is considering Japanese doctoral / master's program scholarships on Bridge Asset / Maintenance Management. These candidates must have experience BMS and Asset Management in NHA.

Considering sustainability of BMS in NHA, they must join for more than 6 months as the additional members of BMU.

The candidate's information (CV, proposal of his/her study theme, grade report of the university, language test result, etc.) is requested to be submitted in late April 2018 (at the latest, by the end of April) for the pre-selection by the professors.



## **2 Delay of Work Schedule and/or Problems (if any)**

### **Inventory Survey & Bridge Inspection**

#### **Verification of prioritization without Bridge Inspection Data**

#### **Server procurement**

#### **Time-consuming for decision-making in NHA**

### **2-1 Detail**

#### **(1) Inventory Survey**

- 12 Trainee Engineers would be assigned by December 1<sup>st</sup>, 2017. (M/M Nov. 10<sup>th</sup>, 2017)
- Inventory Survey Training for 11 Trainee Engineers was held on February 1<sup>st</sup> and 2<sup>nd</sup>, 2018.
- Supplementary one for 7 Trainee Engineers was held on February 14<sup>th</sup>, 2018.
- Inventory Survey was delayed till February 23<sup>rd</sup> due to NHA internal issues. (Finance & Administration Sections, transportation availability).
- Inventory Survey by 10 Trainee Engineers was limited only in Rawalpindi and Wazirabad MUs due to the delay. Inventory survey in Lahore MU will be implemented later.

#### **(2) Bridge Inspection**

- Bridge Inspection Training will be held between April 16<sup>th</sup> and 20<sup>th</sup>, 2018.
- The representative 36 bridges and 5 culverts will be selected in Rawalpindi and Wazirabad MUs in such a way to cover almost all types of bridges & culverts in NHA.
- These will be inspected with the first priority on OJT basis in order to enhance BMU capability by the end of August, 2018.
- These will be checked and evaluated by the end of September, 2018.
- OJT for prioritization and budget estimation for maintenance plan will be implemented in October, 2018 with 36 bridges and 5 culverts.

#### **(3) Verification of prioritization without Bridge Inspection Data**

- Prototype (Excel based) would be verified for prioritization function with 100 bridges and 200 culverts inspected by RAMS & Certified Master Trainers by November 2017. (M/M May 19, 2017)
- The prioritization concept was confirmed by Project Coordinator with 57 dummy bridge inspection data in December 2017.
- BMS programming will start late March in order to finish before August 2018.
- BMS program can hardly be modified because of tremendous huge complexity despite

that the actual bridge inspection data will be available after August.

**(4) Server procurement**

- 3 quotations from the local market was planned to be gotten in December 2017 in order to install the Server in February 2018.
- 3 quotations with checklist pertaining to JICA Expert Team's specifications was planned to be prepared in February 2018 in order to install the Server in April 2018.
- In case of providing the Server, the procedures must be taken in April 2018 with consideration of inspection duration, it will be installed in August 2018.
- In case of not providing the Server, the plain PC can be used instead.
- Considering of only 36 bridges and 5 culverts in the model area, the Server is not mandatory. NHA have to clarify its future policy.

**(5) Delay in signing on the Minutes of Meetings**

- The Minutes of JCC-2 Meeting held on April 8<sup>th</sup> 2017 was signed and received July 11<sup>th</sup> 2017, 2 months later.
- The Minutes of JCC-3 Meeting held on July 12<sup>th</sup> 2017 was signed and received September 17<sup>th</sup> 2017, 2 months later.
- The Minutes of JCC-4 Meeting held on December 13<sup>th</sup> 2017 was not signed and received yet. At the time of March 29<sup>th</sup> 2018, 3 months later.

**(6) Time-consuming for decision-making in NHA**

- Ex-Chairman promised that 3 BMU engineers and 12 Trainee Engineers would be allocated by December 1<sup>st</sup>, 2017.
- BMU was allocated in January, 2018.
- 10 to 12 Trainee Engineers were gathered in February 2018, but they could not go sites due to no approval on transportation and equipment.
- Who will take responsibility in order to get the requisite approvals from the concerned sections/authorities?
- It is mandatory to reduce the time for getting signatures on the minutes of the meetings.

**Problems:**

**(1) Restrictions and conditions**

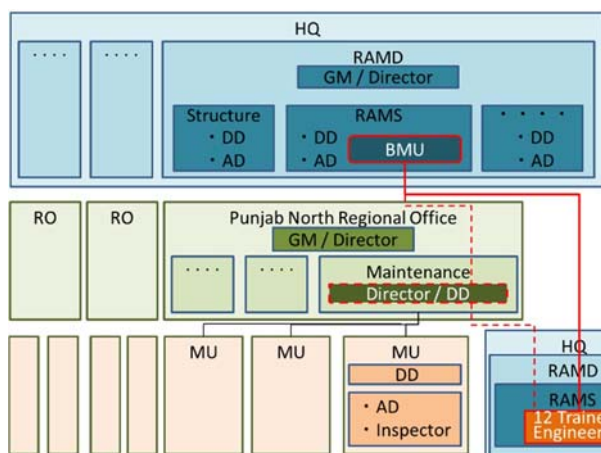
- JICA Expert Team will visit in October 2018 for the last time.
- JICA Expert Team will prevent from visiting Islamabad in the month of Ramazan and during the General Election.
- The Draft Final Report will be explained at JCC-6 in October 2-18.

## 2-2 Cause

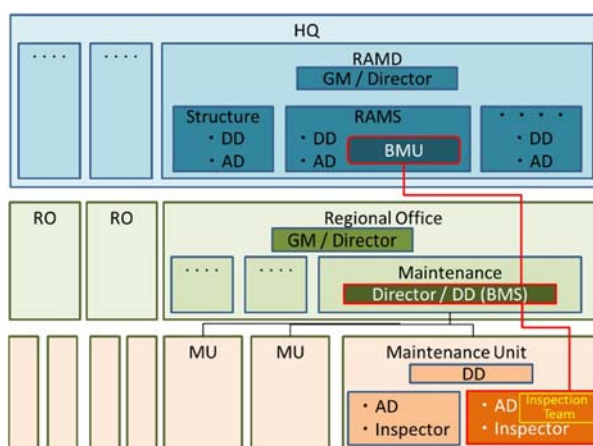
### (1) NHA's BMS Strategies

- JICA Expert Team has proposed short-term and long-term visions, and NHA has approved and accepted them. In the short-term vision, Inventory Survey and Bridge Inspection in the model area will be implemented by Trainee Engineers. However, because they are not permanent employees, NHA must make up BMS strategies including timeline to shift from Trainee Engineers (short-term) to Assistant Directors and Inspectors in Maintenance Units (long-term).

#### ■ Short-term vision for starting BMS



#### ■ Long-term vision for national-wide



### (2) 49 ADs & 49 Inspectors in MUs

- In order to implement BMS in NHA effectively, the detailed working paper needs to be approved by NHA Executive Board and National Highway Council. The proposal needs to be prepared for creation of new staffs and budgets.

### (3) BMS staff in Regional Office

- BMU takes an additional role of BMS RO staff (so-we-called "Master Trainer") in the model area. However, BMU will not be able to take care of other than the model area (jurisdiction of Rawalpindi MU and Wazirabad MU in Punjab North).
- On the next step, BMU will take the role of Trainer for BMS staff (in HQ, RO and MU).
- In order to continue Bridge Inspection in Punjab North, BMS RO staff in Punjab North is required.
- In long-term, BMS RO staff in each RO must be necessary when new ADs and Inspectors are assigned for BMS.

**(4) Standard Operation Procedures (SOP) for BMS**

- BMS activities are not smooth because BMS staff, their roles and responsibilities are not clear.
- SOP for BMS organization and BMS staff (in HQ, RO and MU, respectively) needs to be prepared.
- In order to implement BMS in NHA effectively, the detailed working paper needs to be approved by NHA Executive Board and National Highway Council.

**(5) Composite Schedule of Rates (CSR) for repair works**

- CSR items for bridge repair works need to be included officially.
- In order to implement BMS in NHA effectively, the detailed working paper needs to be approved by NHA Executive Board and National Highway Council.

**(6) NHA Policy for BMS**

- NHA should declare its policy for BMS in brochures, posters and website.

**(7) Conventional after-the-fact repair/replacement**

- MUs and ROs request HQ to repair and replace bridges with emergency budget when they find critical damages. This conventional after-the-fact procedures should not be taken as much as possible for promoting preventative maintenance.
- NHA needs to have the rule that any repair estimation other than BMS standards will not be entered/processed.

**2-3 Action to be taken**

- (1) NHA needs to make up BMS strategies including timeline and to declare in brochures and posters, and on website.
- (2) NHA should prepare not limited to (1) official establishment of exclusive BMS organization in NHA, (2) confirmation of timeline for national-wide implementation of BMS, and (3) measures to implement the abovementioned activities for granted Equipment and Server & Terminal PCs.
- (3) NHA needs to prepare SOP (Standard Operating Procedures) related to BMS (including, BMS Organization, BMS staff (HQ, RO, MU respectively), their roles and responsibilities, especially SOP for BMU (BMS HQ staff).
- (4) NHA should prepare the detailed working paper to be approved by NHA Executive Board and National Highway Council for creation of new staff (49 ADs and 49 Bridge Inspectors) and budgets.
- (5) NHA needs to prepare CSR (Composite Schedule of Rates) for bridge repair works.

**2-4 Roles of Responsible Persons/Organization (JICA, NHA, etc.)**

**[NHA]**

- NHA's strategies for BMS (timeline)
- To declare NHA policy for BMS in brochure and poster, and on website
- Plans for BMS Organization and arrangement of BMS staff
- SOP for BMS
- CSR for bridge repair works

**[JICA]**

- To amend R/D and PDM with discussion for mutual agreement.
- To revise draft of brochure and poster

**[JICA Expert Team]**

- OJT for BMU (Bridge Inspection Training and Data Input Training)
- OJT for BMU (BMS Training)
- To review inspection results and ability, and to advise BMU to enhance its capacity
- BMS software in August 2018
- OJT of BMS
- Draft final report

**[BMU]**

- OJT for BMU (Bridge Inspection Training and Data Input Training)
- OJT for BMU (BMS Training)
- OJT of BMS
- Draft final report

### **3 Modification of the Project Implementation Plan**

#### **3-1 PO**

- Because the current situation of NHA is different from that when Record of Discussion (R/D) and Project Design Matrix (PDM) were created, discussion about amendment of R/D and PDM of this project has been carried out.
- As a result of discussion, please refer to the attached documents.

#### **3-2 PDM**

- Because the current situation of NHA is different from that when R/D and PDM were created, discussion about amendment of R/D and PDM of this project has been carried out.
- As a result of discussion, please refer to the attached documents.
- In order to achieve sustainable BMS in NHA, it is necessary to discuss about how to continue BMS.

#### **3-3 Other modifications on detailed implementation plan**

(None)

### **4 Preparation of NHA towards after completion of the Project**

#### **(1) NHA Policy for BMS**

- NHA's efforts are necessary which are not only for the Project duration, but also for perpetuity.
- For declaration NHA's efforts to BMS, brochures and posters are considered.
- How Government of Pakistan considers the priority of the highway?
- Assignment of staffs on project basis, and problem related to BMU staff shuffling.

## **II. Project Monitoring Sheet I & II as Attached**

PM Form 1: PDM (Project Design Matrix)

PM Form 2: PO (Plan of Operation)

Minutes of Meeting on Project Design Matrix (PDM) amendment

Main Points Discussed (Appendix 2) in Record of Discussion (R/D)

## Project Design Matrix

**Project Title:** The Project for Technical Assistance on Implementation of Bridge Management System in NHA

Version 5

Dated 11, April, 2018

**Implementing Agency:** National Highway Authority

**Target Group:**

**Period of Project:** July, 2016 – April, 2019 (34 months)

**Project Site:** in/around Islamabad, Pakistan

**Model Site:** Jurisdiction of Rawalpindi MU and Wazirabad MU in Punjab North

| <b>Narrative Summary</b>  | <b>Objectively Verifiable Indicators</b>   | <b>Means of Verification</b>   | <b>Important Assumption</b>  | <b>Achievement</b>                                 | <b>Remarks</b>  |
|---|--|--|--|--|---|
| <p><b>Overall Goal</b></p> <p>Bridge maintenance status improved on the bridges of National Highways in the model area.</p>                       | <p>1) The bridges identified in the maintenance plan prepared under the Project are maintained and repaired according to the plan.</p> <p>2) In the model area, more than [65] bridges are annually inspected and the bridge maintenance plan is annually revised.</p>   | <p>1) Inspection and maintenance record in the BMS</p> <p>2) Bridge maintenance plan</p>   | <ul style="list-style-type: none"> <li>· Copyright of software (source code)</li> <li>· Availability of optimum maintenance budget.</li> <li>· Continuous update of bridge data</li> </ul>                   |  | <p>The model area means jurisdiction of Rawalpindi MU and Wazirabad MU in Punjab North.</p> |
| <p><b>Project Purpose</b></p> <p>Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of the model area.</p> | <p>Bridge maintenance budget document with breakdowns for the model area prepared by [December, 2018].</p>   | <p>Analysis of the model area input data to BMS and bridge maintenance budget document (with anticipated budget requirement for forthcoming years)</p> | <p>1)NHA gradually arranges adequate human resources for BMS implementation.</p> <p>2)NHA allocates enough budget to maintain and repair prioritized bridges in the annual maintenance plan.</p>             |  |   |
| <p><b>Outputs</b></p> <p>1. Manuals, Database and BMS developed for bridge inspection and bridge repair</p>                                       | <p>1-1 Draft manuals for (1) bridge inspection by [December, 2016], for (2) bridge repair by [December, 2016] and for (3) data input developed by [December, 2017]</p> <p>1-2. Draft bridge/culvert inspection formats developed by [December, 2016].</p> <p>1-3. Prototype Database developed by [July, 2017], and prototype BMS by [December, 2017].</p> | <p>1-1. 3 types of draft manuals</p> <p>1-2. Draft bridge/culvert inspection formats</p> <p>1-3. Prototype Database &amp; BMS</p>                      | <ul style="list-style-type: none"> <li>· BMS is continuously in use by NHA for preparation of bridge maintenance plan.</li> <li>· BMU (Bridge Management Unit) is established in NHA headquarter.</li> </ul> | <p>Completed</p> <p>Completed</p> <p>Completed</p> |   |

|  |   |   |  |                                 |  |
|--|---|---|--|---------------------------------|--|
| <p>2. Bridge/culvert inspection in the model area is implemented after BMS training.</p>   | <p>1-4. 2 types of draft training materials for (1) bridge/culvert inspection and (2) bridge repair developed by [December, 2016].<br/>1-5. Manuals (1-1), formats (1-2), Database &amp; BMS (1-3), and training materials (1-4) finalized by [September, 2018].<br/>2-1 On-the-job-training (OJT) by JICA Expert Team which enables BMU to implement BMS in NHA by [December, 2018].<br/>2-2 Inventory Survey, Bridge Inspection and Data Input Training for NHA engineers.<br/>2-3 Bridge/culvert inspection, bridge repair and data input to Database completed in the model area including the representative [36] bridges and [5] culverts by [October, 2018].<br/>2-4. The results of bridge repair method selection and data input to a bridge inspection database for model area evaluated to be accurate by BMU &amp; JICA Expert Team by [October, 2018].</p> | <p>1-4. 2 types of draft training materials<br/>1-5. 3 types of manuals, bridge/culvert inspection formats, Database &amp; BMS, and 2 types of training materials<br/>2-1. Training records and reports<br/>2-2. Training records and reports</p>                     | <p>· BMS organization is gradually established in NHA, who will implement BMS in a sustainable manner.</p>   | <p>Completed</p>                | <p>Definition of Master Trainer / Certified Master Trainer /</p> |
| <p>3. Bridge data of the model area is available with BMU at NHA headquarters and bridge maintenance plan is prepared according to the data.</p> | <p>3-1 BMS Software Training for BMU by [December, 2018].<br/>3-2 Analysis of Bridge Inspection Data of the model area using BMS Software.</p>  | <p>2-3 Inspection data of the model area including the representative [36] bridges and [5] culverts in Bridge Inspection Database.<br/>2-4. Input data to Database and its evaluation<br/>3-1. Record of BMS Training<br/>3-2 Output data of BMS (Prioritization)</p> | <p>(1) &amp; (2) completed<br/><br/>Inventory Survey Training was held on February 1.<br/>Bridge Inspection Training is scheduled between April 16 and 20.</p> | <p>Not yet<br/><br/>Not yet</p> |  |



|  |  |                                     |  |                |  |
|--|--|-------------------------------------|--|----------------|--|
|  | <p>3-3 Bridge maintenance plan with repair methods and cost estimate for structures in model area including typical 36 bridges and 5 culverts is formulated.</p> | <p>3-3. Bridge maintenance plan</p> |  | <p>Not yet</p> |  |
|--|--|-------------------------------------|--|----------------|--|

| Activities   | Inputs  | The Pakistani Side  | Pre-Conditions  |
|--|---|---|---|
| <p>1-1. JICA Expert Team develops draft manuals for (1) bridge inspection, (2) bridge repair and (3) data input.</p> <p>1-2. JICA Expert Team develops draft bridge/culvert inspection formats.</p> <p>1-3. JICA Expert Team develops Prototype Bridge Inspection Database &amp; BMS.</p> <p>1-4. JICA Expert Team develops draft training materials for (1) bridge inspection and (2) bridge repair.</p> <p>1-5. BMU reviews and finalizes the above manuals, inspection formats, prototype and training materials.</p> <p>2-1 JICA Expert Team provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.</p> <p>2-2 BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training) .</p> <p>2-3 Inventory Survey and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.</p> <p>2-4 The results of bridge repair method selection and data input to a bridge inspection database for model area evaluated to be accurate by BMU &amp; JICA Expert Team by [October, 2018].</p> <p>3-1 JICA Expert Team implements BMS Software Training for BMU.</p> <p>3-2 BMU analyzes Bridge Inspection Data of the model area using BMS Software.</p> <p>3-3 BMU prepares the annual bridge/culvert maintenance plan including budget estimation based on the analysis of registered data in Bridge Inspection Database.</p> | <p><b>The Japanese Side</b></p> <p>1. EXPERTS</p> <ul style="list-style-type: none"> <li>1) Bridge Inspection Expert</li> <li>2) Bridge Repair Expert</li> <li>3) BMS Expert</li> <li>4) Capacity Development Expert</li> <li>5) Project Monitoring Expert</li> <li>6) Local Coordinator (Pakistani)</li> </ul> <p>2. <b>EQUIPMENT</b> (subject to changes)</p> <p>Non-destructive testing equipment such as</p> <ul style="list-style-type: none"> <li>· Crack Scale &amp; Test Hammer</li> <li>· Carbonation</li> </ul> | <p><b>The Pakistani Side</b></p> <p>1. PERSONNEL</p> <p>Administrative Personnel</p> <ul style="list-style-type: none"> <li>1) Person in Charge: Member (Planning)</li> <li>2) Project Manager: General Manager (RAMD)</li> <li>3) Project Coordinator: Deputy Director (BMU) - I</li> </ul> <p>Counterpart Personnel</p> <ul style="list-style-type: none"> <li>Deputy Director (BMU) - II</li> <li>Deputy Director (BMU) - III</li> </ul> <p>2. OFFICE &amp; FACILITIES</p> <ul style="list-style-type: none"> <li>· Office for JICA Experts in NHA's HQ Building with office furniture, internet and telephone.</li> </ul> <p>3. ARRANGEMENT</p> <ul style="list-style-type: none"> <li>· Training Arrangements</li> <li>· Transportation for the field trips of JICA Experts in/around Islamabad.</li> </ul> <p>4. BUDGET ALLOCATION</p> <p>Budget for traveling and accommodation expenses of the training participants.</p> | <p>· Pakistan, especially Islamabad and Lahore, is continuously safe enough for JICA Expert Team to implement the activities.</p> <hr/> <p>&lt;Issues and countermeasures&gt;</p> <p>Standard Operation Procedure (SOP) related to bridge maintenance is need to be built up.</p> |





**MINUTES OF MEETINGS**  
**BETWEEN**  
**JAPAN INTERNATIONAL COOPERATION AGENCY**  
**AND**  
**THE AUTHORITIES CONCERNED OF**  
**THE ISLAMIC REPUBLIC OF PAKISTAN**  
**ON**  
**THE PROJECT FOR TECHNICAL ASSISTANCE ON IMPLEMENTATION OF**  
**BRIDGE MANAGEMENT SYSTEM**  
**IN NHA**

Japan International Cooperation Agency (herein after referred to as “JICA”) dispatched Mission (hereinafter referred to as “the Mission”) headed by Mr Shuntaro Kawahara from 8th April to 13th April 2018, for the purpose of discussing amendment of Record of Discussions on The Project for Technical Assistance on Implementation of Bridge Management System in NHA originally signed on July 8th, 2015 and once amended on February 8th, 2017.

During its stay in Islamic Republic of Pakistan, the Mission exchanged views and opinions with National Highway Authority (NHA).

As a result of the discussions, both parties confirmed the matters referred to in the document attached hereto.

Islamabad, April 12, 2018

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Mr. Shuntaro Kawahara  
Mission Leader  
Japan International Cooperation Agency  
Japan

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Mr. Asim Amin  
Member (Planning)  
National Highway Authority  
Islamic Republic of Pakistan

### Main Points Discussed

#### 1. Amendment of PDM & PO

Both sides agreed on the draft of amendment of Project Design Matrix (PDM) and Plan of Operation (PO) as shown in Annex 1 and 2 respectively considering present progress of the Project and NHA's human resources allocated to it. The PDM and PO are to be flexibly revised according to the progress and achievement of the Project, upon mutual agreement between National Highway Authority (NHA) and Japan International Cooperation Agency (JICA) at Joint Coordination Committee (JCC) by signing the minutes of meetings.

#### 2. Target Bridges

In order to cover most of all types of bridges and culverts in NHA, typical 36 bridges and 5 culverts in the model area (Punjab North) are selected, in which JICA Expert Team implements Bridge Inspection on-the-job-training (OJT) for BMS staff in NHA.

During the Project, with ten Trainee Engineers assigned for inventory survey and bridge inspection, the accumulated numbers of the data after inventory survey and after inspection in model area are expected to be more than [250] and [41] , respectively.

#### 3. Culvert Inspection

Due to the intense request from NHA to include culvert inspection in Bridge Management System (BMS), considering safety for the road users as well as bridges, culverts are included in BMS in NHA. However, culverts with no more than 2.0 m clearance are excluded from Periodical Inspection.

#### 4. BMS Organization

NHA agreed to gradually organize BMS sufficient staff for bridge maintenance in Headquarters, Regional Offices and Maintenance Units respectively in order to make BMS in NHA sustainable even after the Project completion.

#### 5. Bridge Management Unit (BMU)

NHA has established Bridge Management Unit (BMU) in January, 2018. BMU members are initially Mr. Muhammad Asif Azam, Mr. Sohaib Mansoor, Mr. Ghulam Murtaza Simair and one IT engineer. BMU will implement BMS in NHA as per approved Standard Operation Procedure (SOP).

Both sides agreed that NHA will assign Mr. Sohaib Mansoor and Mr. Ghulam Murtaza of BMU to Project Coordinators and to let them participate in JCC.

Both sides also agreed that NHA will not replace or dismiss the current BMU members until their skills are transferred to new BMU members.

## **6. Target staff of activity 2-1 & 2-2**

The 1st Master Trainer's (MT) Training was conducted for 65 participants at HTRC from February to March, 2017. OJT has not been implemented because of the BMS organization was not formed and MTs could not be selected.

JICA requested NHA to continuously employ the Trainee Engineers (inspectors) from the viewpoint of sustainable BMS.

Both sides mutually agreed to hire 12 Inspectors for the period of 1 year to inspect the structures in the model area. NHA will continue their services upon the expiry of their contracts as required.

JICA requested NHA to assign BMU staff in Regional Offices and Maintenance Units in the model area for the purpose of sustainable BMS in NHA.

Both sides confirmed that it was essential for BMU in NHA to train up BMS staff (formerly-considered Master Trainer) in Regional Offices. And NHA committed to gradually assign BMS staff in Regional Offices and Maintenance Units in the model area.

## **7. Equipment**

Both sides agreed that Equipment supply by JICA would exclude detectors for Crack Depth, Rebar Arrangement, Rebar & Cover and Rebar Corrosion as well as Server and Terminals for Database & BMS.

## **8. Master Trainer**

BMU tentatively takes the roles to supervise inspection and to review evaluation in the model area (Punjab North).

NHA will assign BMS staff (formerly-considered Master Trainer) in each Regional Office for BMS implementation in addition to current BMU.

## **9. Project Schedule**

Commencement of the Project was in July 2016 and completion of the Project was initially December 2018. Both sides agreed to extend the Project duration until April 2019. And JICA need administrative procedures for almost 3 months, therefore project activities should be ended by December, 2018.

|   | <b>Action</b>                           | <b>Responsibility</b> | <b>Timeline</b>  | <b>Target</b>            |
|---|---|-----------------------|--|--------------------------|
| 1 | Inventory Survey in model area          | Inspectors            | 22 February to 12 <sup>th</sup> April, 2018            | 250 Bridges and Culverts |
| 2 | Bridge Inspection Manuals               | BMU / Experts         | By the end of April, 2018                              |                          |
| 3 | Bridge Inspection Training and Planning | BMU / Experts         | 16 <sup>th</sup> April to 20 <sup>th</sup> April, 2018 | 1 Bridges and 1 Culvert  |
| 4 | Bridge Inspection in model area         | Inspectors            | May to August, 2018                                    | 36 Bridges + 5 Culverts  |
| 5 | Bridge Inspection Evaluation            | BMU / Experts         | September, 2018  |                          |
| 6 | Input and Run BMS trial and error       | BMU / Experts         | October to November, 2018                              |                          |
| 7 | Final Dispatch of the Experts           | -                     | December, 2018   |                          |

Both sides agreed that implementation of Activity 2-1, 2-2 and 2-3, which are bridge inspection, bridge repair method selection, data input to a bridge inspection database and training necessary for such activities, will be preferably scheduled to avoid the flood season, from July to September, and Ramadan for smooth and effective implementation of the Activities.

Both sides agree to complete Activity 2-2 and 2-3 in following schedule;

- 1) Inventory Survey Training                      Completed in February, 2018
- 2) Inventory Survey in model area              by the end of April, 2018
- 3) Bridge Inspection Training                    16<sup>th</sup> April to 20<sup>th</sup> April, 2018
- 4) Bridge Inspection in model area              by the end of August, 2018

## **10. Training in Japan**

During the Second Detailed Planning Survey, the Japanese side took note of the request from NHA for trainings in Japan as a component of the Project.

The first training in Japan was carried out for the 2 engineers in Road Asset Management Division (RAMD) in January, 2017. The second training in Japan is canceled because of no eligible person (candidate). JICA will review necessity of further trainings in Japan to achieve the project purpose during the implementation of the Project



## **11. Sustainability of the Bridge Maintenance in NHA**

JICA requested NHA to continue bridge maintenance cycle in systematic, programmatic and responsive way after the Project completion. In this connection, followings should be prepared.

### **(1) Nationwide implementation of BMS**

As short-term plan is in execution, meanwhile timeline for nationwide implementation of BMS should be confirmed by NHA.

### **(2) Standard Operating Procedures (SOP)**

For successful implementation of BMS in NHA, SOP is required to be prepared which must clearly define roles and responsibilities of each individual under BMS organization. In addition, 3 manuals (Bridge Inspection, Repair, and Data Input) including SOP are to be approved by the NHA Executive Board.

### **(3) Composite Schedule of Rates (CSR)**

The Bridge/Culvert Repair Manual does not have CSR and it is necessary to be included before finalization of repair manual. NHA must assign this task to its quantity estimator or related person as BMU does not have any such information.

Annex 1 : The draft of the amendment of the Project Design Matrix (PDM)

Annex 2 : The draft of revised PDM

Annex 3 : Plan of Operation (PO)

Annex 4 : Minutes of Meetings at JICA Headquarters (signed November 10<sup>th</sup>, 2017)

## The draft of the amendment of the Project Design Matrix (PDM)

### (1) Overall Goal

| Before   | Amended Version   |
|--|---|
| <b>Overall Goal</b>  |   |
| Bridge maintenance status improved on the bridges of National Highways in Pakistan.  | Bridge maintenance status improved on the bridges of National Highways <u>in the model area</u> .   |
| <p>Reason:</p> <p>The concept of the model area was confirmed in the meeting at JICA HQ on November 10<sup>th</sup>, 2017. Considering 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. Overall goal should be scaled down to a realistic scope.</p> <p>The model area means jurisdiction of Rawalpindi MU and Wazirabad MU in Punjab North.</p> |   |
| <b>Objectively Verifiable Indicators</b>   |   |
| Based on the bridge data, the number of bridge structures in the worst condition has decreased by one-third in [January, 2022] from the start of the Project.  | <ol style="list-style-type: none"> <li>1) The bridges identified in the maintenance plan prepared under the Project are maintained and repaired according to the plan.</li> <li>2) In the model area, more than [65] bridges are annually inspected and the bridge maintenance plan is annually revised.</li> </ol> |
| <p>Reason:</p> <p>We defined improvement of maintenance status as sustainable revision of bridge maintenance plan and repair of identified bridges according to the plan.</p>  |   |
| <b>Means of Verification</b>   |   |
| Output data of the BMS   | <ol style="list-style-type: none"> <li>1) Inspection and maintenance record in the BMS</li> <li>2) Bridge maintenance plan</li> </ol>   |
| <p>Reason:</p> <ol style="list-style-type: none"> <li>1) Specify the types of the BMS outputs</li> <li>2) "Bridge maintenance plan" is added from the viewpoint of BMS sustainability in NHA.</li> </ol>   |   |
| <b>Important Assumption</b>  |   |
| <ul style="list-style-type: none"> <li>· Copyright of software (source code)</li> <li>· Availability of optimum maintenance budget.</li> <li>· Continuous update of bridge data</li> </ul>   | <ol style="list-style-type: none"> <li>1) Availability of optimum maintenance budget.</li> <li>2) Continuous update of bridge data</li> </ol>   |
| <p>Reason:</p> <p>Added to achieve Overall Goal.</p> <p>Budget allocation, which is affected by policy priority and major disasters, is the most critical constraint for bridge improvement.</p>   |   |

(2)Project Purpose

| Before   | Amended Version   |
|--|---|
| <b>Project Purpose</b>   |   |
| Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of entire NHA Network.   | Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of the model area.  |
| Reason:<br>The concept of the model area was confirmed in the meeting at JICA HQ on November 10 <sup>th</sup> , 2017. Considering number of bridges of entire NHA network, inspection of the nation-wide bridges during the project period is too ambitious to be the project purpose. |   |
| <b>Objectively Verifiable Indicators</b>   |   |
| Bridge maintenance budget document with breakdowns prepared by [September, 2018].  | Bridge maintenance budget document with breakdowns for the model area prepared by [December, 2018].   |
| Reason:<br>The concept of the model area was confirmed in the meeting at JICA HQ on November 10 <sup>th</sup> , 2017.  |   |
| <b>Means of Verification</b>   |   |
| Analysis of complete input data to BMS and bridge maintenance budget document (with anticipated budget requirement for forthcoming years)  | Analysis of <u>the model area</u> input data to BMS and bridge maintenance budget document (with anticipated budget requirement for forthcoming years)                        |
| Reason:<br>The concept of the model area was confirmed in the meeting at JICA HQ on November 10 <sup>th</sup> , 2017.  |   |
| <b>Important Assumption</b>  |   |
|  | 1) NHA arranges adequate human resources for BMS implementation.<br>2) NHA allocates enough budget to maintain and repair prioritized bridges in the annual maintenance plan. |
| Reason:<br>Added to achieve Overall Goal   |   |

(3)Outputs

1) Output1

| Before   | Amended Version  |
|--|--|
| <b>Output 1</b>  |  |
| Manuals, Database and BMS developed for bridge inspection and bridge repair <u>method selection</u>  | Manuals, Database and BMS developed for bridge inspection and bridge repair  |
| Reason: Rename according to practice   |  |
| <b>Objectively Verifiable Indicators</b>   |  |
| 1-1. Draft manuals for (1) bridge/culvert inspection, (2) bridge repair <u>method selection</u> by [December, 2016] and draft manual for (3) data input to <u>Database &amp; BMS</u> developed by [December, 2017].  | 1-1.Draft manuals for (1) bridge inspection by [December, 2016], for (2) bridge repair by [December, 2016] and for (3) data input developed by [December, 2017]  |
| 1-4. 2 types of draft training materials <u>for the master trainers</u> for (1) bridge/culvert inspection and (2) bridge repair <u>method selection</u> developed by [December, 2016].   | 1-4. 2 types of draft training materials for (1) bridge/culvert inspection and (2) bridge repair developed by [December, 2016].  |
| Reason: Rename according to practice   |  |
| <b>Activities</b>  |  |
| <p>1-1. Develop 3 types of draft manuals i.e. (1) bridge/culvert inspection, (2) bridge repair method selection and (3) data input to Database.</p> <p>1-2. Develop draft bridge/culvert inspection formats.</p> <p>1-3. Develop prototype Database &amp; BMS.</p> <p>1-4. Develop 2 types of draft training materials for training i.e. (1) bridge/culvert inspection and (2) bridge repair method selection.</p> <p>1-5. Review and finalize the above 3 types of manuals (Activity 1-1), inspection formats (Activity 1-2), prototypes (Activity 1-3) and 2 types of training materials (Activity 1-4).</p> | <p>1-1 <u>JICA Expert Team</u> develops draft manuals for (1) bridge inspection, (2) bridge repair and (3) data input.</p> <p>1-2 <u>JICA Expert Team</u> develops draft bridge/culvert inspection formats.</p> <p>1-3 <u>JICA Expert Team</u> develops Prototype Bridge Inspection Database &amp; BMS.</p> <p>1-4 <u>JICA Expert Team</u> develops draft training materials for (1) bridge inspection and (2) bridge repair.</p> <p>1-5 <u>BMU</u> reviews and finalizes the above manuals, inspection formats, prototype and training materials.</p> |
| Reason:<br>Clarify the practitioner in charge.<br>Rename according to practice.  |  |

2) Output2

| Before  | Amended Version  |
|---|--|
| <b>Output 2</b>   |  |
| Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and bridge repair method selection of uniformed contents implemented on all the bridges of National Highways in Pakistan.   | Bridge inspection in the model area is implemented after BMS training.   |
| Reason:<br>Clarify the practitioner in charge.<br>Simplify the expression.  |  |
| <b>Objectively Verifiable Indicators</b>  |  |
| <p>2-1. 3 Master Trainers' training for (1) bridge/culvert inspection and (2) bridge repair method selection implemented by [March 2017], and (3) data input to Database implemented by [September, 2018].</p> <p>2-2. 3 types of training (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database) implemented by Master Trainers (trained in Activity 2-1) to all field staff by [November, 2017].</p> <p>2-3. Bridge/culvert inspection, bridge repair method selection, and data input to Database completed for all NHA bridges by [June, 2018].</p> <p>2-4. 90% or more results of bridge repair method selection and data input to a bridge inspection database by the staff of MUs evaluated to be accurate by NHA's HO &amp; JICA Experts by [October, 2018].</p> <p>2-5. Certification of master trainers after training by JICA experts (scoring more than 80% in capacity test).</p> | <p>2-1 On-the-job-training (OJT) by JICA Expert Team which enables BMU to manage BMS in NHA by [December, 2018].</p> <p>2-2 Inventory Survey, Bridge Inspection and Data Input Training for NHA engineers.</p> <p>2-3 Bridge/culvert inspection, bridge repair method selection, and data input to Database completed in the model area including the representative [36] bridges and [5] culverts by [October, 2018].</p> <p>2-4 The results of bridge repair method selection and data input to a bridge inspection evaluated to be accurate by BMU &amp; JICA Expert Team by [October, 2018].</p> |
| Reason:<br>Clarify the practitioner in charge.<br>2-1: Training target from Master Trainer to Bridge Management Unit.<br>2-2: Definition of BMS Training<br>2-3: Definition of OJT<br>2-4: Non availability of adequate MU staff<br>2-5: Deleted because of no Certified Master Trainer   |  |

| <b>Means of Verification</b>   |   |
|--|---|
| 2-3. Completed bridge inspection formats and input data to a bridge inspection database  | 2-3 Bridge inspection data of the model area including the representative [36] bridges and [5] culverts in Bridge Inspection Database.  |
| Reason:<br>Focus on the model area.<br>Registered data in Bridge Inspection Database instead of the formats and input data.  |   |
| <b>Activities</b>  |   |
| 2-1. Implement 3 types of master trainer's training for the staff of NHA's HQ and ROs at the target bridges (for (1) bridge /culvert inspection, (2) bridge repair method selection, and (3) data input to Database).<br>2-2. Implement 3 types of OJT for the field staff by Master Trainers (trained in Activity 2-1), (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) inspection data input to Database.<br>2-3. Implement (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database for all the bridges/culverts, by field staff (trained in Activity 2-1 & 2-2). | 2-1 <u>JICA Expert Team</u> provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.<br><br>2-2 <u>BMU</u> implements BMS training (Inventory Survey Training and Bridge Inspection Training).<br><br>2-3 Inventory Survey and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training<br><br>2-4 JICA Expert Team reviews inspection results and ability, and advises BMU staff to enhance their capacity. |
| Reason:<br>Clarify the practitioner in charge.<br>Simplify the expression.<br>2-4: Added in order to make capacity building in NHA more fruitful.  |   |

### 3) Output3

| Before   | Amended Version   |
|--|---|
| <b>Output 3</b>  |   |
| 3. Data on all the bridges of National Highways in Pakistan input by MUs to Database available to NHA's HQ and ROs.  | 3. Bridge data of the model area is available with BMU at NHA headquarters and bridge maintenance plan is prepared according to the data.   |
| Reason:<br>Clarify the practitioner in charge.<br>Database will be available only in HQ for the time being.  |   |
| <b>Objectively Verifiable Indicators</b>   |   |
| 3-1. Training for management of BMS implemented by [December, 2017].<br>3-2. Data on all the bridges of National Highways in Pakistan input to Database by [October, 2018].<br>3-3. Cost estimate necessary for bridge maintenance in the fiscal year of 2019 based on BMS.  | 3-1 BMS Software Training for BMU by [December, 2018].<br>3-2 Analysis of Bridge Inspection Data of the model area using BMS Software.<br>3-3 Bridge maintenance plan with repair methods and cost estimate for 41 bridges and culverts is formulated.  |
| Reason:<br>Simplify and correct expression.  |   |
| <b>Means of Verification</b>   |   |
| 3-1. Training records and report<br>3-2. Training records and report<br>3-3. Input data to Database  | 3-1 Record of BMS Software Training<br>3-2 Output data of BMS (Prioritization)<br>3-3 Bridge maintenance plan   |
| Reason:<br>Not input data, but output data of BMS analysis.  |   |
| <b>Activities</b>  |   |
| 3-1. Implement training for NHA HQ regarding management of BMS (software and database).<br>3-2. Monitor bridge data input by NHA staff (Activity 2-3) to Database, and data transfer to BMS by HQ RAMD (Road Asset Management Department) staff.<br>3-3. Prepare the annual bridge/culvert maintenance plan including estimated budget for 2019 based on the data transferred to BMS (Activity 3-2). | 3-1 <u>JICA Expert Team</u> implements BMS Software Training for BMU.<br>3-2 <u>BMU analyzes Bridge Inspection Data of the model area using BMS Software.</u><br>3-3 <u>BMU prepares the annual bridge/culvert maintenance plan and schedule including budget estimation based on the analysis of registered data in Bridge Inspection Database</u> |
| Reason:<br>Clarify the practitioner in charge.   |   |

4) Important Assumption for Outputs

| Before   | Amended Version  |
|--|--|
| <b>Important Assumption</b>  |  |
| <p>BMS is continuously in use by NHA for preparation of bridge maintenance plan.</p>   | <p>BMS is continuously in use by NHA for preparation of bridge maintenance plan.</p> <p>BMU (Bridge Management Unit) is established in NHA headquarters.</p> <p>BMS organization and BMS staff are established in NHA, who will implement BMS in a sustainable manner.</p> |
| <p>Reason:<br/>                     BMU is necessary in Activity 1-5 and to achieve project purpose.<br/>                     BMS staff necessary to achieve Project Purpose</p> |  |



(4)Inputs

1) Inputs (Japanese side)

| Before  | Amended Version   |
|---|---|
| <b>2. Equipment</b>   |   |
| (subject to changes)<br>Non-destructive testing equipment such as<br>· Crack Scale & Test Hammer<br>· Concrete Compression Strength<br>· <u>Crack Depth</u><br>· <u>Rebar Arrangement</u><br>· <u>Rebar &amp; Cover</u><br>· <u>Rebar Corrosion</u><br>· Carbonation<br>· <u>Server (and Terminals) for Database &amp; BMS</u><br>(Numbers and specifications will be determined through mutual consultations between JICA and NHA during the implementation of the Project as necessary) | (subject to changes)<br>Non-destructive testing equipment such as<br>· Crack Scale & Test Hammer<br>· Concrete Compression Strength<br><br>· Carbonation<br><br>(Numbers and specifications will be determined through mutual consultations between JICA and NHA during the implementation of the Project as necessary) |
| Reason:<br>Both sides agreed that Equipment supply by JICA would exclude detectors for Crack Depth, Rebar Arrangement, Rebar & Cover and Rebar Corrosion as well as Server and Terminals for Database & BMS.  |   |

2) Inputs (Pakistani side)

| Before  | Amended Version  |
|---|--|
| <b>1. Personnel</b>   |  |
| Administrative Personnel<br>1) Person in Charge:<br>Member (Planning)<br>2) Project Manager:<br>General Manager (RAMD)<br>3) Member<br>Director (Design)<br>Counterpart Personnel<br>1) Project Coordinator:<br>Deputy Director (BMS)<br>2) Assistant Project Coordinator:<br><u>Assistant Director (BMS)</u> | Administrative Personnel<br>1) Person in Charge:<br>Member (Planning)<br>2) Project Manager:<br>General Manager (RAMD)<br>3) Member<br>Director (Design)<br>Counterpart Personnel<br>1) Project Coordinator:<br>Deputy Director I (BMU)<br>Deputy Director II (BMU)<br>Deputy Director III (BMU) |
| Reason:<br>Assistant Director (BMS) has never been assigned since the beginning of the Project. BMU is considered as the key persons in NHA BMS and should attend JCC.  |  |

(5)Pre-Conditions

| Pre-Conditions  | Amended Version   |
|---|---|
| Pre-Conditions  |   |
| <ul style="list-style-type: none"><li>· The participants for training by JICA experts (Activity 2-1) must have at least 15 years of remaining service period in NHA.</li><li>· Pakistan, especially Islamabad and Lahore, is continuously safe enough for JICA Experts to implement the activities.</li></ul> | (delete)<br><br><ul style="list-style-type: none"><li>· Pakistan, especially Islamabad and Lahore, is continuously safe enough for <u>JICA Expert Team</u> to implement the activities.</li></ul> |
| Reason:<br>Internal issues in NHA<br>Unification of terms   |   |

This amendment will become effective as of April, 12, 2018.

## Annex2 The draft of revised PDM

**Project Title:** The Project for Technical Assistance on Implementation of Bridge Management System in NHA

**Implementing Agency:** National Highway Authority

**Target Group:**

**Period of Project:** July, 2016 – April, 2019 (34 months)

**Project Site:** in/around Islamabad, Pakistan

**Model Site:** Jurisdiction of Rawalpindi MU and Wazirabad MU in Punjab North

Version 5

Dated 11, April, 2018

| Narrative Summary  |   | Objectively Verifiable Indicators  | Means of Verification   | Important Assumption | Achievement | Remarks  |
|--|---|--|---|----------------------|-------------|--|
| <b>Overall Goal</b><br>Bridge maintenance status improved on the bridges of National Highways in the model area.                       | <ol style="list-style-type: none"> <li>The bridges identified in the maintenance plan prepared under the Project are maintained and repaired according to the plan.</li> <li>In the model area, more than [65] bridges are annually inspected and the bridge maintenance plan is annually revised.</li> </ol>   | <ol style="list-style-type: none"> <li>Inspection and maintenance record in the BMS</li> <li>Bridge maintenance plan</li> </ol>  | <ol style="list-style-type: none"> <li>Availability of optimum maintenance budget.</li> <li>Continuous update of bridge data</li> </ol>   |                      |             | The model area means jurisdiction of Rawalpindi MU and Wazirabad MU in Punjab North. |
| <b>Project Purpose</b><br>Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of the model area. | Bridge maintenance budget document with breakdowns for the model area prepared by [December, 2018].   | Analysis of the model area input data to BMS and bridge maintenance budget document (with anticipated budget requirement for forthcoming years)  | <ol style="list-style-type: none"> <li>NHA arranges adequate human resources for BMS implementation.</li> <li>NHA allocates enough budget to maintain and repair prioritized bridges in the annual maintenance</li> </ol>   |                      |             |  |
| <b>Outputs</b><br>1. Manuals, Database and BMS developed for bridge inspection and bridge repair                                       | <ol style="list-style-type: none"> <li>1-1 Draft manuals for (1) bridge inspection by [December, 2016], for (2) bridge repair by [December, 2016] and for (3) data input developed by [December, 2017]</li> <li>1-2. Draft bridge/culvert inspection formats developed by [December, 2016].</li> <li>1-3. Prototype Database developed by [July, 2017], and prototype BMS by [December, 2017].</li> <li>1-4. 2 types of draft training materials for the master trainers for (1) bridge/culvert inspection and (2) bridge repair method selection developed by [December, 2016].</li> </ol> | <ol style="list-style-type: none"> <li>1-1. 3 types of draft manuals</li> <li>1-2. Draft bridge/culvert inspection formats</li> <li>1-3. Prototype Database &amp; BMS</li> <li>1-4. 2 types of draft training materials</li> </ol> | <ul style="list-style-type: none"> <li>BMS is continuously in use by NHA for preparation of bridge maintenance plan.</li> <li>BMU (Bridge Management Unit) is established in NHA headquarters.</li> <li>BMS organization and BMS staff are established in NHA, who will implement BMS in a sustainable manner.</li> </ul> | Completed            | Completed   | Completed  |

|  |  |  |   |  |
|--|--|--|---|--|
| <p>2. Bridge inspection in the model area is implemented after BMS training.</p>                         | <p>1-5. Manuals (1-1), formats (1-2), Database &amp; BMS (1-3), and training materials (1-4) finalized by [September, 2018].</p> <p>2-1 On-the-job-training (OJT) by JICA Expert Team which enables BMU to manage BMS in NHA by [December, 2018].</p> <p>2-2 Inventory Survey, Bridge Inspection and Data Input Training for NHA engineers.</p> <p>2-3 Bridge/culvert inspection, bridge repair method selection, and data input to Database completed in the model area including the representative [36] bridges and [5] culverts by [October, 2018].</p> <p>2-4. The results of bridge repair method selection and data input to a bridge inspection evaluated to be accurate by BMU &amp; JICA Expert Team by [October, 2018].</p> <p>3-1 BMS Software Training for BMU by [December, 2018].</p> <p>3-2 Analysis of Bridge Inspection Data of the model area using BMS Software.</p> <p>3-3 Bridge maintenance plan with repair methods and cost estimate for 41 bridges and culverts is formulated.</p> | <p>1-5. 3 types of manuals, bridge/culvert inspection formats, Database &amp; BMS, and 2 types of training materials</p> <p>2-1. Training records and reports</p> <p>2-2. Training records and reports</p> <p>2-3 Bridge inspection data of the model area including the representative [36] bridges and [5] culverts in Bridge Inspection Database.</p> <p>2-4. Input data to Database and its evaluation</p> <p>3-1. Record of BMS Training</p> <p>3-2 Output data of the BMS (Prioritization)</p> <p>3-3. Bridge maintenance plan</p> | <p>Currently under revision</p> <p>(1) &amp; (2) completed</p> <p>Inventory Survey Training was held on February 1.</p> <p>Bridge Inspection Training is scheduled between April 16 and 20.</p> | <p>Definition of Master Trainer / Certified Master Trainer /</p> |
| <p>3. Bridge data of the model area is available with BMU at NHA headquarters and bridge maintenance</p> |  |  | <p>Not yet</p> <p>Not yet</p> <p>Not yet</p>  |  |

| Activities  | Inputs   | The Japanese Side  | The Pakistani Side  | Pre-Conditions |
|---|--|--|---|----------------|
| <p>1-1. JICA Expert Team develops draft manuals for (1) bridge inspection, (2) bridge repair and (3) data input.</p> <p>1-2. JICA Expert Team develops draft bridge/culvert inspection formats.</p> <p>1-3. JICA Expert Team develops Prototype Bridge Inspection Database &amp; BMS.</p> <p>1-4. JICA Expert Team develops draft training materials for (1) bridge inspection and (2) bridge repair.</p> <p>1-5. BMU reviews and finalizes the above manuals, inspection formats, prototype and training materials.</p> <p>2-1 JICA Expert Team provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.</p> <p>2-2 BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training) .</p> <p>2-3 Inventory Survey and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.</p> <p>2-4 JICA Expert Team reviews inspection results and ability, and advises BMU to enhance their capacity.</p> <p>3-1 JICA Expert Team implements BMS Software Training for BMU.</p> <p>3-2 BMU analyzes Bridge Inspection Data of the model area using BMS Software.</p> <p>3-3 BMU prepares the annual bridge/culvert maintenance plan and schedule including budget estimation based on the analysis of registered data in Bridge Inspection Databases.</p> | <p><b>Inputs</b></p> <p><b>The Japanese Side</b></p> <p>1. EXPERTS</p> <ul style="list-style-type: none"> <li>1) Bridge Inspection Expert</li> <li>2) Bridge Repair Expert</li> <li>3) BMS Expert</li> <li>4) Capacity Development Expert</li> <li>5) Project Monitoring Expert</li> <li>6) Local Coordinator (Pakistani)</li> </ul> <p>2. <b>EQUIPMENT</b> (subject to changes)</p> <p>Non-destructive testing equipment such as</p> <ul style="list-style-type: none"> <li>· Crack Scale &amp; Test Hammer</li> <li>· Concrete Compression Strength</li> <li>· Carbonation</li> </ul> <p>(Numbers and specifications will be determined through mutual consultations between JICA and NHA during the implementation of the Project as necessary)</p> | <p><b>The Pakistani Side</b></p> <p>1. PERSONNEL</p> <p>Administrative Personnel</p> <ul style="list-style-type: none"> <li>1) Person in Charge: Member (Planning)</li> <li>2) Project Manager: General Manager (RAMD)</li> <li>3) Member Director (Design)</li> </ul> <p>Counterpart Personnel</p> <ul style="list-style-type: none"> <li>1) Project Coordinator: Deputy Director I (BMU)</li> <li>Deputy Director II (BMU)</li> <li>Deputy Director III (BMU)</li> </ul> <p>2. OFFICE &amp; FACILITIES</p> <ul style="list-style-type: none"> <li>· Office for JICA Experts in NHA's HQ Building with office furniture, internet and telephone.</li> </ul> <p>3. ARRANGEMENT</p> <ul style="list-style-type: none"> <li>· Training Arrangements</li> <li>· Transportation for the field trips of JICA Experts in/around Islamabad.</li> </ul> <p>4. BUDGET ALLOCATION</p> <p>Budget for traveling and accommodation expenses of the training participants.</p> | <p>Pakistan, especially Islamabad and Lahore, is continuously safe enough for JICA Expert Team to implement the activities.</p> <p>&lt;Issues and countermeasures&gt;</p> <p>Standard Operation Procedure (SOP) related to bridge maintenance is need to be built up.</p> |                |





**THE PROJECT FOR TECHNICAL ASSISTANCE ON IMPLEMENTATION OF  
BRIDGE MANAGEMENT SYSTEM IN NHA**

**MINUTES OF MEETINGS  
OF  
MEETING AT JICA HEADQUARTERS**

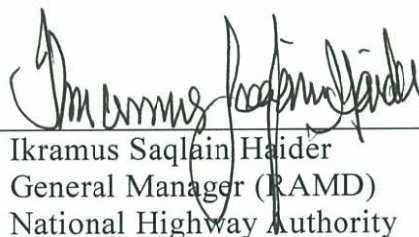
The meeting of “the Project for Technical Assistance on Implementation of Bridge Management System in NHA (hereinafter referred to as the “Project”)” was held on 10<sup>th</sup> of November 2017 at JICA Headquarters with attendance of the representatives of the National Highway Authority (hereinafter referred to as “NHA”), Japan International Cooperation Agency (hereinafter referred to as “JICA”) and members of the JICA Expert Team (hereinafter referred to as the “Expert Team”) to discuss the organization including human resources to be appointed for the Project.

As a result of the discussions, the details are shown as follows, that were mutually accepted by attendees.

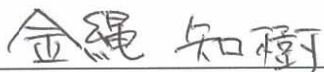
Tokyo, 10<sup>th</sup> November, 2017



Asim Amin  
General Manager (Design)  
National Highway Authority



Ikramus Saqlain Haider  
General Manager (RAMD)  
National Highway Authority



Tomoki KANENAWA  
Director  
Team1, Transportation and ICT Group  
Infrastructure and Peacebuilding  
Department  
JICA



Yukio IGO  
Project Manager/Bridge Inspection  
JICA Expert Team



Subject: **MINUTES OF MEETING**  
**The Project for Technical Assistance on Implementation of Bridge Management System (BMS) in NHA**

1. A meeting was held on 10<sup>th</sup> November 2017 at JICA Headquarters, Japan to discuss the issues pertaining to Technical Assistance on Implementation of Bridge Management System (BMS) in National Highway Authority Pakistan. Following have attended the meeting:

**National Highway Authority**

- |      |                        |   |
|------|------------------------|---|
| i.   | Shahid Ashraf Tarar    | Chairman NHA  |
| ii.  | Raja Nowsherwan        | Member (Planning)                                     |
| iii. | Asim Amin              | General Manager (Design)                              |
| iv.  | Ikramus Saqlain Haider | General Manager (RAMD)                                |
| v.   | Mirza Salman Babar Beg | Deputy Chief of Mission, Embassy of Pakistan in Japan |

**Japan International Cooperation Agency (JICA) Officials, JICA HQ**

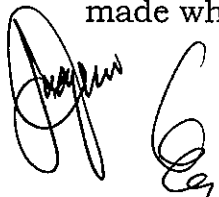
- |      |                    |   |
|------|--------------------|---|
| i.   | Tomoki Kanenawa    | Director, Team1, Transportation and ICT Group Infrastructure and Peacebuilding Department |
| ii.  | Masahiro Suzuki    | Assistant Director, South Asia Division-2 (Pakistan/Afghanistan), South Asia Department   |
| iii. | Nobuyuki Tsuneoka  | Senior Advisor  |
| iv.  | Kazunobu Takahashi | Team1, Transportation and ICT Group Infrastructure and Peacebuilding Department           |
| v.   | Naila Almas        | Senior Program Officer, JICA Pakistan Office  |

**Japan International Cooperation Agency (JICA) Expert Team**

- |      |                |  |
|------|----------------|--|
| i.   | Yukio Igo      | Project Manager/Bridge Inspection Expert |
| ii.  | Haruo Tomiyama | Capacity Development Expert              |
| iii. | Kotoko Yoneda  | Program Coordinator Expert               |

2. During the meeting, JICA Expert deliberated on the concept of Technical Assistance for establishment of Bridge Management System (BMS), what are the current challenges, what is the future strategy and current organizational structure required for running of BMS in NHA.

3. Chairman NHA agreed with the suggestions made by the JICA Expert Team and ensured full support for the BMS concept and confirmed that NHA will provide the necessary organizational structure required for running BMS in NHA. Following points were discussed and deliberated at length and decisions were made which are:



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| Sr. No. | Matter Discussed   | Action to be Taken by   |
|---------|--|---|
| i.      | NHA will arrange the below mentioned organization for BMS by 1 <sup>st</sup> December 2017:  |   |
|         | a. 03 x engineers at Bridge Management Unit (hereinafter referred to as "BMU") in NHA HQ. The engineers for BMU will be selected from the candidates of Certified Master Trainers and will work dedicatedly for BMU.   | Member (Planning) and GM (RAMD) to get 03 x Engineers placed in BMU after approval of Chairman NHA.   |
|         | b. 12 x Inspectors to begin with the inspection of model area.<br><br>Chairman NHA agreed with the concept that Yes we will do a short-term model section analysis for which Punjab-North was agreed as the candidate region. It was further agreed that 12 x trainee engineers already working on different NHA projects will be selected and placed in BMU to work as Inspector for short-term data collection team. | Member (Planning) and GM (RAMD) to get 12 x trainee engineers selected and placed in BMU as inspectors for short-term model section analysis. |
|         | c. Chairman NHA also directed that complete network analysis cannot be ignored and after three to four months time, 01 x Assistant Director and 01 x Inspector (one team) per two contiguous maintenance units will be placed. This arrangement will be further strengthened after availability of more human resource.  | Member (Planning) and GM (RAMD) to get 01 x Assistant Director and 01 x Inspector (one team) per two contiguous maintenance units.            |
| ii.     | The Expert Team will inform NHA about the specifications of the required server for BMS, and NHA will confirm the availability of their current server or otherwise NHA will request JICA Expert Team to provide a server for the assignment.  | JICA Expert Team  |

4. The meeting ended with vote of thanks to JICA for arranging such a great educational / informative visit to Japan which enabled NHA officials to acquire knowledge of BMS best practices.

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# The project for technical assistance on implementation of Bridge Management System in NHA

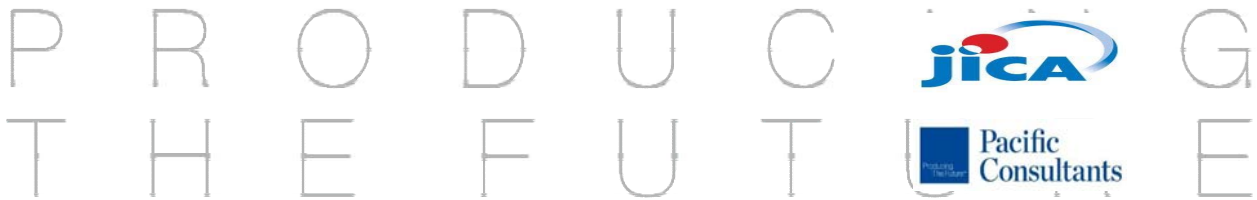
## JCC-5

### Joint Coordination Committee

April 11<sup>th</sup> 2018

at

Auditorium NHA HQ Islamabad



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### History of JCC Meetings

#### 1st JCC Meeting

Date: July 29<sup>th</sup> ,2016

- JICA Experts Team presented the whole plan of executing the project.
- Project Design Matrix (PDM) and Plan of Operation (PO) was approved.

#### 3rd JCC Meeting

Date: July 12<sup>th</sup> , 2017

- Causes of delay and risks and their solutions were discussed.
- The main reason was shortage of human resources.

#### 2nd JCC Meeting

Date: December 9<sup>th</sup> , 2016

- Decision about new BMS Software was approved.
- List of NDT Equipment was presented.
- 1st MT Training schedule and contents were discussed
- PDM related to new BMS was revised

#### 4th JCC Meeting

Date: December 13<sup>th</sup> , 2017

- JICA Expert Team suggested about BMS organization of NHA .(Long-term vision and Short-term vision)
- JICA, JICA Expert Team and Chairman agreed about BMS organization.

# Opening Remarks

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## Contents

|                                        |
|----------------------------------------|
| 1-Progress of Activities               |
| 2-Record of Discussions of the Project |
| 3-Main Points Discussed                |
| 4-Vision for BMS by NHA                |
| 5-Discussion about Brochure            |
| 6-Others                               |

4

# 1-Progress of Activities

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## 1-1.Progress of Inputs

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### **a)JICA Experts Team**

- After JCC-4, BMU organized in NHA.JICA experts team progress with BMS staff.
- We gave Inventory survey training materials for BMS staff.
- We have revised the Bridge Inspection manual and the Bridge Repair manual with BMS staff.

### **b)Counterpart**

#### **1) Organizing BMU**

- Mr. Ghulam Murtaza Simair has been on duty since January 1st.
- Mr. Sohaib Mansoor has been on duty since January 16th.
- Mr. Muhammad Asif Azam has been on duty.

2 BMUs have been collaborating with JICA Expert Team in the project room (317) since January 16th.

#### **2) Bridge Inspector**

- For 10 Trainee Engineers and MU staff, Inventory Survey Training was held on February 1st, and Inventory Survey on-site Training was held on February 2nd.
- Inventory Survey started on February 23rd.Delay occurred due to official approval of TEs, equipment procurement, and transportation arrangement.

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## 1-1. Progress of Inputs

### (5) In-country Training

#### 1) Inventory Survey Training

- In office training on February 1st. → On-site training on February 2<sup>nd</sup>

<Attendees>

(NHA)

- Counterpart side : Member (Planning) 1 person、 BMU 3 persons
- Trainee Engineers : 11 persons
- MU : Wazirabad 4 persons  
Rawalpindi 2 persons
- Others : 1 persons

(JICA)

- JICA Expert Team : 2 persons

(Total)

- Total : 24 persons



Figures: Inventory Survey Training (in office)



Figures: Inventory Survey Training (on site) 7

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## 1-1. Progress of Inputs

### 2) Supplementary Inventory Survey Training

- In office training on February 14th, for 20 minutes
- Mr. Murtaza (BMU) made supplementary explanation on dimension measurement, skewed angle, etc.

<Attendees>

(NHA)

- Counterpart side : BMU 1 person
- Trainee Engineers : 7 persons

(JICA)

- JICA Expert Team side : 2 persons

(Total)

- Total : 10 persons



Figures: Supplementary Inventory Survey Training (in office)

# Inventory Survey

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## Trainee Engineers

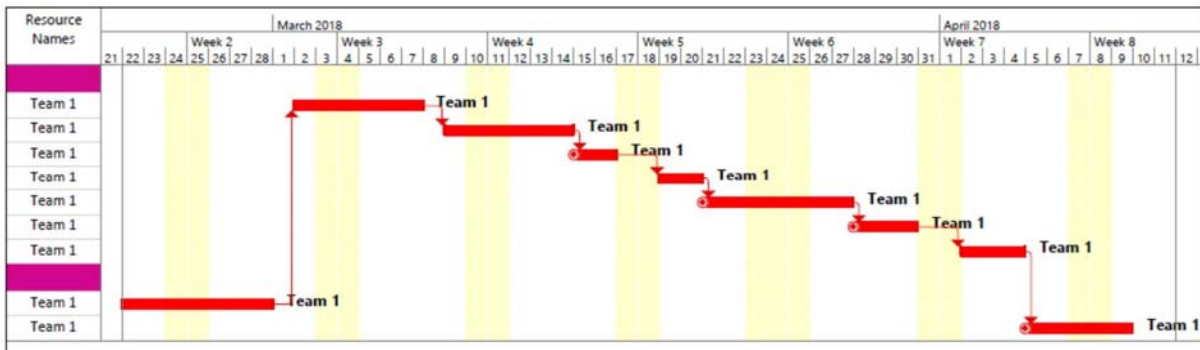
| Survey Team | Maintenance Unit | Trainee Engineers   | Contact Numbers |
|-------------|------------------|---------------------|-----------------|
| Team No.1   | LAHORE           | Safwan Naeem        | 03318727566     |
|             |                  | Ashar Tariq         | 03347721894     |
|             |                  | Shawez Hassan       | 03005093900     |
|             |                  | Imran               | 03127232007     |
| Team No.2   | WAZIRABAD        | Shahzeb Farooq      | 03235053321     |
|             |                  | Jawad Naeem         | 03455058505     |
|             |                  | Shahzeb Salim       | 03311160026     |
|             |                  | Akhunzada           |                 |
| Team No.3   | RAWALPINDI       | Abdur Rehman        | 03415179869     |
|             |                  | Ubaid               | 03325579996     |
|             |                  | Hussain Ahmed Abbas | 03353688147     |
|             |                  |                     |                 |

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## Team 1 (WZD-RWD)

| ID | Task Mode | Task Name                                                     | Bridges    | Culverts   | Duration | Start       | Finish      | Predecessors |
|----|-----------|---------------------------------------------------------------|------------|------------|----------|-------------|-------------|--------------|
| 1  | ?         | <b>WAZIRABAD MAINTENANCE UNIT</b>                             | <b>151</b> | <b>85</b>  |          |             |             |              |
| 2  | ?         | WZD-1: Narang Mandi More - Kala Shah Kaku (N5/M2 Interchange) | 14         | 0          | 4 days   | Fri 3/2/18  | Wed 3/7/18  | 18FS+1 day   |
| 3  | ?         | WZD-2: Kala Shah Kaku (N5/M2 Interchange) - Muridke           | 12         | 7          | 4 days   | Fri 3/9/18  | Wed 3/14/18 | 2FS+1 day    |
| 6  | ?         | WZD-5: Gujranwala Bypass                                      | 4          | 13         | 2 days   | Thu 3/15/18 | Fri 3/16/18 | 3            |
| 9  | ?         | WZD-8: Gujrat Bypass (End) - Lala musa                        | 6          | 7          | 2 days   | Mon 3/19/18 | Tue 3/20/18 | 6            |
| 10 | ?         | WZD-9: Lala musa - Kharian                                    | 14         | 4          | 4 days   | Wed 3/21/18 | Tue 3/27/18 | 9            |
| 11 | ?         | WZD-10: Kharian - Dina                                        | 11         | 2          | 3 days   | Wed 3/28/18 | Fri 3/30/18 | 10           |
| 12 | ?         | WZD-11: Dina - Missa Kassowal                                 | 12         | 0          | 3 days   | Mon 4/2/18  | Wed 4/4/18  | 11           |
| 13 | ?         | <b>RAWALPINDI MAINTENANCE UNIT</b>                            | <b>104</b> | <b>176</b> |          |             |             |              |
| 18 | ?         | RWD-5: Tarnol - Taxila                                        | 10         | 21         | 5 days   | Thu 2/22/18 | Wed 2/28/18 |              |
| 26 | ?         | RWD-13: Khunda More - Jand                                    | 3          | 22         | 3 days   | Thu 4/5/18  | Mon 4/9/18  | 12           |

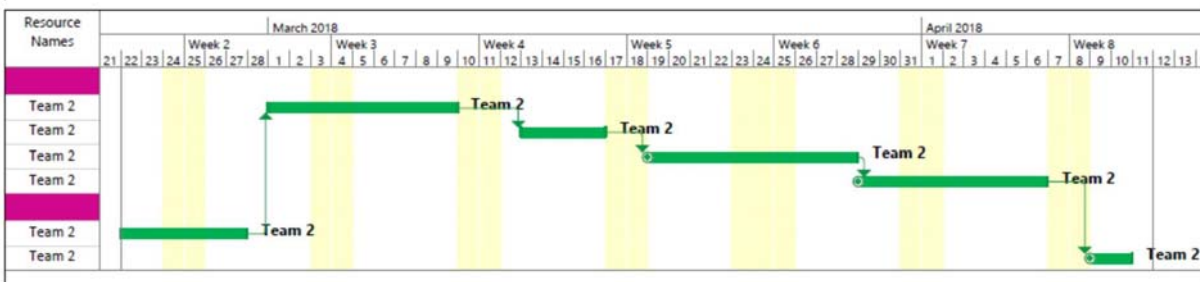


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## Team 2 (WZD-RWD)

| ID | Task Mode | Task Name                                                 | Bridges    | Culverts   | Duration | Start       | Finish      | Predecessors |
|----|-----------|-----------------------------------------------------------|------------|------------|----------|-------------|-------------|--------------|
| 1  | ?         | <b>WAZIRABAD MAINTENANCE UNIT</b>                         | <b>151</b> | <b>85</b>  |          |             |             |              |
| 4  | ?         | WZD-3: Muridke - Sadhoke                                  | 23         | 15         | 7 days   | Thu 3/1/18  | Fri 3/9/18  | 19FS+1 day   |
| 5  | ?         | WZD-4: Sadhoke - Chand Da Qila                            | 12         | 11         | 4 days   | Tue 3/13/18 | Fri 3/16/18 | 4FS+1 day    |
| 7  | ?         | WZD-6: Gujranwala Bypass (End) - Wazirabad Bypass (Start) | 22         | 10         | 7 days   | Mon 3/19/18 | Wed 3/28/18 | 5            |
| 8  | ?         | WZD-7: Wazirabad Bypass (Start) - Gujrat Bypass (End)     | 21         | 16         | 7 days   | Thu 3/29/18 | Fri 4/6/18  | 7            |
| 13 | ?         | <b>RAWALPINDI MAINTENANCE UNIT</b>                        | <b>104</b> | <b>176</b> |          |             |             |              |
| 19 | ?         | RWD-6: Taxila - Hassanabdal                               | 7          | 23         | 4 days   | Thu 2/22/18 | Tue 2/27/18 |              |
| 25 | ?         | RWD-12: Fatehjang - Khunda More                           | 0          | 20         | 2 days   | Mon 4/9/18  | Tue 4/10/18 | 8            |

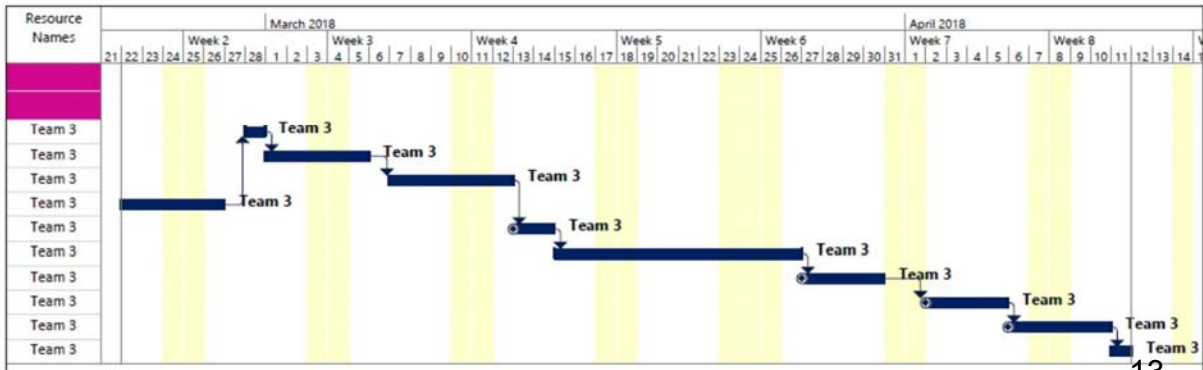


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| ID | Task Mode | Task Name                                                  | Bridges    | Culverts   | Duration | Start       | Finish      | Predecessors |
|----|-----------|------------------------------------------------------------|------------|------------|----------|-------------|-------------|--------------|
| 1  |           | <b>WAZIRABAD MAINTENANCE UNIT</b>                          | <b>151</b> | <b>85</b>  |          |             |             |              |
| 13 |           | <b>RAWALPINDI MAINTENANCE UNIT</b>                         | <b>104</b> | <b>176</b> |          |             |             |              |
| 14 |           | RWD-1: Missa Kassowal - Gujjar Khan                        | 3          | 0          | 1 day    | Wed 2/28/18 | Wed 2/28/18 | 17FS+1 day   |
| 15 |           | RWD-2: Gujjar Khan - Rawat                                 | 6          | 11         | 3 days   | Thu 3/1/18  | Mon 3/5/18  | 14           |
| 16 |           | RWD-3: Rawat - Rawalpindi (GPO)                            | 13         | 6          | 4 days   | Wed 3/7/18  | Mon 3/12/18 | 15FS+1 day   |
| 17 |           | RWD-4: Rawalpindi (GPO) - Tarnol                           | 10         | 4          | 3 days   | Thu 2/22/18 | Mon 2/26/18 |              |
| 20 |           | RWD-7: Hassanabdal - Burhan (N5/M1 Interchange)            | 5          | 8          | 2 days   | Tue 3/13/18 | Wed 3/14/18 | 16           |
| 21 |           | RWD-8: Burhan (N5/M1 Interchange) - Kamra (Attock Road)    | 18         | 20         | 7 days   | Thu 3/15/18 | Mon 3/26/18 | 20           |
| 22 |           | RWD-9: Kamra (Attock Road) - Haji Shah (Attock Road)       | 15         | 2          | 4 days   | Tue 3/27/18 | Fri 3/30/18 | 21           |
| 23 |           | RWD-10: Haji Shah (Attock Road) - Khairabad (Indus Bridge) | 10         | 12         | 4 days   | Mon 4/2/18  | Thu 4/5/18  | 22           |
| 24 |           | RWD-11: Tarnol - Fatehjang                                 | 3          | 18         | 3 days   | Fri 4/6/18  | Tue 4/10/18 | 23           |
| 27 |           | RWD-14: Jand - Khushalgarh                                 | 1          | 9          | 1 day    | Wed 4/11/18 | Wed 4/11/18 | 24           |



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**INVENTORY DATA ENTRY AT BMU OFFICE - NHA H/Q**

| TEAMS     | FULL DAYS (For Group) | PART TIME (Only one TE)   |
|-----------|-----------------------|---------------------------|
| Team No.1 | 1-Mar-2018            | 15-Mar-2018               |
|           | 8-Mar-2018            | 21-Mar-2018               |
|           | 10-Apr-2018           | 28-Mar-2018<br>5-Apr-2018 |
| Team No.2 | 28-Feb-2018           | 19-Mar-2018               |
|           | 12-Mar-2018           | 29-Mar-2018               |
|           | 11-Apr-2018           | 9-Apr-2018                |
| Team No.3 | 27-Feb-2018           | 13-Mar-2018               |
|           | 6-Mar-2018            | 27-Mar-2018               |
|           | 12-Apr-2018           | 2-Apr-2018<br>6-Apr-2018  |



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## Equipment Checklist for Inventory Survey

| Sr. No | Equipment                    | Quantity (Nos) |
|--------|------------------------------|----------------|
| 1      | Safety Halmets               | 4              |
| 2      | Reflective Waists            | 4              |
| 3      | Measuring Tape               | 1              |
| 4      | Tourch                       | 1              |
| 5      | Slate for Numbering          | 1              |
| 6      | GPS                          | 1              |
| 7      | Cones for Traffic Management | 4              |
| 8      | Field Data Books             | 2              |



**Handed Over by**

**Taken Over by**

Signature: \_\_\_\_\_  
 Name: \_\_\_\_\_  
 Date: \_\_\_\_\_

Signature: \_\_\_\_\_  
 Name: \_\_\_\_\_  
 Date: \_\_\_\_\_

**Note:**

- (a) Proper handling of the survey data record and equipments is the sole responsibility of all the Team members
- (b) Inventory Survey data is sole property of NHA and it should not be shared with anyone outside BMU.
- (c) The Equipments shall be handedover to the BMU in good conditions and when the Inventory Survey is completed.

## Progress of Inventory Survey (as of the end of March)

255 Bridges and 261 Culverts (516 structures) expected in the model area

|               | Team 1     |            |             | Team 2     |            |             | Team 3                   |            |             |
|---------------|------------|------------|-------------|------------|------------|-------------|--------------------------|------------|-------------|
|               | Bridge     | Culvert    | Score       | Bridge     | Culvert    | Score       | Bridge                   | Culvert    | Score       |
| 23-Feb        | 4          | 2          | 1.20        | 3          | 6          | 1.35        | 6                        | 0          | 1.50        |
| 26-Feb        | 2          | 6          | 1.10        | 1          | 3          | 0.55        | 2                        | 5          | 1.00        |
| 27-Feb        | 5          | 0          | 1.25        | 1          | 3          | 0.55        | Data Entry               |            |             |
| 28-Feb        | 0          | 5          | 0.50        | Data Entry |            |             | 4                        | 0          | 1.00        |
| 1-Mar         | Data Entry |            |             | 0          | 0          | 0.00        | Veh/vehicle out of order |            |             |
| 2-Mar         | 0          | 0          | 0.00        | 2          | 6          | 1.10        | 2                        | 5          | 1.00        |
| 5-Mar         | 8          | 0          | 2.00        | 3          | 0          | 0.75        | 0                        | 2          | 0.20        |
| 6-Mar         | 6          | 0          | 1.50        | 2          | 3          | 0.80        | Data Entry               |            |             |
| 7-Mar         | 1          | 0          | 0.25        | 4          | 1          | 1.10        | 5                        | 3          | 1.55        |
| 8-Mar         | Data Entry |            |             | 2          | 1          | 0.6         | 6                        | 1          | 1.60        |
| 9-Mar         | 0          | 0          | 0.00        | 12         | 10         | 4.00        | 0                        | 3          | 0.30        |
| 12-Mar        | 6          | 0          | 1.50        | Data Entry |            |             | 4                        | 2          | 1.2         |
| 13-Mar        | 1          | 6          | 0.85        |            | 1          | 2.00        | 2                        | 4          | 0.9         |
| 14-Mar        | 6          | 1          | 1.60        | 2          | 6          | 1.10        | 3                        | 2          | 0.95        |
| 15-Mar        | Seminar    |            |             |            | 7          | 0.70        | Seminar                  |            |             |
| 16-Mar        | Data Entry |            |             | 3          | 5          | 1.25        | 1                        | 7          | 0.95        |
| 19-Mar        | 6          | 0          | 1.50        | Data Entry |            |             | 3                        | 6          | 1.35        |
| 20-Mar        |            |            | 0.00        |            |            | 0.00        | 3                        | 3          | 1.05        |
| 21-Mar        | 4          | 0          | 1.00        | 3          | 1          | 0.85        | 2                        | 3          | 0.8         |
| 22-Mar        | 7          | 0          | 1.75        | 3          | 5          | 1.25        | e-counted structure no   |            |             |
| 23-Mar        |            |            | 0.00        |            | 8          | 0.80        |                          |            | 0           |
| 26-Mar        | 6          | 0          | 1.50        | 0          | 8          | 0.80        | Veh/vehicle out of order |            |             |
| 27-Mar        | 7          | 0          | 1.75        | 4          | 5          | 1.50        | 2                        | 4          | 0.9         |
| 28-Mar        | Data Entry |            |             | 0          | 6          | 0.60        | 4                        | 2          | 1.2         |
| 29-Mar        |            |            |             | Data Entry |            |             | 2                        | 0          | 0.5         |
| 30-Mar        |            |            |             |            |            |             |                          |            |             |
| <b>Tot al</b> | <b>69</b>  | <b>20</b>  | <b>1.01</b> | <b>45</b>  | <b>85</b>  | <b>1.03</b> | <b>51</b>                | <b>52</b>  | <b>0.94</b> |
| <b>Tot al</b> | <b>86</b>  | <b>76</b>  |             | <b>85</b>  | <b>95</b>  |             | <b>84</b>                | <b>90</b>  |             |
|               |            | <b>162</b> |             |            | <b>180</b> |             |                          | <b>174</b> |             |

## Situation of Inventory Survey



## 1-2. Progress of Activities, 1-3. Achievement of Output

| Narrative Summary                                                                               | Objectively Verifiable Indicators                                                                                                                                                                                                                           | Achievement              | Remarks                                                                              |
|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------|
| <b>Overall Goal</b>                                                                             |                                                                                                                                                                                                                                                             |                          |                                                                                      |
| Bridge maintenance status improved on the bridges of National Highways in the model area.       | 1) The bridges identified in the maintenance plan prepared under the Project are maintained and repaired according to the plan.<br>2) In the model area, more than [65] bridges are annually inspected and the bridge maintenance plan is annually revised. |                          | The model area means jurisdiction of Rawalpindi MU and Wazirabad MU in Punjab North. |
| <b>Project Purpose</b>                                                                          |                                                                                                                                                                                                                                                             |                          |                                                                                      |
| Capacity of NHA to inspect bridges and prepare maintenance plan with cost estimate is enhanced. | Quality of inspection and maintenance plan are reviewed and assured by Japanese and local experts.                                                                                                                                                          |                          |                                                                                      |
| <b>Outputs</b>                                                                                  |                                                                                                                                                                                                                                                             |                          |                                                                                      |
| 1. Manuals, Database and BMS developed for bridge inspection and bridge repair                  | 1-1. Draft manuals for (1) bridge inspection and (2) bridge repair by [December, 2016] and for (3) data input by [December, 2017].                                                                                                                          | Completed                |                                                                                      |
|                                                                                                 | 1-2. Draft bridge/culvert inspection formats developed by [December, 2016].                                                                                                                                                                                 | Completed                |                                                                                      |
|                                                                                                 | 1-3. Prototype Database developed by [July, 2017], and prototype BMS by [December, 2017].                                                                                                                                                                   | Completed                |                                                                                      |
|                                                                                                 | 1-4. 2 types of draft training materials for the master trainers for (1) bridge/culvert inspection and (2) bridge repair method selection developed by [December, 2016].                                                                                    | Completed                |                                                                                      |
|                                                                                                 | 1-5. Manuals (1-1), formats (1-2), Database & BMS (1-3), and training materials (1-4) finalized by [September, 2018].                                                                                                                                       | Currently under revision |                                                                                      |

## 1-2. Progress of Activities, 1-3. Achievement of Output

| Outputs                                                    |                                                                                                      |                                                                                                                    |                                                                                                           |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| 2. Bridge inspection is implemented after BMS training.    | 2-1 On-the-job-training (OJT) which enables BMU to manage BMS training in NHA.                       | (1) & (2) completed                                                                                                | Definition of Master Trainer / Certified Master Trainer / Bridge Management Unit (BMU) / Directors in RO. |
|                                                            | 2-2 BMS training (Inventory Survey Training and Bridge Inspection Training).                         | Inventory Survey Training was held on February 1. Bridge Inspection Training is scheduled between April 16 and 20. |                                                                                                           |
|                                                            | 2-3 Inventory Survey and Bridge Inspection on-the-job-training (OJT) .                               |                                                                                                                    |                                                                                                           |
| 3. BMU makes up bridge maintenance plan with BMS software. | 3-1 BMS Software Training for BMU.                                                                   | Not yet                                                                                                            |                                                                                                           |
|                                                            | 3-2 Analysis of Bridge Inspection Database (BIDB) with BMS Software.                                 | Not yet                                                                                                            |                                                                                                           |
|                                                            | 3-3 Bridge maintenance cost estimation for the next fiscal year based on Bridge Inspection Database. | Not yet                                                                                                            |                                                                                                           |

## 2 . RECORD OF DISCUSSION

# 1-OVERALL GOAL

## 1.1-Goal

| OLD VERSION                                                                                           | AMMENDED VERSION                                                                                     |
|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ Bridge maintenance status improved on NHA network</li> </ul> | <ul style="list-style-type: none"> <li>■ Bridge maintenance status improved in model area</li> </ul> |

### Reason

Model area was confirmed in the meeting at JICA HQ on November 10th, 2017. Considering 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. Overall goal should be scaled down to a realistic scope.

The model area means jurisdiction of Rawalpindi MU and Wazirabad MU in Punjab North Region

# OVERALL GOAL

## 1.2-Objectively Verifiable Indicators

| OLD VERSION                                                                                                                                                                                                      | AMMENDED VERSION                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ Based on the bridge data, the number of bridge structures in the worst condition has decreased by one-third in [January, 2022] from the start of the Project</li> </ul> | <ul style="list-style-type: none"> <li>■ 1) The bridges identified in the maintenance plan prepared under the Project are maintained and repaired according to the plan.</li> <li>■ 2) In the model area, more than [65] bridges are annually inspected and the bridge maintenance plan is annually revised.</li> </ul> |

### Reason

Model area was confirmed in the meeting at JICA HQ on November 10th, 2017. Considering 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. Overall goal should be scaled down to a realistic scope.

The model area means jurisdiction of Rawalpindi MU and Wazirabad MU in Punjab North

## OVERALL GOAL

### 1.3-Means of Verification

| OLD VERSION                                                                | AMMENDED VERSION                                                                                                                    |
|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ Output data of the BMS</li> </ul> | <ul style="list-style-type: none"> <li>■ Inspection and maintenance record in the BMS</li> <li>■ Bridge maintenance plan</li> </ul> |

**Reason**

Specify the types of the BMS outputs  
 2) "Bridge maintenance plan" is added from the viewpoint of BMS sustainability in NHA.

### 1.4-Important Assumption

| OLD VERSION                                                                                                                                                                                | AMMENDED VERSION                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ Copyright of software (source code)</li> <li>■ Availability of optimum maintenance budget.</li> <li>■ Continuous update of bridge data</li> </ul> | <ul style="list-style-type: none"> <li>■ Availability of optimum maintenance budget.</li> <li>■ Continuous update of bridge data</li> <li>■ Major disaster affecting budget allocation does not occur</li> </ul> |

**Reason**

Added to achieve Overall Goal.  
 Budget allocation, which is affected by policy priority and major disasters, is the most critical constraint for bridge improvement

## 2-PROJECT PURPOSE

### 2.1- Purpose

| OLD VERSION                                                                                                                                                          | AMMENDED VERSION                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of entire NHA Network.</li> </ul> | <ul style="list-style-type: none"> <li>■ Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of <u>the model area</u>.</li> </ul> |

**Reason**

Considering number of bridges of entire NHA network, inspection of the nation-wide bridges during the project period is too ambitious to be the project purpose. Because a major purpose of a technical cooperation project is generally capacity development, the project purpose should be modified so as to clearly describe targeted capacity necessary for sustaining bridge maintenance and achieving overall goal.



### 2.2-Objectively Verifiable Indicators

| OLD VERSION                                                                                                                           | AMMENDED VERSION                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ Bridge maintenance budget document with breakdowns prepared by [September, 2018].</li> </ul> | <ul style="list-style-type: none"> <li>■ Bridge maintenance budget document with breakdowns for the model area prepared by [December, 2018].</li> </ul> |

**Reason**

Objectively Verifiable Indicators should be a certain level of capacity of inspection and planning according to the modified project purpose

### 2.3-Means of Verification

| OLD VERSION                                                                                                                                                                                   | AMMENDED VERSION                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ Analysis of complete input data to BMS and bridge maintenance budget document (with anticipated budget requirement for forthcoming years)</li> </ul> | <ul style="list-style-type: none"> <li>■ Analysis of the model area input data to BMS and bridge maintenance budget document (with anticipated budget requirement for forthcoming years)</li> </ul> |

**Reason**

Necessary documents to review Objectively Verifiable Indicators should be described

### 2.4-Important Assumption

| OLD VERSION | AMMENDED VERSION                                                                                                                                                                                                                    |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | <ul style="list-style-type: none"> <li>■ NHA arranges adequate human resources for BMS implementation.</li> <li>■ NHA allocates enough budget to maintain and repair prioritized bridges in the annual maintenance plan.</li> </ul> |

**Reason**

Added to achieve Overall Goal

## 3.1-Output 1

## OLD VERSION

- Manuals, Database and BMS developed for bridge inspection and bridge repair method selection

## AMMENDED VERSION

- Manuals, Database and BMS developed for bridge inspection and bridge repair

**Reason**-Rename according to practice

## 3.2-Objectively verifiable indicators

## OLD VERSION

- Draft manuals for (1) bridge/culvert inspection, (2) bridge repair method selection by [December, 2016] and draft manual for (3) data input to Database & BMS developed by [December, 2017].

## AMMENDED VERSION

- Draft manuals for (1) bridge inspection by [December, 2016], (2) bridge repair by [December, 2016] and for (3) data input developed by [December, 2017]

**Reason**

Rename according to practice

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## 3.3- Important Assumption

## OLD VERSION

- 

## AMMENDED VERSION

- BMU (Bridge Management Unit) is working in NHA headquarters.

**Reason** BMU is necessary in Activity 1-5 and to achieve project purpose.

## 3.4-Activities

1-1. Develop 3 types of draft manuals i.e. (1) bridge/culvert inspection, (2) bridge repair method selection and (3) data input to Database.

1-2. Develop draft bridge/culvert inspection formats.

1-3. Develop prototype Database & BMS.

1-4. Develop 2 types of draft training materials for training i.e. (1) bridge/culvert inspection and (2) bridge repair method selection.

1-5. Review and finalize the above 3 types of manuals (Activity 1-1), inspection formats (Activity 1-2), prototypes (Activity 1-3) and 2 types of training materials (Activity 1-4).

1-1 JICA Expert Team develops draft manuals for (1) bridge inspection, (2) bridge repair and (3) data input.

1-2 JICA Expert team develops draft bridge/culvert inspection formats.

1-3 JICA Expert Team develops Prototype Bridge Inspection Database & BMS.

1-4 JICA Expert Team develops draft training materials for (1) bridge inspection and (2) bridge repair.

1-5 BMU reviews and finalizes the above manuals, inspection formats, prototype and training materials.

**Reason** Clarify the practitioner in charge. Rename according to practice

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### 3.5- Output 2

| OLD VERSION                                                                                                                                                                                                                                                                                     | AMMENDED VERSION                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>Trainers of bridge inspection and bridge repair method selection trained at NHA's HQ and ROs, and bridge inspection and bridge repair method selection of uniformed contents implemented on all the bridges of National Highways in Pakistan.</li> </ul> | <ul style="list-style-type: none"> <li>Bridge inspection in the model area is implemented after BMS training.</li> </ul> |

**Reason** Clarify the practitioner in charge.  
Simplify the expression.

### 3.6- Objectively Verifiable Indicators

| OLD VERSION                                                                                                                                                                                                                                                                                                                                                                                                                                             | AMMENDED VERSION                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>2-1. 3 Master Trainers' training for (1) bridge/culvert inspection and (2) bridge repair method selection implemented by [March 2017], and (3) data input to Database implemented by [September, 2018].</p> <p>2-2. 3 types of training (for (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database) implemented by Master Trainers (trained in Activity 2-1) to all field staff by [November, 2017].</p> | <p>2-1 On-the-job-training (OJT) by JICA Expert Team which enables BMU to manage BMS in NHA by [December, 2018].</p> <p>2-2 Inventory Survey, Bridge Inspection and Data Input Training for NHA engineers.</p> |

**Reason** Clarify the practitioner in charge.  
2-1: Training target from Master Trainer to Bridge Management Unit.  
2-2: Clarification of training types

### 3.6- Objectively Verifiable Indicators

| OLD VERSION                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | AMMENDED VERSION                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>2-3. Bridge/culvert inspection, bridge repair method selection, and data input to Database completed for all NHA bridges by [June, 2018].</p> <p>2-4. 90% or more results of bridge repair method selection and data input to a bridge inspection database by the staff of MUs evaluated to be accurate by NHA's HO &amp; JICA Experts by [October, 2018].</p> <p>2-5. Certification of master trainers after training by JICA experts (scoring more than 80% in capacity test)</p> | <p>2-3 Bridge/culvert inspection, bridge repair method selection, and data input to Database completed in the model area including the representative [36] bridges and [5] culverts by [October, 2018].</p> <p>2-4. The results of bridge repair method selection and data input to a bridge inspection evaluated to be accurate by BMU &amp; JICA Expert Team by [October, 2018].</p> |

**Reason** Clarify the practitioner in charge.

2-3: Definition of OJT

2-4: Non availability of adequate MU staff

2-5: Deleted because of no Certified Master Trainer

### OUTPUTS

#### 3.7- Means of verification

| OLD VERSION                                                                                    | AMMENDED VERSION                                                                                                                              |
|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <p>2-3. Completed bridge inspection formats and input data to a bridge inspection database</p> | <p>2-3 Bridge inspection data of the model area including the representative [36] bridges and [5] culverts in Bridge Inspection Database.</p> |

**Reason** Focus on the model area.

Registered data in Bridge Inspection Database instead of the formats and input data.

#### 3.8-Important assumptions

| OLD VERSION | AMMENDED VERSION                                                                                                |
|-------------|-----------------------------------------------------------------------------------------------------------------|
|             | <p>2 BMS organization and BMS staff are established in NHA, who will implement BMS in a sustainable manner.</p> |

**Reason** BMS staff necessary to achieve Project Purpose

### 3.9- Activities

| OLD VERSION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | AMMENDED VERSION                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>2-1. Implement 3 types of master trainer’s training for the staff of NHA’s HQ and ROs at the target bridges (for (1) bridge /culvert inspection, (2) bridge repair method selection, and (3) data input to Database).</p> <p>2-2. Implement 3 types of OJT for field staff by Master Trainers (trained in Activity 2-1), (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) inspection data input to Database.</p> <p>2-3. Implement (1) bridge/culvert inspection, (2) bridge repair method selection, and (3) data input to Database for all the bridges/culverts, by field staff (trained in Activity 2-1 &amp; 2-2).</p> | <p>2-1 JICA Expert Team provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.</p> <p>2-2 BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training).</p> <p>2-3 Inventory Survey and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training</p> <p>2-4 JICA Expert Team reviews inspection results and ability, and advises BMU staff to enhance their capacity.</p> |

**Reason** Clarify the practitioner in charge. Simplify the expression  
 2-4: Added in order to make capacity building in NHA more fruitful

### OUTPUTS

#### 3.10- Output 3

| OLD VERSION                                                                                                                                                         | AMMENDED VERSION                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ Data on all the bridges of National Highways in Pakistan input by MUs to Database available to NHA’s HQ and ROs</li> </ul> | <ul style="list-style-type: none"> <li>■ Bridge data of the model area is available with BMU at NHA headquarters and bridge maintenance plan is prepared according to the data.</li> </ul> |

**Reason** Clarify the practitioner in charge. Database will be available only in HQ for the time being

#### 3.11- Objectively verifiable indicators

| OLD VERSION                                                                                                                                                                                                                                                                                | AMMENDED VERSION                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>3-1. Training for management of BMS implemented by [December, 2017].</p> <p>3-2. Data on all the bridges of National Highways in Pakistan input to Database by [October, 2018].</p> <p>3-3. Cost estimate necessary for bridge maintenance in the fiscal year of 2019 based on BMS.</p> | <p>3-1 BMS Software Training for BMU by [December, 2018].</p> <p>3-2 Analysis of Bridge Inspection Data of the model area using BMS Software.</p> <p>3-3 Bridge maintenance plan with repair methods and cost estimate for 41 bridges and culverts is formulated.</p> |

**Reason** Simplify and correct expression

### 3.12- Means of verification

| OLD VERSION                                                                                         | AMMENDED VERSION                                                                                              |
|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| 3-1. Training records and report<br>3-2. Training records and report<br>3-3. Input data to Database | 3-1 Record of BMS Software Training<br>3-2 Output data of BMS (Prioritization)<br>3-3 Bridge maintenance plan |

**Reason** Focus on the model area.  
Registered data in Bridge Inspection Database instead of the formats and input data.

### 3.13-Important assumptions

| OLD VERSION | AMMENDED VERSION                                                                                      |
|-------------|-------------------------------------------------------------------------------------------------------|
|             | <del>3-2 Bridge inspection results and evaluations are registered in Bridge Inspection Database</del> |

**Reason** Bridge inspection data is necessary to analyze with BMS software

### 3.14- Activities

| OLD VERSION                                                                                                                                                                                                                                                                                                                                                                                                                                                              | AMMENDED VERSION                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ 3-1. Implement training for NHA HQ regarding management of BMS (software and database).</li> <li>■ 3-2. Monitor bridge data input by NHA staff (Activity 2-3) to Database, and data transfer to BMS by HQ RAMD (Road Asset Management Department) staff.</li> <li>■ 3-3. Prepare the annual bridge/culvert maintenance plan including estimated budget for 2019 based on the data transferred to BMS (Activity 3-2).</li> </ul> | 3-1 <u>JICA Expert Team</u> implements BMS Software Training for BMU.<br><br>3-2 <u>BMU</u> analyzes Bridge Inspection Data of the model area using BMS Software.<br><br>3-3 <u>BMU</u> prepares the annual bridge/culvert maintenance plan and schedule including budget estimation based on the analysis of registered data in Bridge Inspection Database |

**Reason** Clarify the practitioner in charge.

| OLD VERSION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | AMMENDED VERSION                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>EQUIPMENT</b> (subject to changes)<br/>                     Non-destructive testing equipment such as</p> <ul style="list-style-type: none"> <li>■ Crack Scale &amp; Test Hammer</li> <li>■ Concrete Compression Strength</li> <li>■ Crack Depth</li> <li>■ Rebar Arrangement</li> <li>■ Rebar &amp; Cover</li> <li>■ Rebar Corrosion</li> <li>■ Carbonation</li> <li>■ Server (and Terminals) for Database &amp; BMS</li> <li>■ (Numbers and specifications will be determined through mutual consultations between JICA and NHA during the implementation of the Project as necessary)</li> </ul> | <p>Non-destructive testing equipment such as</p> <ul style="list-style-type: none"> <li>■ Crack Scale &amp; Test Hammer</li> <li>■ Concrete Compression Strength</li> <li>■ Rebar Detector</li> <br/> <li>■ Carbonation</li> <li>■ Server (and Terminals) for Database &amp; BM</li> </ul> |

**Reason** Regarding depth of concrete cracks, degree of steel corrosion and detection of rebar location, bridge repair prioritization and budgetary estimation can go without such equipment for those measurements. Furthermore, because the equipment requires skills and academic knowledge, it can be thought not ready to utilize the equipment with consideration of current situation in NHA

| OLD VERSION                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | AMMENDED VERSION                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>PERSONNEL</b><br/>                     Administrative Personnel</p> <ol style="list-style-type: none"> <li>1) Person in Charge:<br/>Member (Planning)</li> <li>2) Project Manager:<br/>General Manager (RAMD)</li> <li>3) Member<br/>Director (Design)</li> </ol> <p>Counterpart Personnel</p> <ol style="list-style-type: none"> <li>1) Project Coordinator:<br/>Deputy Director (BMS)</li> <li>2) Assistant Project Coordinator:<br/><u>Assistant Director (BMS)</u></li> </ol> | <p>Administrative Personnel</p> <ol style="list-style-type: none"> <li>1) Person in Charge:<br/>Member (Planning)</li> <li>2) Project Manager:<br/>General Manager (RAMD)</li> <li>3) Member<br/>Director (Design)</li> </ol> <p>Counterpart Personnel</p> <ol style="list-style-type: none"> <li>1) Project Coordinator:<br/>Deputy Director I (BMU)<br/>Deputy Director II (BMU)<br/>Deputy Director III (BMU)</li> </ol> |

**Reason** Assistant Director (BMS) has never been assigned since the beginning of the Project. BMU is considered as the key persons in NHA BMS and should attend JCC

## 5-PRE-CONDITIONS

| OLD VERSION                                                                                                                                                                                                                                                                                                   | AMMENDED VERSION                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>■ The participants for training by JICA experts (Activity 2-1) must have at least 15 years of remaining service period in NHA.</li><li>■ Pakistan, especially Islamabad and Lahore, is continuously safe enough for JICA Experts to implement the activities.</li></ul> | <ul style="list-style-type: none"><li>■ (delete)</li><li>■ Pakistan, especially Islamabad and Lahore, is continuously safe enough for <u>JICA Expert Team</u> to implement the activities.</li></ul> |

**Reason** Internal issues in NHA & Unification of terms

## 3-Main Points Discussed

## Main Points Discussed

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Between NHA and JICA

1. Project Design Matrix (PDM) & Plan of Operation (PO)
2. Culvert Inspection
3. BMS Organization
4. Bridge Management Unit (BMU)
5. Target Bridges
6. Target Staff of Activity 2-1 & 2-2
7. Schedule for Activity 2-1, 2-2 & 2-3
8. Equipment
9. Master Trainer
10. Training in Japan
11. Project Schedule
12. Sustainability of the Bridge Maintenance in NHA

## Main Points Discussed

---

### **1. Project Design Matrix (PDM) & Plan of Operation (PO)**

- Both sides agreed on the amended contents of the Project Design Matrix (PDM) and Plan of Operation (PO) as shown in Annex 1 and 2 of Appendix 1 respectively considering present progress of the Project and NHA's human resources allocated to it.
- The PDM and PO are to be flexibly revised according to the progress and achievement of the Project, upon mutual agreement between National Highway Authority (NHA) and Japan International Cooperation Agency (JICA) at Joint Coordination Committee (JCC) by signing the minutes of meetings.

### **2. Culvert Inspection**

- Due to the intense request from NHA to include culvert inspection in Bridge Management System (BMS), considering safety for the road users as well as bridges, culverts are included in BMS in NHA. However, culverts with no more than 2.0m clearance are excluded from Periodical Inspection.

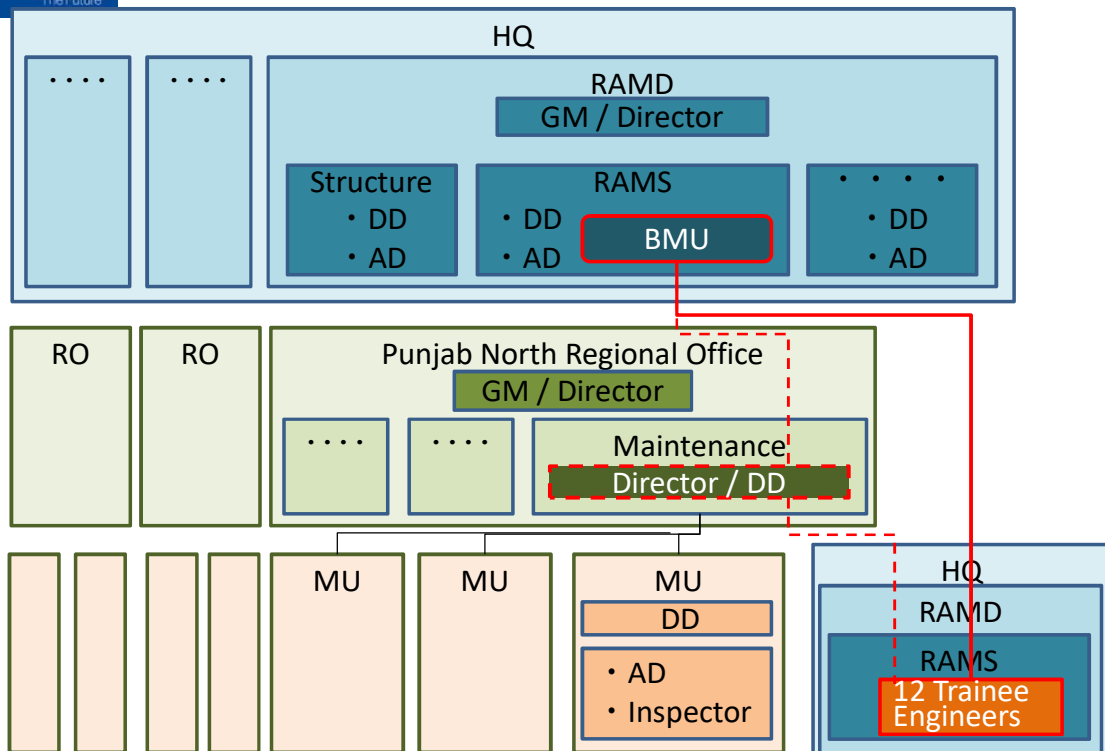
3.BMS Organization

|                  | BMS Staff                    | Roles                                 |
|------------------|------------------------------|---------------------------------------|
| Headquarters     | Bridge Management Unit (BMU) | BIDB Analysis<br>Maintenance plan     |
| Regional Office  | BMS RO staff                 | Supervise MU<br>Review MU             |
| Maintenance Unit | BMS MU staff                 | Inventory Survey<br>Bridge Inspection |

※BIDB = Bridge Inspection Database

BMS Organization Structure (Short-term Plan)

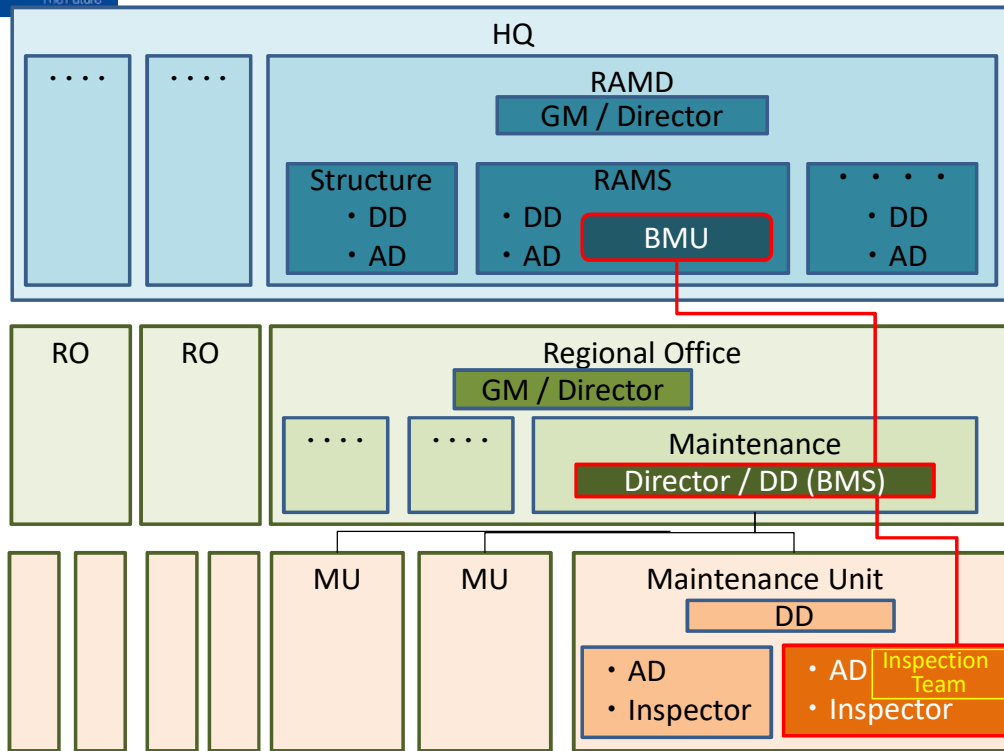
Model Area: Rawalpindi & Wazirabad MU in Punjab North



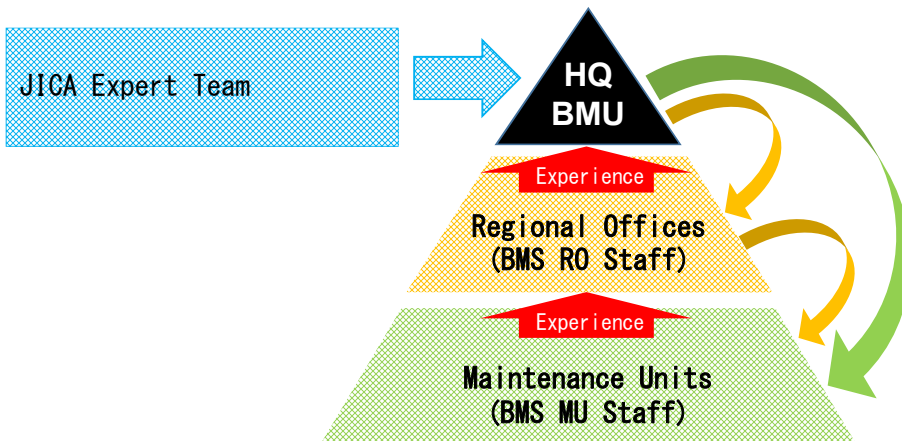


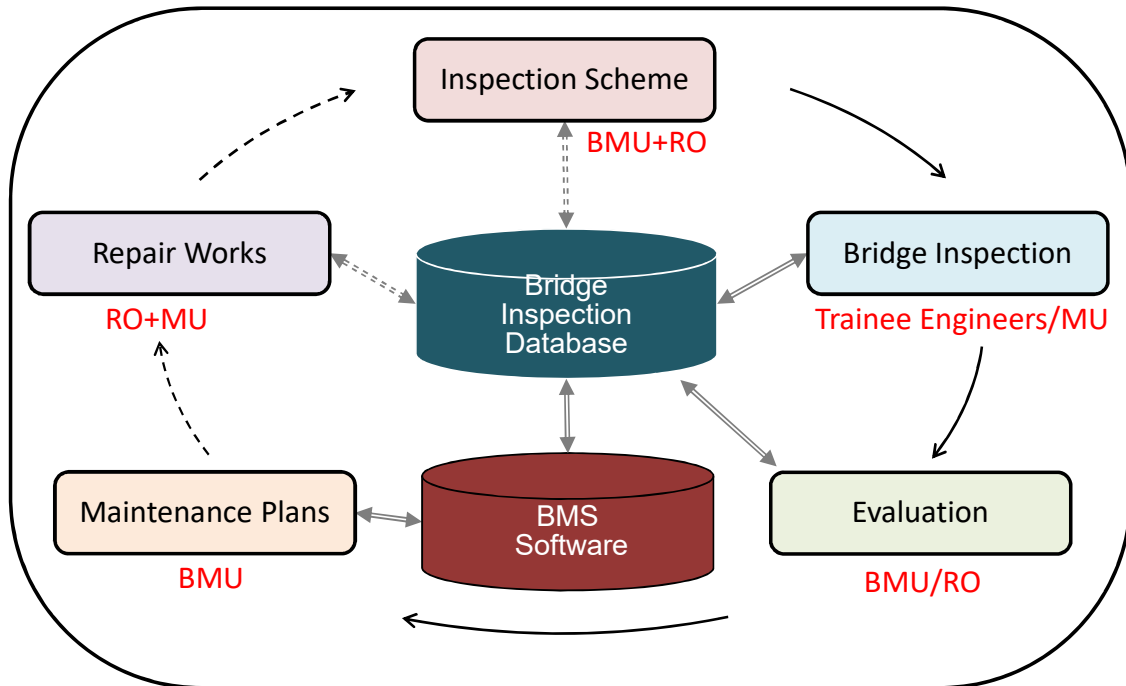
# BMS Organization Structure (Long-term Plan, nation-wide)

**BMS Staff  
in HQ, RO and MU**



# BMS Organization Structure





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#### **4. Bridge Management Unit (BMU)**

- NHA has established Bridge Management Unit (BMU) in January, 2018. BMU members are initially Mr. Muhammad Asif Azam, Mr. Sohaib Mansoor, Mr. Ghulam Murtaza Simair and one IT engineer. BMU will implement BMS in NHA as per approved SOP.
- Both sides agreed that NHA will assign Mr. Sohaib Mansoor and Mr. Ghulam Murtaza of BMU to Project Coordinators and to let them participate in JCC.

#### **5. Target Bridges**

- Typical 36 bridges and 5 culverts in the model area covers most of all types.
- JICA Expert Team implements Bridge Inspection on-the-job-training (OJT) for BMS staff (BMU and Trainee Engineers).

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## Main Points Discussed

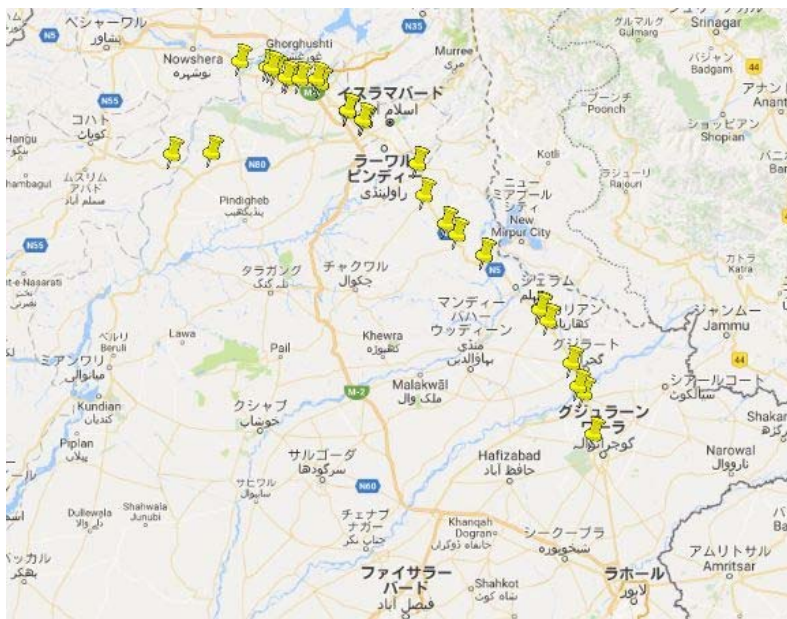
### 5. Target Bridges Bridge Inspection Lists(Drafts)

| NO. | Category                            | Main Construction Type               | bridge name | MU         | Location             | bridge Length(m) | Number of Spans | Clear Height(m) |
|-----|-------------------------------------|--------------------------------------|-------------|------------|----------------------|------------------|-----------------|-----------------|
| 1   | Main Construction Type              | 1-A / Slab                           | P-N5S-2741  | Rawalpindi | Kamra                | 37.606           | 5               | 1.729           |
| 2   |                                     | 1-A / Slab                           | P-N5S-2501  | Rawalpindi | Sangani              | 4.025            | 1               | 3.291           |
| 3   |                                     | 1-A / Slab                           | P-N5N-2120  | Wazirabad  | Kharian              | 43.210           | 8               | 3.900           |
| 4   |                                     | 1-A / Slab                           | P-N5S-2121  | Wazirabad  | Kharian              | 43.151           | 8               | 3.200           |
| 5   |                                     | 1-A / Slab                           | P-N5N-1860  | Wazirabad  | Wazirabad            | 14.313           | 3               | 3.100           |
| 6   |                                     | 1-A / Slab                           | P-N5N-2000  | Wazirabad  | Gujrat               | 14.311           | 4               | 0.880           |
| 7   |                                     | 2-A / Continuous Slab                | P/N80-60    | Rawalpindi | Rangli               | 13.085           | 3               | 1.600           |
| 8   |                                     | 1-Bb / Box Cross-section             | P-N5N-2630  | Rawalpindi | Burhan               | 352.630          | 10              | 8.948           |
| 9   |                                     | 1-C / Slab Arch                      | P-N5N-2500  | Rawalpindi | Sangani              | 3.532            | 1               | 2.200           |
| 10  |                                     | 1-C / Slab Arch                      | P-N5S-2251  | Rawalpindi | Sohawa               | 39.697           | 3               | 6.000           |
| 11  |                                     | 2-C / Continuous Slab Arch           | P-N5S-2721  | Rawalpindi | Kamra                | 58.329           | 7               | 2.000           |
| 12  |                                     | 1-D / Truss                          | P-N5N-2310  | Rawalpindi | Ghungrilla           | 67.931           | 9               | 6.176           |
| 13  |                                     | 2-D / Continuous Truss               | P/N80-70    | Rawalpindi | Khushalgarh          | 288.680          | 2               | 20.486          |
| 14  |                                     | 1-F / Box/Frame Structure            | P-N5N-2060  | Wazirabad  | Al-Khalil            | 4.797            | 1               | 1.000           |
| 15  |                                     | 2-F / Continuous Box/Frame Structure | P-N5N-2650  | Rawalpindi | Haro                 | 10.611           | 3               | 2.125           |
| 16  | Passage Type                        | A / River                            | P-N5N-2640  | Rawalpindi | Karsheen (Burhan)    | 157.997          | 5               | 6.990           |
| 17  |                                     | A / River                            | P-N5N-2260  | Rawalpindi | Missa Kaswal         | 81.051           | 3               | 8.800           |
| 18  |                                     | A / River                            | P-N5S-2261  | Rawalpindi | Missa Kaswal         | 105.829          | 3               | 8.780           |
| 19  |                                     | B / Nullah                           | P-N5N-2560  | Rawalpindi | Wah Garden           | 127.574          | 6               | 5.062           |
| 20  |                                     | B / Nullah                           | P-N5S-2561  | Rawalpindi | Wah Garden           | 131.625          | 12              | 4.996           |
| 21  |                                     | C / Flood Relief Channel             | P-N5N-2200  | Rawalpindi | Dina                 | 147.743          | 10              | 2.923           |
| 22  |                                     | C / Flood Relief Channel             | P-N5S-2201  | Rawalpindi | Dina                 | 150.054          | 5               | 2.931           |
| 23  |                                     | D / Irrigation Channel               | P-N5N-2680  | Rawalpindi | Kamra                | 208.916          | 6               | 0.000           |
| 24  |                                     | D / Irrigation Channel               | P-N5N-1830  | Wazirabad  | Wazirabad Bypass     | 5.305            | 1               | 0.800           |
| 25  |                                     | E / Railway                          | P-N5N-2320  | Rawalpindi | Rawat                | 36.924           | 1               | 5.130           |
| 26  |                                     | E / Railway                          | P-N5S-2321  | Rawalpindi | Rawat                | 23.865           | 1               | 7.313           |
| 27  |                                     | F / Roadway                          | P-N5N-2450  | Rawalpindi | Motorway Interchange | 91.325           | 4               | 5.766           |
| 28  |                                     | F / Roadway                          | P-N5S-2451  | Rawalpindi | Motorway Interchange | 92.224           | 4               | 5.817           |
| 29  |                                     | G / Pedestrian Way                   | P-N5N-2460  | Rawalpindi | Motorway Interchange | 3.600            | 1               | 2.329           |
| 30  |                                     | G / Pedestrian Way                   | P-N5N-2490  | Rawalpindi | Sangani              | 3.600            | 1               | 2.329           |
| 31  | Main Material Type (Superstructure) | E / Steel Girder Concrete Slab       | P-N5S-2571  | Rawalpindi | Hasanabdal           | 14.119           | 2               | 4.555           |
| 32  | Main Material Type (Abutment)       | B / Brick Masonry                    | P-N5N-2890  | Rawalpindi | Mula Mansoor         | 3.681            | 1               | 2.110           |
| 33  |                                     | C / Mass Concrete                    | P-N5N-1720  | Rawalpindi | Honda Gujranwala     | 8.153            | 4               | 0.792           |
| 34  | Main Material Type (Pier)           | A / Stone Masonry                    | P-N5S-2671  | Rawalpindi | Attock Flour Mill    | 27.913           | 3               | 2.736           |
| 35  |                                     | B / Brick Masonry                    | P-N5S-2091  | Wazirabad  | Panjan Kasana        | 11.321           | 4               | 1.210           |
| 36  |                                     | E / Column                           | P-N5N-2590  | Rawalpindi | Katcha More          | 104.321          | 4               | 6.121           |

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### 5. Target Bridges(maps)



(Maintenance Unit)  
Rawalpindi: 29 bridges  
Wazirabad: 7 bridges

(Clear Height)  
Within 5m : 25 bridges  
Over 5m : 11 bridges

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## **6.Target Staff of Activity 2-1 & 2-2**

### **BMU staff in RO and MU**

- Both sides mutually agreed to hire 12 Inspectors for the period of 1 year to inspect the structures in the model area. NHA will continue their services upon the expiry of their contracts as required.
- JICA requested NHA to assign BMS staff in Regional Offices and Maintenance Units in the model area for the purpose of sustainable BMS in NHA.
- Both sides confirmed that it was essential for BMU in NHA to train up BMS staff (formerly-considered Master Trainer) in Regional Offices. And NHA committed to assign BMS staff in Regional Offices and Maintenance Units in the model area.

## **7.Schedule for Activity 2-1, 2-2 & 2-3**

Both sides agreed that implementation of Activity 2-1, 2-2 and 2-3, which are bridge inspection, bridge repair method selection, data input to a bridge inspection database and training necessary for such activities, will be preferably scheduled to avoid the flood season, from July to September, and Ramadan for smooth and effective implementation of the Activities.

Both sides agreed to complete Activity 2-2 and 2-3 in following schedule;

- |                                   |                                |
|-----------------------------------|--------------------------------|
| 1)Inventory Survey Training       | Completed in February, 2018    |
| 2)Inventory Survey in model area  | by the end of April, 2018      |
| 3)Bridge Inspection Training      | 16th April to 20th April, 2018 |
| 4)Bridge Inspection in model area | by the end of October, 2018    |

Both sides agreed to extend the project duration until April 2019. And JICA need administrative procedures for almost 3 months, therefore project activities should be ended by December, 2018.

## **8.Equipment**

### **<Server Procurement>**

- 3 quotations from the local market was planned to be gotten in December 2017 in order to install the Server in February 2018.
- 3 quotations with checklist pertaining to JICA Expert Team's specifications was planned to be prepared in February 2018 in order to install the Server in April 2018.
- In case of providing the Server, the procedures must be taken in April 2018 with consideration of inspection duration, it will be installed in August 2018.
- In case of not providing the Server, the plain PC can be used instead.
- Considering of only 36 bridges and 5 culverts in the model area, the Server is not mandatory. NHA have to clarify its future policy.

## **9.Master Trainer**

- BMU tentatively takes the roles to supervise inspection and to review evaluation in the model area (Punjab North).
- NHA will assign BMS staff (formerly-considered Master Trainer) in each Regional Office for BMS implementation in addition to current BMU.

## **10.Training in Japan**

- During the Second Detailed Planning Survey, the Japanese side took note of the request from NHA for trainings in Japan as a component of the Project.
- The first training in Japan was carried out for the 2 engineers in RAMD in January, 2017. The second training in Japan is canceled because of no eligible person (candidate). JICA will review necessity of further trainings in Japan to achieve the project purpose during the implementation of the Project



| JICA Expert Team                                                                    | BMU                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| OJT for BMU (Bridge Inspection and Data Input)                                      |                                                                         |
| OJT for BMU (BMS Training: BMU trains BMS staff)                                    |                                                                         |
| To review inspection results and ability, and to advise BMU to enhance its capacity | To check inspection results and to advise BMS Staff (Trainee Engineers) |
| OJT of BMS Software                                                                 |                                                                         |
| Draft Final Report                                                                  |                                                                         |

<Issues>

**Nationwide implementation of BMS**

As short-term plan is in execution, meanwhile timeline for nationwide implementation of BMS should be confirmed by NHA.

**Standard Operating Procedures**

For successful implementation of BMS in NHA, SOP is required to be prepared which must clearly define roles and responsibilities of each individual under BMS organization. In addition, 3 manuals (Bridge Inspection, Repair, and Data Input) including SOP are to be approved by the NHA Executive Board.

**Composite Schedule of Rates (CSR)**

The Bridge/Culvert Repair Manual does not have CSR and it is necessary to be included before finalization of repair manual. NHA must assign this task to its quantity estimator or related person as BMU does not have any such information.

## 4 -Vision for BMS by NHA

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## NHA strategies with timeline

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# NHA's future plan

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# NHA's SOP

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## 49 ADs + 49 Bridge Inspectors

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## NHA's CSR

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# 5-Discussion about Brochure

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Brochure(1/4)

The brochure cover features a central collage of images related to bridge construction and maintenance, including workers in safety gear, a bridge structure, and a road. Logos for JICA (Japan International Cooperation Agency) and NHA (National Highway Authority) are prominently displayed at the top left. The title 'A Project for Technical Assistance on Implementation of Bridge Management System in NHA' is located at the bottom left. The right side of the cover contains two sections: 'MESSAGE FROM THE CHAIRMAN (NHA)' featuring a portrait of Javed Rafique Malik and his message, and 'THE CHIEF REPRESENTATIVE' featuring a portrait of Yasuhiro TOJO and his message.

**MESSAGE FROM**  
**THE CHAIRMAN (NHA)**

Dear Reader, Assalamu Alaikum,

The NHA Network comprises of all major routes providing linkages across the country and carrying about 90% of inland freight and 95% of passenger traffic. The economic, social and strategic significance of bridge structures is well understood. Today's ever increasing reliance on roads as leading modes of transportation in Pakistan, the continuous and advanced monitoring and maintenance of bridge structures utilizing optimal funds is an absolute necessity. We are in process of development and execution of a computerized Bridge Management System with the technical assistance of Japan International Cooperation Agency (JICA) in line with international standards and practices. The Japanese endeavor in this domain will certainly be beneficial for knowledge sharing and capacity building of engineering fraternity in Pakistan.

Sincerely Yours,  
Javed Rafique Malik  
Chairman, National Highway Authority

**THE CHIEF REPRESENTATIVE**

Dear Reader, Assalamu Alaikum,

The Official Development Assistance (ODA) towards Pakistan started in 1954. Since then, for more than 60 years, JICA has cooperated for economic and social development of Pakistan in various sectors such as power, industry & investments, transport, agriculture & irrigation, education, health, water & sanitation, environment, disaster management and stabilization of Pakistan-Afghanistan border areas. In particular, more than 3,000 Pakistani officials have acquired a lot of knowledge through programs in Japan, and more than 1,700 Japanese experts have worked in Pakistan in various sectors. In addition, Japan has contributed to development of various infrastructures through ODA loan and Grant Aid.

Sincerely Yours,  
Yasuhiro TOJO,  
Chief Representative, JICA Pakistan

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## Brochure(2/4)

### Transport Infrastructure in Pakistan

The development of infrastructure pertaining to roads is critical to economy and development of the country as almost all economic sub-sectors depend on its road network. The increasing intensity of transportation vehicles has resulted in a need of continuous expansion, maintenance, replacement and modernization of transport infrastructure.

Pakistan has an existing road network of around 266,000 km, out of which National Highway Authority (NHA) is responsible for operating 12,131 km (4.5%) road network only which carries 80% of the country's commercial traffic. Bridges are vital links in transportation system because their failure can cause immense public and private losses. Many bridges have exceeded their design life which necessitates the preservation and maintenance of NHA's bridge infrastructure system.

### Support by JICA

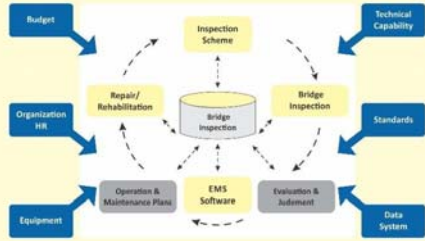
Japan International Cooperation Agency (JICA) provides development assistance to the developing countries in three major areas, i.e., technical cooperation, provision of grant and low-cost yen loans. Thus, Japan has also supported development of infrastructure in Pakistan in areas of transportation and energy. Some of the JICA's assisted projects carried out in the past are:

- Improvement of Railways in Pakistan (LA 1980-1996, Multiple Projects)
- Kohat Tunnel Construction Project (LA 1994-2002, 2003)
- Indus Highway Construction Project N-55 (LA 1989, 1991, 1993, 2006)
- Improvement of Karori - Wash Section of National Highway N-25 (GA, 2006)
- East-West Road Improvement Project N-70 (LA-2008)
- Lahore and Karachi Transport Master Plan (TC-2010)
- Rural Roads Construction in four provinces (LA 1993, 2008, 2011, multiple projects)

JICA's practical assistance to developing countries is termed as Technical Cooperation. It includes the dispatch of JICA experts for sharing the Japanese experience and knowledge, the training of local officials for 'capacity development' and the supply of equipment. Technical assistance ventures encompass individual empowerment to make them self-reliant. This project is also awarded as a technical cooperation project.

### Bridge Management in Pakistan

Many bridges in Pakistan have been constructed for the past 20 years. Since the time of their construction, they have not been properly inspected or maintained. A significant number is even older and hence requires more frequent maintenance and large-scale repair works.



NHA has been facing many challenges in bridge management and much of the repair works on bridges are carried out in emergency situations without adequate planning. The Project of technical assistance on implementation of Bridge Management System in NHA is also a technical assistance project which is expected to serve as a milestone in area of Bridge Management. For NHA, it is essential to implement the operation and maintenance cycle of bridges efficiently. The bridge management is an ongoing endeavor which consists of 'inspection scheme', 'bridge inspection', 'evaluation and judgement', 'operation and management' and 'repair and rehabilitation' with centralization of Bridge Inspection Database (BIDB) and analysis for prioritization to minimize the maintenance budget with utilization of BMS Software.

### Illustrative diagram of BMS

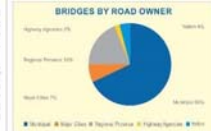
Regularly scheduled inspections are an essential component of an effective bridge management system. Trained and qualified people perform the necessary inspection and ongoing maintenance. Moreover, record of inspection reports are kept. So, BMS is a systemized procedure for evaluation, inspection, recording, maintenance and repair of bridge and culverts. Under the BMS, the bridges managed and operated by NHA will be regularly inspected following the standard procedure and evaluation will be recorded into a customized BIDB software.

### BMS in Japan

During the era of 1960s to 1980s, massive development in infrastructure took place in Japan and huge number of roads and bridges were constructed. However, since 2000, the infrastructure market in Japan has shifted from new construction to maintenance of existing structures. This is why, a decline in construction of new bridges is observed.



Bridge Management System (BMS) in Japan serves the purpose of storing and updating all the bridge data as bridge inventory data, results of inspection and evaluation, history of repair and maintenance works as electronic database.



The BMS can give distribution in bridges and prioritize the repair works. The required operation and maintenance cost can also be assessed.

The PDCA Cycle is applied in bridge management system. At first, results of inspection and diagnosis are accumulated, and repair design is prepared after which priority evaluation for each bridge is carried out. Priority evaluation is comprised of different weightage of several indexes (i.e. Sources of bridge, bridge priority (depending on size, age, structure type and environment features) and road priority level (i.e., highway, national road, ordinary road, etc.). Based upon the priority evaluation a short-term schedule (5-10 years) is made.

- Priority evaluation is important to that
- The budget and human resources can be equalized
  - Risk of accidents and risk treatments are properly assessed
  - Accountability of proper execution, for citizens and road users

It is legally constituted in Japan to inspect all bridges at least once in 5 years. In order to assure the knowledge and experience of engineers, license of Road Bridge Inspector is required to implement bridge inspection. This license is issued by Japan Bridge Engineering Center

## Brochure(3/4)

Based on the performance of NHA Officers, three persons were selected as a Bridge Management Unit (BMU), newly established in NHA Headquarters. Another training was also conducted for trainee engineers in NHA which was focused on Bridge Inventory Survey in the area of Punjab North. The trainee engineers will later work with engineers of BMU for implementing a BMS Prototype for Punjab North. Based on the outcome, the model BMS prototype will be extended nation wide throughout Pakistan by the end of year 2018.



Developing mechanisms to improve financial stability of bridge development and maintenance program

### Non-Destructive Testing Equipment

Non-Destructive Testing (NDT) Equipment is a primary resource for carrying out inspection of existing structures. JICA through this technical assistance project, is providing NDT Equipment which includes test hammers, crack scale, rebound hammers along with carbonation check equipment. Bridge Inspection Database is a very useful tool for keeping the record of bridge inventory, inspection data and selection of method for bridge repair while, BMS Software has a prioritizing function that can prioritize the bridges based on damage evaluation. In this way, the bridge/culvert inspection sheets, inspection and evaluation criteria, selection of repair technique for bridges and culverts is being standardized that will be helpful in implementation of a successful Bridge Management System in NHA.

### Our Goal

Our goal is to establish a comprehensive Bridge Management System in NHA which would constitute a very positive and long awaited nascent beginning. Once a system has been successfully established and becomes functional, NHA can expand its scope. The project is expected to help bridge engineers in Pakistan for economical, efficient and quality output.

- Our project will ensure NHA to achieve the following:
- Preparation of annual bridge maintenance/ repair plan.
  - Modernization of bridge inspection methods, procedures and guidelines.
  - Strengthening NHA's capacity to provide timely and effective bridge maintenance and repair.
  - Developing mechanisms to improve financial stability of bridge development and maintenance program.

Strengthening NHA's capacity to provide timely and effective bridge maintenance and repair



Please Provide me pictures for this page, cus thats all I have

(J-BEC)  
Activities under BMS Project in

**Workshop & Review**

- Bridge Inspection Method
- Bridge Inspection Report Writing, Inspection Process
- Capacity Management
- Bridge Inspection Training Equipment

**Work Sessions**

- Bridge Inspection Capacity and BMS Software for Road Inspection Bridge

Preparation of annual bridge maintenance/repair plan

Modernization of bridge inspection methods, procedures and guidelines

# 6-Others

## Daily Inspection (NEXCO)

| Type       | Method                           |
|------------|----------------------------------|
| From a car | Visual, feeling, far sight, etc. |
| At night   | Visual, far sight, etc.          |
| Off a car  | Close sight, far sight, etc.     |

| Type       | Frequency         | Traffic Volume            |
|------------|-------------------|---------------------------|
| From a car | 4 days+ / 2 weeks | < 25,000 / day            |
|            | 5 days+ / 2 weeks | < 50,000 / day            |
|            | 6 days+ / 2 weeks | < 80,000 / day            |
|            | 7 days+ / 2 weeks | >= 80,000 / day           |
| At night   | Once+ / year      | -                         |
| Off a car  | Once+ / year      | Signage, expansion joints |
|            | Twice+ / year     | Bridge intersections      |

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## Basic Inspection (NEXCO)

| Type  | Method                       |
|-------|------------------------------|
| Basic | Close sight, far sight, etc. |

| Type  | Frequency    |
|-------|--------------|
| Basic | Once+ / year |



## Periodical Inspection (NEXCO)

| Type                             | Method                                                                    |
|----------------------------------|---------------------------------------------------------------------------|
| To hold soundness                | Close sight<br>Touching, hammering and non-destructive tests if necessary |
| + to prevent from other's injury | Close sight, touching and hammering<br>Non-destructive tests if necessary |

| Type                  | Frequency       |
|-----------------------|-----------------|
| Peropdical Inspection | Once+ / 5 years |

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## Bridge Inspection Car



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# Bridge Inspection Car





(6) Version 6 (3 December 2018)

## TO CR of JICA Pakistan OFFICE

## PROJECT MONITORING SHEET

**Project Title: The Project for Technical Assistance on Implementation of Bridge Management System in NHA**

**Version of the Sheet: Ver.6 (Term: April, 2018 - November, 2018.)**

**Name: Kenichi TOMI**

**Title: Project Monitoring Expert**

**Name: Ikramus Saqlain Haider**

**Title: Project Director, GM (RAMD)**

**Name: Yukio IGO**

**Title: Project Manager/Bridge Inspection**

**Submission Date: 3<sup>rd</sup> December, 2018**

## I. Summary

## 1 Progress

## 1-1 Progress of Inputs

## (1) Experts

Duration: from April 1, 2018 to November 30, 2018

Unit: Days

|                          |          | Plan        |                 |       | Actual      |                 |       | Actual / Plan |
|--------------------------|----------|-------------|-----------------|-------|-------------|-----------------|-------|---------------|
|                          |          | by previous | during 8 months | total | by previous | during 8 months | total |               |
| Bridge Inspection        | Pakistan | 294         | 52              | 346   | 241         | 112             | 353   | 102%          |
|                          | Japan    | 38          | 9               | 47    | 63          | 9               | 72    | 153%          |
| Bridge Repair            | Pakistan | 128         | 0               | 128   | 103         | 0               | 103   | 80%           |
|                          | Japan    | 30          | 7               | 37    | 16          | 0               | 16    | 43%           |
| Bridge Man. System       | Pakistan | 65          | 18              | 83    | 49          | 49              | 98    | 118%          |
|                          | Japan    | 69          | 17              | 86    | 63          | 22              | 85    | 99%           |
| Bridge Man. A-System     | Pakistan | 0           | 0               | 0     | 0           | 0               | 0     |               |
|                          | Japan    | 11          | 9               | 20    | 10          | 22              | 32    | 160%          |
| Capacity Development     | Pakistan | 244         | 76              | 320   | 209         | 94              | 303   | 95%           |
|                          | Japan    | 17          | 3               | 20    | 18          | 8               | 28    | 140%          |
| Project Monitoring       | Pakistan | 69          | 31              | 100   | 56          | 33              | 89    | 89%           |
|                          | Japan    | 0           | 0               | 0     | 0           | 0               | 0     |               |
| Bridge Man. Spec. Logic  | Pakistan | 18          | 0               | 18    | 18          | 0               | 18    | 100%          |
|                          | Japan    | 26          | 25              | 51    | 12          | 31              | 48    | 94%           |
| Bridge Man. A-Spec. Log. | Pakistan | 31          | 18              | 49    | 31          | 18              | 49    | 100%          |
|                          | Japan    | 15          | 15              | 30    | 6           | 23              | 30    | 100%          |
| Total                    | Pakistan | 849         | 195             | 1044  | 707         | 306             | 1013  | 97%           |
|                          | Japan    | 206         | 85              | 291   | 188         | 115             | 311   | 107%          |

**(2) Equipment**

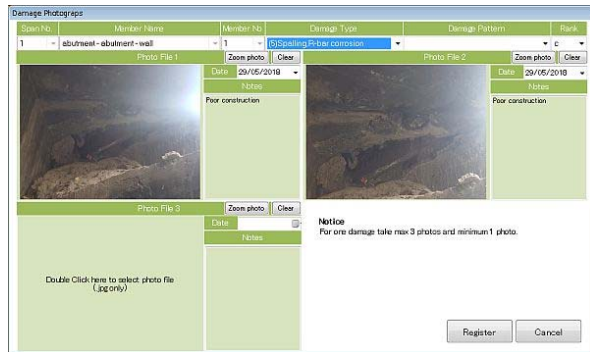
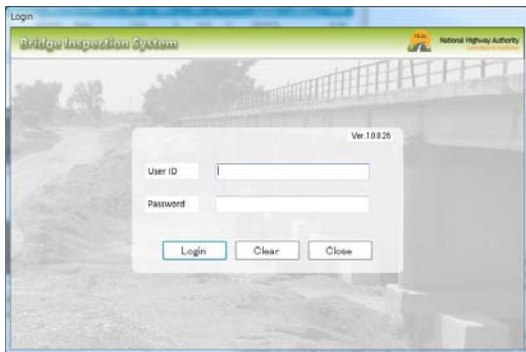
JICA Expert Team provided Equipment to Counterpart

| Purpose                          | Equipment       | Quantity | Remarks                        |
|----------------------------------|-----------------|----------|--------------------------------|
| Safety                           | Helmet          | 100      | February 1 <sup>st</sup> 2017  |
| Crack width, Spalling, Honeycomb | Crack Scale     | 100      | February 24 <sup>th</sup> 2017 |
|                                  | Test Hammer     | 100      | February 24 <sup>th</sup> 2017 |
| Carbonation                      | Phenolphthalein | 18       | June 28 <sup>th</sup> 2018     |

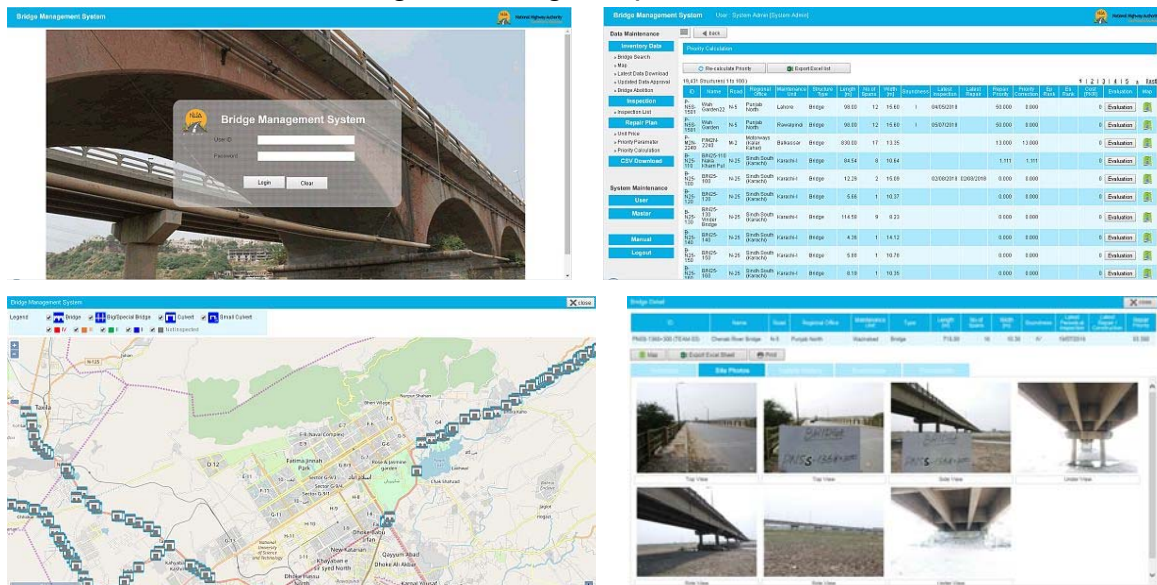
**(3) Bridge Inspection Database & BMS**

Bridge Inspection Database (BIDB) data input software was released as ver. 1.0.0.0 on December, 2018. The finalized BIDB as ver. 1.0.0.26 based on NHA opinions and requests was delivered in November, 2018.

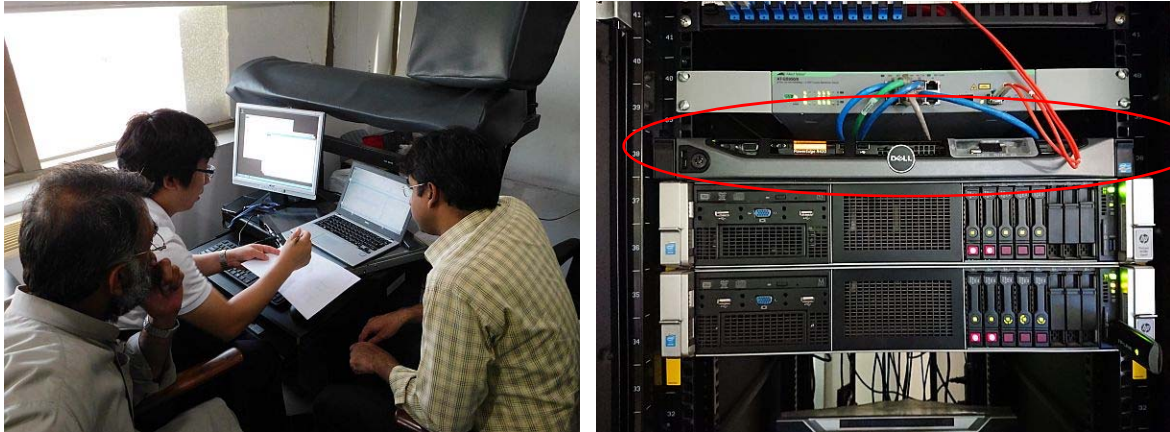
BMS Software was installed on the server prepared by NHA, and released as ver. 1.0.0.0 for BMS Software Training in August, 2018. The finalized one as ver. 1.0.0.5 based on NHA opinions and requests was delivered in November, 2018.



Figures: Bridge Inspection Database



Figures: BMS Software



Figures: BMS Software installation with BMU

**(4) Counterpart Personnel**

| Personnel             | Title                      | Name                                 |
|-----------------------|----------------------------|--------------------------------------|
| Person in Charge      | Member (Planning)          | Mr. Raja Nowsherwan (~2017.10)       |
|                       |                            | Mr. Asim Amin (2017.10~2018.10)      |
|                       | Member (Engg. & Cord.)     | Mr. Arbab Ali Dhakan (2018.10~)      |
| Project Manager       | General Manager (RAMD)     | Mr. Ikramus Saqlain Haider           |
| Project Coordinator   | Deputy Director (BMU- I )  | Mr. Muhammad Asif Azam               |
| Counterpart Personnel | Deputy Director (BMU- II ) | Mr. Ghulam Murtaza Simair (2018.1 ~) |
|                       | Deputy Director (BMU-III)  | Mr. Sohaib Mansoor (2018.1~)         |
| IT Engineer           | Assistant Director         | Mr. Ashfaq Ahmed (2018.7~2018.10)    |
|                       |                            | Mr. M Nur-UI-Eain (2018.10~)         |

**(5) Trainee Engineer (Bridge Inspector)**

- 10 TEs have implemented Inventory Survey and Bridge Inspection in the model area.
- 2 TEs have left NHA because of their brand-new employment.
- 8 TEs went to Inventory Survey in Lahore MU on 7<sup>th</sup> August 2018, but no results were achieved due to shortage of transportation (vehicles).
- 8 TEs have been waiting for the field works due to lack of transportation since 27<sup>th</sup> August 2018 (after Eid ul Adha).
- 8 TEs have resumed the field work, i.e. Inventory Survey in Maintenance Unit Lahore

from 19<sup>th</sup> November 2018 with two vehicles allocated by Lahore Regional Office.

- 4 TEs hiring process have been initiated for a period of 15 months starting from 1st December 2018 to February 2020.
- 8 TEs contract will be extended till February 2020, which was previously ending in February 2019. Then, 12 TEs are expected for the short-term plan till February 2020.

#### **(6) Office & Facilities**

Counterpart has been providing Project Room with office furniture and internet to JICA Expert Team.

| No. | Project Room | Duration                                                           |
|-----|--------------|--------------------------------------------------------------------|
| 1   | G17          | 2016/07/20 – 2016/08/04 (1 <sup>st</sup> visit)                    |
| 2   | 316+Annex    | 2016/8/22 – 2017/03/23 (2 <sup>nd</sup> to 6 <sup>th</sup> visits) |
| 3   | 317          | 2017/05/05 – 2018/04/20 (6 <sup>th</sup> visit)                    |
| 4   | G24+G25      | 2018/04/20 –                                                       |

#### **(7) Budget Allocation**

- Counterpart bears budget for traveling and accommodation expenses of TEs.
- Budget allocation includes Monthly Salaries, Travelling Expenditures / facilities, boarding and lodging facilities for TEs.
- In addition to that a Bridge Management Unit has been created within RAMD along with all allied facilities.
- The Computer Bureau has also extended full support for the establishment of Server based Database and has also provided 3 terminal computers (Laptops).

#### **(8) Training in Japan**

The first training in Japan is carried out for the 2 engineers in RAMD in January, 2017.

The second one was planned for 10 engineers in June 2017. However, it is canceled because of no eligible person (candidate).

#### **(9) In-country Training**

##### **1) BMS Training (Bridge inspection), (April 16th to 20th, 2018)**

Bridge Inspection Training was organized on 2 days lectures and 3 days field training to make it more practical training. And time for each team to announce the results of the inspection was also set up, and contents of the training that the participants can act on their own initiative was made.

The purpose and significance of this training is to transfer knowledge, experience and know-how possessed by JICA Expert Team to BMU through training so that BMU can implement the same training continuously in future. From this point of view, the members

of BMU lectured as much as possible, and JICA Expert Team took a role to support them.  
 In office training on April 16th and 17th  
 On-site training on April 18th to 20th

[Attendees]

Counterpart side: BMU 2 persons  
 JICA Expert Team side: 6 persons  
 Trainee Engineers: 10 persons  
 RO & MU (Punjab North, Punjab South): 9 persons  
 Total: 27 persons

[Activity and Lecturer]

| Date                   | Topics and Activity                                             | Main Lecturer                   |
|------------------------|-----------------------------------------------------------------|---------------------------------|
| April 16 <sup>th</sup> | Presentation - Introduction of BMS, Summary of training program | Mr. Yukio Igo (JICA)            |
|                        | Lecture - Basics of Bridge engineering                          | Ms. Momina Rauf (JICA)          |
|                        | Lecture - Bridge Inspection Manual                              | Mr. Haruo Tomiyama (JICA)       |
|                        | Lecture - Bridge Inspection (Concrete structure)                | Mr. Sohaib Mansoor (BMU)        |
|                        | Test and Review - Bridge Engineering and Inspection             | Mr. Haruo Tomiyama (JICA)       |
| April 17 <sup>th</sup> | Lecture - Bridge Inspection (Others)                            | Mr. Haruo Tomiyama (JICA)       |
|                        | Lecture - Repair and strengthening                              | Mr. Ghulam Murtaza Simair (BMU) |
|                        | Lecture - How to fill out Inspection Sheet                      | Mr. Ghulam Murtaza Simair (BMU) |
| April 18 <sup>th</sup> | Test and Review - Repairs and Inspection Sheet                  | Ms. Kayo Yonezawa (JICA)        |
|                        | Site Inspection - Wah Garden PC Slab Girder                     | Mr. Akio Mori (JICA)            |
|                        | Evaluation and Input                                            | Mr. Sohaib Mansoor (BMU)        |
| April 19 <sup>th</sup> | Review                                                          | Mr. Ghulam Murtaza Simair (BMU) |
|                        | Site Inspection - Wah Garden RC Slab Girder                     | Mr. Kenichi Tomi (JICA)         |
|                        | Evaluation                                                      | Mr. Akio Mori (JICA)            |
| April 20 <sup>th</sup> | Review                                                          | Mr. Sohaib Mansoor (BMU)        |
|                        | Site Inspection - Brick Masonry and Concrete Box Culvert        | Mr. Ghulam Murtaza Simair (BMU) |
|                        | Evaluation                                                      | Mr. Kenichi Tomi (JICA)         |
|                        | Examination                                                     | Mr. Akio Mori (JICA)            |



Figures: Bridge Inspection Training (in office)





Figures: Bridge Inspection Training (on site)



Figures: Bridge Inspection Training (Data Input and Presentation)

## 2) OJT of Bridge Inspection

JICA Expert Team confirmed and corrected the result of inspection, and commented on the items to be corrected / improved, urged the understanding of BMU and Trainee Engineers. This work continued through the exchange with e-mail also during the period when JICA Expert Team was not in Pakistan.

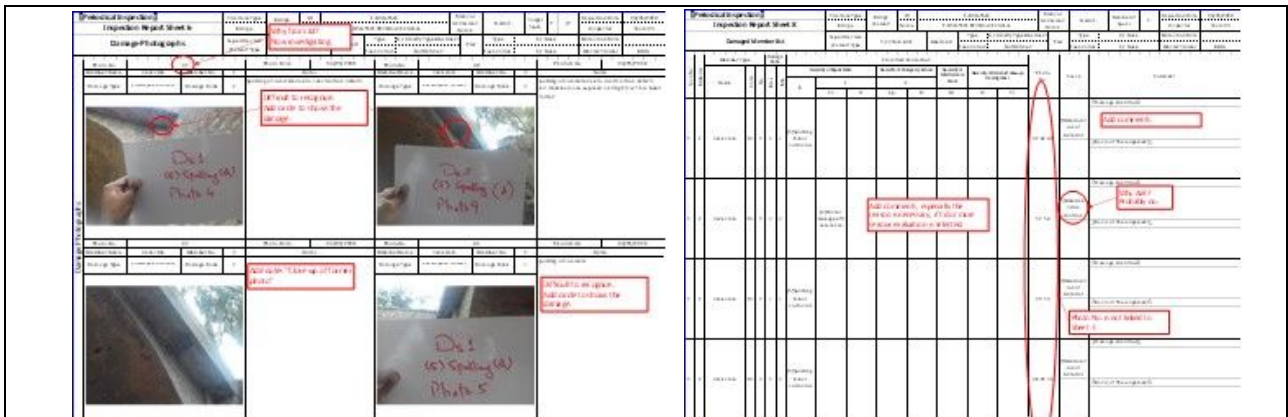
Table: Progress of Bridge Inspection

| Date       | Team 01(Plan)     |         |                  | Team 1(Implemented)               |         |                  |
|------------|-------------------|---------|------------------|-----------------------------------|---------|------------------|
|            | Bridge            | Span No | Maintenance Unit | Bridge                            | Span No | Maintenance Unit |
| 03/05/2018 | PN5S 1581         | 1,2,3   | Rawalpindi       | PN5S 1581                         | 1,2,3,4 | Rawalpindi       |
| 04/05/2018 | PN5S 1581         | 4,5,6   | Rawalpindi       | PN5S 1581                         | 5,6,7,8 | Rawalpindi       |
| 05/05/2018 | Holiday           |         |                  | Holiday                           |         |                  |
| 06/05/2018 | Holiday           |         |                  | Holiday                           |         |                  |
| 07/05/2018 | Data Entry at HQ  |         |                  | Data Entry (No PC available)      |         |                  |
| 08/05/2018 | Data Entry at HQ  |         |                  | Data Entry of Span 1,2 P-N5S-1581 |         |                  |
| 09/05/2018 | P-N5N-1401+700    | 1       | Wazirabad        | P-N5N-1401+700                    | 1       | Wazirabad        |
|            | P-N5S-1403+220    | 1,2     | Wazirabad        | P-N5N-1420+200                    | 1,2     | Wazirabad        |
| 10/05/2018 | P-N5S-1403+220    | 3,4     | Wazirabad        | P-N5N-1421+400                    | 1,2     | Wazirabad        |
|            | P-N5N-1419+600    | 1       | Wazirabad        | P-N5N-1419+600                    | 1       | Wazirabad        |
| 11/05/2018 | P-N5N-1419+600    | 2       | Wazirabad        | P-N5N-1419+600                    | 2       | Wazirabad        |
|            | P-N5-1467+900     | 1,2     | Wazirabad        | P-N5-1467+900                     | 1,2     | Wazirabad        |
| 12/05/2018 | Holiday           |         |                  | Holiday                           |         |                  |
| 13/05/2018 | Holiday           |         |                  | Holiday                           |         |                  |
| 14/05/2018 | P-N5-1467+900     | 3,4,5   | Wazirabad        | P-N5-1467+900                     | 3,4,5   | Wazirabad        |
| 15/05/2018 | P-N5-1467+900     | 6,7,8   | Wazirabad        | P-N5-1467+900                     | 6,7,8   | Wazirabad        |
| 16/05/2018 | P-N5-1467+900     | 9,10    | Wazirabad        | P-N5-1467+900                     | 9,10    | Wazirabad        |
|            | P-N5N-1469+500    | 1       | Wazirabad        | P-N5N-1469+500                    | 1       | Wazirabad        |
| 17/05/2018 | P-N5N-1469+500    | 2,3     | Wazirabad        | P-N5N-1469+500                    | 2,3     | Wazirabad        |
|            | P-N5S-1469+500    | 1       | Wazirabad        | P-N5S-1469+500                    | 1       | Wazirabad        |
| 18/05/2018 | P-N5S-1469+500    | 2,3     | Wazirabad        | P-N5S-1469+500                    | 2,3     | Wazirabad        |
| 19/05/2018 | Holiday           |         |                  | Holiday                           |         |                  |
| 20/05/2018 | Holiday           |         |                  | Holiday                           |         |                  |
| 21/05/2018 | PN5N 1583         | 1       | Rawalpindi       | P-N5N-1592+200                    | 1,2,3   | Rawalpindi       |
|            | P-N5N-1593+200    | 1,2     | Rawalpindi       | P-N5N-1592+200                    | 4,5,6   | Rawalpindi       |
| 22/05/2018 | P-N5N-1593+200    | 3,4,5   | Rawalpindi       | P-N5N-1592+200                    | 7,8,9   | Rawalpindi       |
| 23/05/2018 | P-N5N-1593+200    | 6,7,8   | Rawalpindi       | P-N5N-1592+200                    | 10      | Rawalpindi       |
| 24/05/2018 | P-N5N-1593+200    | 9,10    | Rawalpindi       | P-N5S-1620+700                    | 1,2     | Rawalpindi       |
|            | P-N5S-1606+950    | 1       | Rawalpindi       | P-N5S-1620+700                    | 1,2,3   | Rawalpindi       |
| 25/05/2018 | P-N5S-1606+950    | 2,3,4   | Rawalpindi       | P-N80-66+300                      | 1,2,3   | Rawalpindi       |
| 26/05/2018 | Holiday           |         |                  | Holiday                           |         |                  |
| 27/05/2018 | Holiday           |         |                  | Holiday                           |         |                  |
| 28/05/2018 | P-N5S-1620+700    | 1,2,3   | Rawalpindi       | P-N80-107+100                     | 1,2,3   | Rawalpindi       |
| 29/05/2018 | P-N5S-1623+300    | 1       | Rawalpindi       | P-N5S-1620+700                    | 3       | Rawalpindi       |
|            | P-N80-79+500      | 1,2     | Rawalpindi       | P-N5S-1581                        | 9       | Rawalpindi       |
| 30/05/2018 | P-N80-79+500      | 3,4     | Rawalpindi       | P-N5S-1581                        | 10,11   | Rawalpindi       |
|            | P-N80-107+100     | 1       | Rawalpindi       | P-N5S-1581                        | 12      | Rawalpindi       |
| 31/05/2018 | P-N80-107+100     | 2,3     | Rawalpindi       | P-N5-1573+500                     | 1       | Rawalpindi       |
| 01/06/2018 | Pedestrian Bridge | 1       | Rawalpindi       |                                   |         |                  |



Figures: OJT of Bridge Inspection





Figures: Examples of corrected Inspection Sheet

### 3) Structural Mechanics Lecture

A structural mechanics lecture was conducted in order to deepen the understanding of important structural matters to pay attention to at the time of inspection.

In office training on September 12th to 17th

[Attendees]

Counterpart side: BMU 2 persons

JICA Expert Team side: 2 persons

Trainee Engineers: 8 persons

Total: 12 persons

[Topics]

| Times           | Date                          | Topics                                                                    |
|-----------------|-------------------------------|---------------------------------------------------------------------------|
| 1 <sup>st</sup> | September 12 <sup>th</sup> AM | Flow of structure design / Calculation of reaction force                  |
| 2 <sup>nd</sup> | September 13 <sup>th</sup> PM | Calculation of section force                                              |
| 3 <sup>rd</sup> | September 14 <sup>th</sup> PM | Geometrical moment of area / Geometrical moment of inertia / Neutral axis |
| 4 <sup>th</sup> | September 17 <sup>th</sup> AM | Calculation of stress level (Bending stress / Shearing stress)            |
| 5 <sup>th</sup> | September 17 <sup>th</sup> PM | Influence of flexural rigidity / Elasticity and plasticity                |

**1. What is flexural rigidity?**

● What is flexural rigidity ?

Flexural rigidity is an amount that represents the difficulty of deformation of a member with respect to the bending moment and is generally expressed by  $EI$ . Here,  $E$  is Young's modulus (modulus of elasticity), and  $I$  is geometrical moment of inertia.

$E$  depends on the material and  $I$  is determined by the cross sectional shape. It will be easy to imagine that it is harder to deform when using the harder material with the same cross-sectional shape, and that the member with the larger cross section is less deformable if it is the same material. However, with regard to the cross section, there is some shape that is resistant to bending deformation rather than simply increasing the cross sectional area. The amount that expresses this difficulty is  $I$ : Geometrical moment of inertia.

**3. Elasticity and plasticity**

● Transition of strain and stress distribution

| Situation | Whole section effective | After crack occurs | Rebar yielding ~ deformation progress | Compressive crush of concrete |
|-----------|-------------------------|--------------------|---------------------------------------|-------------------------------|
| Strain    |                         |                    |                                       |                               |
| Stress    |                         |                    |                                       |                               |

Figures: Structural Mechanics Lecture Materials



Figures: Structural Mechanics Lecture

#### 4) **BMS Software Training**

Operation training on August 9th and 10th

Outline explanation and Hands on operation training of BMS Software is implemented.

Training concerning to the annual maintenance plan formulation on November 6th

Discussion about prioritization and formulation of the annual maintenance plan is implemented, using BMS software.

Additional training for system administration on November 8th and 14th

JICA Expert Team made the explanation and discussion about system administration, such as system configuration, how to backup and so on.

[Attendees: Operation training]

Counterpart side: BMU 3 persons, others 3 persons

JICA Expert Team side: 3 persons

Total: 9 persons

1. Sohaib Mansoor / DD (BMU)
2. Ghulam Murtaza Simair / DD (BMU)
3. Ashfaq Ahmed / AD (BMU / MIS Design)
4. Sadaqat Ullah / AD (S/W)
5. Mian M Sarfaraz / AD (MIS P&CA)
6. Hafeez Akhtar / Database Officer (RAMD)
7. Yukio Igo / JICA Expert Team
8. Akio Mori / JICA Expert Team
9. Momina Rauf / JICA Expert Team



Figures: BMS Software Operation Training

[Attendees: Training concerning to the annual maintenance plan formulation]

Counterpart side: BMU 2 persons

JICA Expert Team side: 3 persons

Total: 5 persons

1. Sohaib Mansoor / DD (BMU)
2. Ghulam Murtaza Simair / DD (BMU)
3. Yukio Igo / JICA Expert Team
4. Akio Mori / JICA Expert Team
5. Ryo Nakai / JICA Expert Team



Figures: BMS Software Training (Prioritization and Annual Maintenance Plan)

[Attendees: Additional training for system administration]

Counterpart side: BMU 1 person, Computer Bureau 1 person

JICA Expert Team side: 2 persons

Total: 4 persons

1. M. Asif Azam / DD (BMU)
2. M Nur-UI-Eain / AD (Computer Networks)
3. Akio Mori / JICA Expert Team
4. Ryo Nakai / JICA Expert Team



Figures: BMS Software Additional Training for system administration

## 1-2 Progress of Activities

### Activity 1-1

**JICA Expert Team develops draft manuals for (1) bridge/culvert inspection, (2) bridge/culvert repair and (3) data input.**

- (1) and (2) were completed as planned in December 2016.
- (3) was completed as planned in December 2017.
- For the sustainable use of BMS Software, additional manuals for **(4) BMS Software operation** [August 2018] and **(5) BMS Software administration** [November 2018] were developed by JICA Expert Team.

### Activity 1-2

**JICA Expert Team develops draft bridge/culvert inspection formats.**

- Completed as planned in December 2016.

### Activity 1-3

**JICA Expert Team develops Prototype Bridge Inspection Database & BMS. [BIDB data input software]**

- Completed as planned in July, 2017.
- Finalized as ver. 1.0.0.26 in November, 2018.

### **[BMS Software]**

- Prototype BMS software (Excel based) in December 2017.
- BMS Software programming was entirely completed and installed on BMS Server at Computer Bureau in August 2018.



**Activity 1-4**

**JICA Expert Team develops draft training materials for (1) bridge/culvert inspection and (2) bridge/ culvert repair.**

- Completed as planned in February 2017.

**Activity 1-5**

**BMU reviews and finalizes the above manuals, inspection formats, prototype and training materials.**

- BMU reviewed in April 2018 and finalized in October 2018.
- BMU submitted a working paper seeking approval of 3 manuals & SOP to Executive Board. The working paper will be presented to NHA Executive Board in due course of time as many other important matters are also in line for consideration.
- BIDB data input software was finalized based on BMU's opinions and requests in November 2018.
- BMS Software was finalized based on BMU's opinions and requests in November 2018.

**Activity 2-1**

**JICA Expert Team provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.**

**【OJT for BMU】**

- BIDB data input OJT: May to August 2018.
- BMS Software Training (Operation): August 9th and 10th 2018
- BMS Software OJT: August to November 2018.
- BMS Software Training (Annual Maintenance Plan): November 8th 2018.
- BMS Software Training (System Administration): November 8th and 14th 2018.

**Activity 2-2**

**BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training).**

- BMS Training (Inventory Survey): February 1st to 2nd 2018.
- BMS Training (Bridge Inspection): April 16th to 20th 2018, at HRTC.
- Structural Mechanics Lectures: September 12th to 17th 2018.

**Activity 2-3**

**Inventory Survey and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.**

- Inventory Survey OJT: February 5th to April 15th 2018.
- Bridge Inspection OJT: May 3rd to June 1st 2018.

#### **Activity 2-4**

**JICA Expert Team reviews the inspection results and ability, and advises BMU to enhance their capacity.**

- JICA Expert Team has reviewed inspection results and ability, and has advised BMU through OJT.
- The BMU has learnt from the valuable experience of the visiting JICA Expert team and has improved capabilities regarding training, survey, data input and final analysis of bridge data.

#### **Activity 3-1**

**JICA Expert Team implements BIDB & BMS Software Training for BMU.**

- BMU prepared the inspection results of 36 bridges and 5 culverts for BMS software training in August, 2018.
- JICA Expert Team conducted BMS Software Operation Training for BMU of 2 civil engineers, 1 IT engineer, and other 3 participants.
- JICA Expert Team also conducted BMS Software Additional Training about system administration for BMU of 1 civil engineer, and IT engineer in Computer Bureau in November, 2018.

#### **Activity 3-2**

**BMU analyzes Bridge Inspection Data of the model area included in database using BMS Software.**

- BMU analyzed Bridge Inspection Data of the model area, and prioritized bridges using BMS software in November, 2018.

#### **Activity 3-3**

**BMU prepares the annual bridge/culvert maintenance plan including budget estimation based on the analysis of registered data in Bridge Inspection Database.**

- Several versions of calculations have been prepared keeping in view the budget availability and the final prioritized list of inspected bridges in the model area. The calculations will be presented on higher forums for consensus.

### **1-3 Achievement of Output**

#### **Output 1-1**

**Draft manuals for (1) bridge inspection by [December, 2016], for (2) bridge repair by [December, 2016] and for (3) data input developed by [December, 2017]**

- (1) and (2) were completed as planned in December 2016.
- (3) was completed as planned in December 2017.
- Additional manuals ((4) **BMS Software Operation** and (5) **BMS Software Administration**) were completed

#### **Output 1-2**

**Draft bridge/culvert inspection formats developed by [December, 2016].**

- Completed as planned in December 2017.

#### **Output 1-3**

**Prototype Database developed by [July, 2017], and prototype BMS by [December, 2017].**

- Prototype BIDB: completed in July 2017.
- Prototype BMS (Excel based): completed in December 2017.
- BMS Software was completed and delivered for BMS Software Training in August 2018 (with actual 36 bridges and 5 culverts inspection data).

#### **Output 1-4**

**2 types of draft training materials for (1) bridge/culvert inspection and (2) bridge repair developed by [December, 2016].**

- Completed in February, 2017.

#### **Output 1-5**

**Manuals (1-1), formats (1-2), Database & BMS (1-3), and training materials (1-4) finalized by [September, 2018].**

- Manuals and formats were finalized in October 2018.
- BIDB data input software was finalized as ver. 1.0.0.26 in November 2018.
- BMS Software was finalized as ver. 1.0.0.5 in November 2018.
- Training materials were finalized in May 2018.

#### **Output 2-1**

**On-the-job-training (OJT) by JICA Expert Team which enables BMU to implement BMS in NHA by [December, 2018].**

- OJT of Inventory Survey Training was implemented in February 2018.

- OJT of Bridge Inspection Training will be implemented in April 2018.
- JICA Expert Team confirmed that BMU obtained capability in November 2018.

#### **Output 2-2**

##### **Inventory Survey, Bridge Inspection and Data Input Training for NHA engineers.**

- Completed in April 2018.

#### **Output 2-3**

##### **Bridge/culvert inspection, bridge repair and data input to Database completed in the model area including the representative [36] bridges and [5] culverts by [October, 2018].**

- Complete in September 2018.

#### **Output 2-4**

##### **The results of bridge repair method selection and data input to a bridge inspection database for model area evaluated to be accurate by BMU & JICA Expert Team by [October, 2018].**

- Completed in October 2018.

#### **Output 3-1**

##### **BMS Software Training for BMU by [December, 2018].**

- BMS Software Operation Training was implemented in August, 2018.
- BMS Software Additional Training about system administration was implemented in November, 2018.

#### **Output 3-2**

##### **Analysis of Bridge Inspection Data of the model area included in Bridge Inspection Database (BIDB) using BMS Software.**

- A prioritized bridge list was formulated according to the analysis of Bridge Inspection Data using BMS Software in November, 2018.

#### **Output 3-3**

##### **Bridge maintenance plan as part of Annual Maintenance Plan, with repair methods and cost estimate for structures in model area including typical 36 bridges and 5 culverts is formulated.**

- Bridge maintenance plan was formulated in restricted cost, which was virtually estimated, for structures in model area.



#### **1-4 Achievement of the Project Purpose**

**Project Purpose: Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of the model area.**

- Bridge Inspection Data of the typical 36 bridges and 5 culverts in the model area were used.
- BMU and JICA Expert Team exchanged opinions on weights and scores for prioritization.
- BMU planned the provisional annual bridge/culvert maintenance plan (AMP) in order to capacity development of NHA for sustainable BMS, JICA Expert Team now focuses on technical assistance to/through BMU with typical 36 bridges and 5 culverts in the model area.

#### **1-5 Changes of Risks and Actions for Mitigation**

##### **[Important Assumption in Activities]**

- BMS is continuously in use by NHA for preparation of bridge maintenance plan.
- BMU (Bridge Management Unit) is established in NHA headquarters.
- BMS organization is gradually established in NHA, who will implement BMS in a sustainable manner.

##### **[Important Assumption in Outputs]**

- NHA arranges adequate human resources for BMS implementation.
- NHA allocates enough budget to maintain and repair prioritized bridges in the annual maintenance plan.

##### **[Issues and Countermeasures]**

#### **1-6 Progress of Actions undertaken by JICA**

- (None)

#### **1-7 Progress of Actions undertaken by NHA**

- NHA has established BMU of 3 civil engineers, and 1 IT engineer has also been assigned.
- NHA has assigned 10 Trainee Engineers for bridge inspection and inventory survey of the model area.

**1-8 Progress of Environmental and Social Considerations (if applicable)**

➤ (None)

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

➤ (None)

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

➤ (None)

## **2 Delay of Work Schedule and/or Problems (if any)**

### **Inventory Survey & Bridge Inspection**

#### **Short-Term & Long-Term Plans (Strategies) in NHA**

#### **Shortage of Human Resources (especially for Inspection)**

#### **Meeting with GM (RAMD), BMU and JICA Expert Team**

### **2-1 Detail**

#### **(1) Inventory Survey**

- Trainee Engineers finished Inventory Survey in the Model Area by April 15<sup>th</sup> 2018.
- Inventory Survey in Lahore MU has been started on 19<sup>th</sup> November 2018. The field inventory survey in Lahore MU has been delayed due to non-availability of vehicles as NHA recently auctioned about 270 vehicles in accordance with the directions of the new Government.

#### **(2) Bridge Inspection**

- Trainee Engineers has finished the inspection of 36 bridges and 5 culverts in the model area by August 29<sup>th</sup> 2018.
- According to periodical inspection of each structure once in 5 years, 65 bridges/culverts in the model area need to be inspected annually.

#### **(3) Meeting with GM (RAMD), BMU and JICA Expert Team**

- GM (RAMD) is requested to provide more time to BMS despite his very busy schedule particularly after General Election (July 25<sup>th</sup> 2018).
- Decision-making on BMS is often delayed due to lengthy administrative procedures in NHA, therefore, all the stake holders are requested to look into the matter and expedite the decision making.
- BMU should have dedicated resources for smooth functioning of the planned activities. The current practice of seeking approval from highest level for every small exercise is unnecessarily retarding the progress.

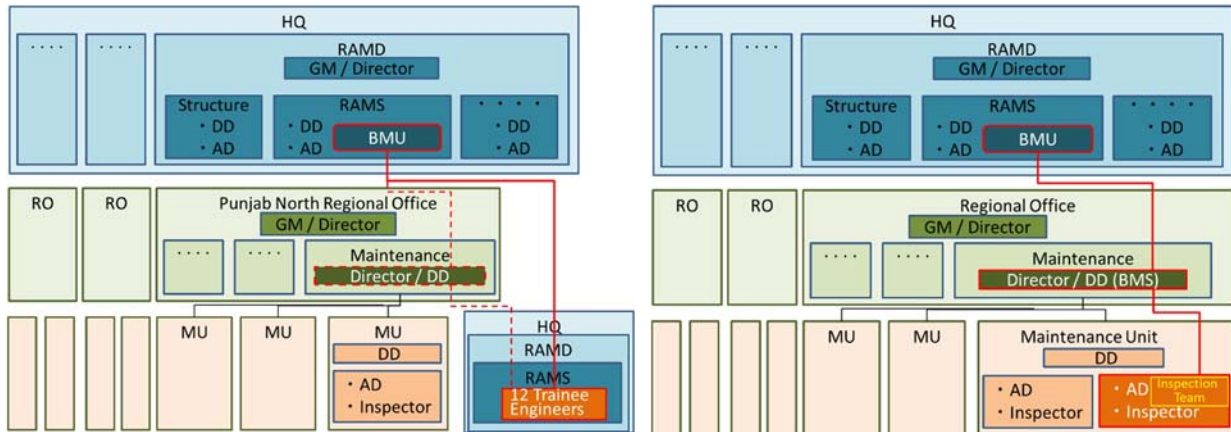
**2-2 Cause**

**(1) JICA Expert Team’s Proposal**

- JICA Expert Team has proposed short-term and long-term visions, and NHA has approved and accepted them. In the short-term vision, Inventory Survey and Bridge Inspection in the model area will be implemented by Trainee Engineers.

**■ Short-term vision for starting BMS**

**■ Long-term vision for national-wide**



**(2) BMS staff in Regional Office**

- BMU takes an additional role of BMS RO staff (so-we-called “Master Trainer”) in the model area. However, BMU will not be able to take the role of Master Trainer for MUs other than the model area (jurisdiction of Rawalpindi MU and Wazirabad MU in Punjab North).
- On the next step, BMU will take the role of Trainer for BMS staff (in HQ, RO and MU).
- In order to continue Bridge Inspection in Punjab North, BMS RO staff in Punjab North is required.
- In long-term, the dedicated BMS RO staff in each RO will be necessary for sustainability of BMS in NHA.

**(3) Standard Operation Procedures (SOP) for BMS**

- BMS activities are not smooth because roles and responsibilities of BMS staff are not clear.
- In order to implement BMS in NHA effectively, the detailed working paper needs to be approved by NHA Executive Board.

**(4) NHA Policy for BMS**

- NHA should declare its policy for BMS in brochures, posters and website.

**(5) Conventional after-the-fact repair/replacement**

- MUs and ROs request HQ to repair or replace bridges with emergency budget when they find critical damages. This conventional after-the-fact procedure should not be taken as much as possible for promoting preventative maintenance.
- As per draft SOP for BMS, NHA needs to have the rule that any request for repair of structures forwarded by the MUs/RO, other than BMS standards, will not be entertained/processed by the NHA HQ.

**2-3 Action to be taken**

**(1) NHA's BMS Strategies**

**[Short-Term]**

December 2018 to February 2020 (15 months)

Scope: Inventory Survey in 6 Regional Offices

Workforce: 12 Trainee Engineers

**[Medium-Term]**

March 2020 to May 2022 (27 months, 3.5 years from now)

Scope: Inventory Survey in remained 6 Regional Offices (Inventory Survey completed)

Bridge Inspection in 12 Reginal Offices (1<sup>st</sup> round)

Workforce: 12 Trainee Engineers + Outsource (Consultants)

**[Long-Term]**

June 2022 and permanent

Scope: Bridge Inspection on once in 5 year basis (20% per year)

Workforce: 12 Trainee Engineers + Outsource (Consultants)

**2-4 Roles of Responsible Persons/Organization (JICA, NHA, etc.)**

**[NHA]**

- NHA secures availability of optimum maintenance budget.
- BMS continues to update of bridge data.
- NHA arranges **adequate human resources** for BMS implementation.
- NHA allocates enough budget to maintain and repair prioritized bridges in the annual maintenance plan.
- BMS is continuously in use by NHA for preparation of bridge maintenance plan.
- BMU is established in NHA headquarters.
- **BMS organization** is gradually established in NHA, who will implement BMS **in a sustainable manner**.

**[JICA]**

- JICA will monitor BMS progress and BMU activities.

**[JICA Expert Team]**

- Project Completion Report and Terminal Evaluation in January 2019.

**[BMU]**

- BMU organizes the Seminar to disseminate BMS concept to inside/outside NHA.
- BMU manages BMS articles for brochure and on web portal.
- BMU takes responsibilities of all the procedures for outsourcing (consultants) procurement.
- BMU provides BMS training for Outsource (Consultant) staff.

### **3 Modification of the Project Implementation Plan**

#### **3-1 PO**

- According to R/D amendment, JICA Expert Team extended the stay to December 2018.
- Draft Project Completion Report (in English) was finalized in November (excluding the part of Terminal Evaluation).

#### **3-2 PDM**

- PDM was amended and signed on October 16<sup>th</sup> 2018.

#### **3-3 Other modifications on detailed implementation plan**

- (None)

### **4 Preparation of NHA towards after completion of the Project**

#### **(1) NHA Policy for BMS**

## **II. Project Monitoring Sheet I & II** as Attached

PM Form 1: PDM (Project Design Matrix)

PM Form 2: PO (Plan of Operation)

## Project Design Matrix

**Project Title:** The Project for Technical Assistance on Implementation of Bridge Management System in NHA

**Implementing Agency:** National Highway Authority

**Target Group:**

**Period of Project:** July, 2016 – April, 2019 (34 months)

**Project Site:** in/around Islamabad, Pakistan

Version 6

Dated 3, December, 2018

**Model Area:** Jurisdiction of Rawalpindi MU and Wazirabad MU in Puniab North

| Narrative Summary                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                            | Objectively Verifiable Indicators                                                                                                                                                | Means of Verification                                                                                                                                                                                                               | Important Assumption | Achievement | Remarks                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------|--------------------------------------------------------------------------------------|
| <b>Overall Goal</b><br>Bridge inspection & maintenance status improved on the bridges of National Highways in the model area.          | <ol style="list-style-type: none"> <li>1) The bridges identified in the maintenance plan prepared under the Project are maintained and repaired according to the plan.</li> <li>2) In the model area, more than [65] bridges are annually inspected and the bridge maintenance plan is annually revised.</li> </ol>                                                                                        | Inspection and maintenance record in the BMS based on which bridge/culvert maintenance plan is prepared as part of Annual Maintenance Plan                                       |                                                                                                                                                                                                                                     |                      |             | The model area means jurisdiction of Rawalpindi MU and Wazirabad MU in Punjab North. |
| <b>Project Purpose</b><br>Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of the model area. | Bridge maintenance plan with breakdowns for the model area prepared by [November, 2018].                                                                                                                                                                                                                                                                                                                   | Analysis of the model area input data to BMS and bridge maintenance plan (with anticipated budget requirement for forthcoming years)                                             | <ul style="list-style-type: none"> <li>· Availability of optimum maintenance budget.</li> <li>· Continuous update of bridge data</li> </ul>                                                                                         |                      |             |                                                                                      |
| <b>Outputs</b><br>1. Manuals, Database and BMS developed for bridge inspection and bridge repair                                       | <ol style="list-style-type: none"> <li>1-1: Draft manuals for (1) bridge inspection by [December, 2016], for (2) bridge repair by [December, 2016] and for (3) data input developed by [December, 2017]</li> <li>1-2: Draft bridge/culvert inspection formats developed by [December, 2016].</li> <li>1-3: Prototype Database developed by [July, 2017], and prototype BMS by [December, 2017].</li> </ol> | <ol style="list-style-type: none"> <li>1-1: 3 types of draft manuals</li> <li>1-2: Draft bridge/culvert inspection formats</li> <li>1-3: Prototype Database &amp; BMS</li> </ol> | <ul style="list-style-type: none"> <li>· NHA arranges adequate human resources for BMS implementation.</li> <li>· NHA allocates enough budget to maintain and repair prioritized bridges in the annual maintenance plan.</li> </ul> | Completed            | Completed   | Completed                                                                            |

|                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                 |                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <p>1-4: 2 types of draft training materials for (1) bridge/culvert inspection and (2) bridge repair developed by [December, 2016].</p> <p>1-5: Manuals (1-1), formats (1-2), Database &amp; BMS (1-3), and training materials (1-4) finalized by [September, 2018].</p> | <p>1-4: 2 types of draft training materials for (1) bridge/culvert inspection and (2) bridge repair developed by [December, 2016].</p> <p>1-5: Manuals (1-1), formats (1-2), Database &amp; BMS (1-3), and training materials (1-4) finalized by [September, 2018].</p>                                                                                                                                                                                                                                                                                                                                           | <p>1-4: 2 types of draft training materials</p> <p>1-5: 3 types of manuals, bridge/culvert inspection formats, Database &amp; BMS, and 2 types of training materials</p>                                                                                                        | <p>Completed</p> <p>Completed and Forwarded to Executive Board Meeting in November 2018.</p>                     |
| <p>2. Bridge/culvert inspection in the model area is implemented after BMS training.</p>                                                                                                                                                                                | <p>2-1: On-the-job-training (OJT) by JICA Expert Team which enables BMU to implement BMS in NHA by [December, 2018].</p> <p>2-2: Inventory Survey, Bridge Inspection and Data Input Training for NHA engineers.</p> <p>2-3: Bridge/culvert inspection, bridge repair and data input to Database completed in the model area including the representative [36] bridges and [5] culverts by [October, 2018].</p> <p>2-4: The results of bridge repair method selection and data input to a bridge inspection database for model area evaluated to be accurate by BMU &amp; JICA Expert Team by [October, 2018].</p> | <p>2-1: Training records and reports</p> <p>2-2: Training records and reports</p> <p>2-3: Inspection data of the model area including the representative [36] bridges and [5] culverts in Bridge Inspection Database.</p> <p>2-4: Input data to Database and its evaluation</p> | <p>Completed in November</p> <p>Completed in April</p> <p>Completed in September</p> <p>Completed in October</p> |
| <p>3. Bridge data of the model area is available with BMU at NHA headquarters and bridge maintenance plan is prepared according to the data.</p>                                                                                                                        | <p>3-1: BMS Software Training for BMU by [December, 2018].</p> <p>3-2: Analysis of Bridge Inspection Data of the model area included in <b>Bridge Inspection Database (BIDB)</b> using BMS Software.</p> <p>3-3: Bridge maintenance plan as part of Annual Maintenance Plan, with repair methods and cost estimate for structures in model area including typical 36 bridges and 5 culverts is formulated.</p>                                                                                                                                                                                                    | <p>3-1: Record of BMS Training</p> <p>3-2: Output data of BMS (Prioritization)</p> <p>3-3: Bridge maintenance plan</p>                                                                                                                                                          | <p>Completed in August</p> <p>Completed in November</p> <p>Completed in November</p>                             |



| Activities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Inputs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | The Japanese Side                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | The Pakistani Side                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Important Assumption |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <p>1-1: JICA Expert Team develops draft manuals for (1) bridge/culvert inspection, (2) bridge/culvert repair and (3) data input.</p> <p>1-2: JICA Expert Team develops draft bridge/culvert inspection formats.</p> <p>1-3: JICA Expert Team develops Prototype Bridge Inspection Database &amp; BMS.</p> <p>1-4: JICA Expert Team develops draft training materials for (1) bridge/culvert inspection and (2) bridge/culvert repair.</p> <p>1-5: BMU reviews and finalizes the above manuals, inspection formats, prototype and training materials.</p> <p>2-1: JICA Expert Team provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.</p> <p>2-2: BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training) .</p> <p>2-3: Inventory Survey and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.</p> <p>2-4: JICA Expert Team reviews the inspection results and ability, and advises BMU to enhance their capacity.</p> <p>3-1: JICA Expert Team implements BIDB &amp; BMS Software Training for BMU.</p> <p>3-2: BMU analyzes Bridge Inspection Data of the model area included in database using BMS Software.</p> <p>3-3: BMU prepares the annual bridge/culvert maintenance plan including budget estimation based on the analysis of registered data in Bridge Inspection Database.</p> | <p><b>1. EXPERTS</b></p> <ul style="list-style-type: none"> <li>1) Bridge Inspection Expert</li> <li>2) Bridge Repair Expert</li> <li>3) BMS Expert</li> <li>4) Capacity Development Expert</li> <li>5) Project Monitoring Expert</li> <li>6) <b>Terminal Evaluation</b></li> <li>7) Local Coordinator (Pakistani)</li> </ul> <p><b>2. EQUIPMENT</b></p> <ul style="list-style-type: none"> <li>· Crack Scale &amp; Test Hammer</li> <li>· Carbonation (Phenolphthalein)</li> <li>· Helmet</li> </ul> | <p><b>1. PERSONNEL</b></p> <p>Administrative Personnel</p> <ul style="list-style-type: none"> <li>1) Person in Charge: Member (Planning)</li> <li>2) Project Manager: General Manager (RAMID)</li> <li>3) Project Coordinator: Deputy Director (BMU) - I Counterpart Personnel Deputy Director (BMU) - II Deputy Director (BMU) - III</li> </ul> <p><b>2. OFFICE &amp; FACILITIES</b></p> <ul style="list-style-type: none"> <li>· Office for JICA Experts in NHA's HQ Building with office furniture, internet and telephone.</li> </ul> <p><b>3. ARRANGEMENT</b></p> <ul style="list-style-type: none"> <li>· Training Arrangements</li> <li>· Transportation for the field trips of JICA Experts in/around Islamabad.</li> </ul> <p><b>4. BUDGET ALLOCATION</b></p> <p>Budget for traveling and accommodation expenses of the training participants.</p> | <ul style="list-style-type: none"> <li>· BMS is continuously in use by NHA for preparation of bridge maintenance plan.</li> <li>· BMU (Bridge Management Unit) is established in NHA headquarters.</li> <li>· BMS organization is gradually established in NHA, who will implement BMS in a sustainable manner.</li> </ul> <p><b>Pre-Conditions</b></p> <ul style="list-style-type: none"> <li>· Pakistan, especially Islamabad and Lahore, is continuously safe enough for JICA Expert Team to implement the activities.</li> </ul> <p><b>&lt;Issues and countermeasures&gt;</b></p> |                      |

Plan of Operation

Version 6

Dated 3, December, 2018

Project Title: The Project for Technical Assistance on Implementation of Bridge Management System in NHA

| Inputs                           | Year                                               | 1st Year |        |      |        | 2nd Year |        |      |        | 3rd Year |        |      |        | 4th Year |        |      |        | Remarks | Monitoring                              |          |
|----------------------------------|----------------------------------------------------|----------|--------|------|--------|----------|--------|------|--------|----------|--------|------|--------|----------|--------|------|--------|---------|-----------------------------------------|----------|
|                                  |                                                    | I        | II     | III  | IV     | I        | II     | III  | IV     | I        | II     | III  | IV     | I        | II     | III  | IV     |         | Issue                                   | Solution |
|                                  |                                                    | Plan     | Actual | Plan | Actual | Plan     | Actual | Plan | Actual | Plan     | Actual | Plan | Actual | Plan     | Actual | Plan | Actual |         |                                         |          |
| Expert                           | Project Manager / Bridge Inspection<br>Yukio IGO   | Plan     |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
|                                  | Bridge Repair<br>Yoshiichi FUJIMOTO                | Plan     |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
|                                  | BMS (System Design)<br>Akio MORI                   | Plan     |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
|                                  | BMS (System Design Assistance)<br>Syougo ABIRU     | Plan     |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
|                                  | Capacity Development<br>Haruo TOMIYAMA             | Plan     |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
|                                  | Project Monitoring<br>Kenichi TOMI                 | Plan     |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
|                                  | Project Monitoring (2)<br>Toshiko SHIMADA          | Plan     |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
|                                  | BMS (Specification Logic)<br>Fumiatsu KAMITANI     | Plan     |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
|                                  | BMS (Specification Logic Assistance)<br>Ryou NAKAI | Plan     |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
|                                  | Equipment                                          | Plan     |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
|                                  | Crack Scale, Test Hammer, Helmet and Carbonation   | Actual   |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
|                                  | Training in Japan                                  | Plan     |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
|                                  | Actual                                             |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         | The 2nd training in Japan is cancelled. |          |
|                                  | In-country/Third country Training                  | Plan     |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
| Master Trainer Training          | Actual                                             |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
| BMS Training (Inventory Survey)  | Plan                                               |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
| BMS Training (Bridge Inspection) | Actual                                             |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
| BMS Software Training            | Plan                                               |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |
| AMP OJT                          | Actual                                             |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |         |                                         |          |

| Activities                                                                                                                                              | Sub-Activities | Year | 1st Year |        |      |        | 2nd Year |        |      |        | 3rd Year |        |      |        | 4th Year |        |      |        | Responsible Organization |     | Achievements | Issue & Countermeasures |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------|----------|--------|------|--------|----------|--------|------|--------|----------|--------|------|--------|----------|--------|------|--------|--------------------------|-----|--------------|-------------------------|
|                                                                                                                                                         |                |      | I        | II     | III  | IV     | I        | II     | III  | IV     | I        | II     | III  | IV     | I        | II     | III  | IV     | Japan                    | NHA |              |                         |
|                                                                                                                                                         |                |      | Plan     | Actual | Plan | Actual | Plan     | Actual | Plan | Actual | Plan     | Actual | Plan | Actual | Plan     | Actual | Plan | Actual |                          |     |              |                         |
| 0-1 Analyze the issues to be improved in the current bridge and culvert maintenance by NHA.                                                             |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        | 2nd                      |     |              |                         |
| 0-2 Study the current bridge and culvert inspection implemented by the staff of MUs on daily basis and regular basis (twice a year).                    |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        | 2nd                      |     |              |                         |
| 0-3 Study the existing bridge and culvert inspection format (in NHA Code 2005).                                                                         |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        | 2nd                      |     |              |                         |
| 0-4 Study the system of and data input to the existing BMS (Smart Bridge).                                                                              |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        | 2nd                      |     |              |                         |
| Output 1: Manuals, Database and BMS developed for bridge inspection and bridge repair                                                                   |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| 1-1: JICA Expert Team develops draft manuals for (1) bridge/culvert inspection, (2) bridge/culvert repair and (3) data input.                           |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| 1-1-1. JICA Expert Team drafts a manual for bridge inspection based on the findings of Activity 0-1 & 0-2.                                              |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 1st |              |                         |
| 1-1-2 JICA Expert Team drafts a manual for bridge repair based on the findings of Activity 0-1 & 0-3.                                                   |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 1st |              |                         |
| 1-1-3 JICA Expert Team drafts a manual for data input to BIDB.                                                                                          |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 1st |              |                         |
| 1-2: JICA Expert Team develops draft bridge/culvert inspection formats.                                                                                 |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 1st |              |                         |
| 1-3: JICA Expert Team develops Prototype Bridge Inspection Database & BMS.                                                                              |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| 1-3-1 JICA Expert Team studies the current IT environment of ROs and MUs including the number of PCs deployed and the condition of internet connection. |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 1st |              |                         |
| 1-3-2 JICA Expert Team considers the specifications of Database & BMS.                                                                                  |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 1st |              |                         |
| 1-3-3 JICA Expert Team develops Prototype of Bridge Inspection Database & BMS.                                                                          |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 1st |              |                         |
| 1-3-4 JICA Expert Team transfers data from Smart Bridge Inventory to BIDB.                                                                              |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 1st |              |                         |
| 1-4: JICA Expert Team develops draft training materials for (1) bridge/culvert inspection and (2) bridge/culvert repair.                                |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| 1-4-1 JICA Expert Team develops bridge inspection training materials for training.                                                                      |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 1st |              |                         |
| 1-4-2 JICA Expert Team develops bridge repair training materials for training.                                                                          |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 1st |              |                         |
| 1-5: BMU reviews and finalizes the above manuals, inspection formats, prototype and training materials.                                                 |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| 1-5-1 JICA Expert Team reviews the lessons learned from Activity 2-1.                                                                                   |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 1st |              |                         |
| 1-5-2 JICA Expert Team revises the manuals, formats, a database and training materials referring to the lessons reviewed in Activity 1-5-1.             |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 1st |              |                         |
| 1-5-3 BMU re-reviews the lessons learned from Activity 2-1, 2-2 & 2-3.                                                                                  |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 2nd |              |                         |
| 1-5-4 BMU finalizes the manuals, formats, a database and training materials referring to the lessons reviewed in Activity 1-5-3.                        |                | Plan |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| Actual                                                                                                                                                  |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          | 2nd |              |                         |
| Output 2: Bridge/culvert inspection in the model area is implemented after BMS training.                                                                |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |
| 2-1: JICA Expert Team provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.                                               |                |      |          |        |      |        |          |        |      |        |          |        |      |        |          |        |      |        |                          |     |              |                         |





# The project for technical assistance on implementation of Bridge Management System in NHA

## JCC-6

### Joint Coordination Committee

December 3<sup>rd</sup> 2018

at

Auditorium NHA HQ Islamabad



P R O D U C I N G  
T H E F U T U R E



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## Contents

1-Project Outline

2-Progress of Activities

3-Vision for BMS by NHA

# 1-Project Outline

3



## Project Outline

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### (1) Project Name

The Project for Technical Assistance on Implementation of Bridge Management System in NHA in Islamic Republic of Pakistan

### (2) Duration

July 12, 2016 – April 30, 2019 (34 months)

### (3) Sponsored by

Japan International Cooperation Agency (JICA)

### (4) Counterpart: National Highway Authority (NHA)

### (5) Supervision Ministry: Ministry of Communications (MOC)

# Project Purpose & Overall Goal

## Project Purpose (in the Project duration)

Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of the model area.

## Overall Goal (after the Project)

Bridge inspection & maintenance status improved on the bridges of National Highways in the model area.

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# Output1

| Activities                                                                                                                    | Acievement                                                       |
|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Output 1:Manuals, Database and BMS developed for bridge inspection and bridge repair                                          |                                                                  |
| 1-1: JICA Expert Team develops draft manuals for (1) bridge/culvert inspection, (2) bridge/culvert repair and (3) data input. | (1) and (2) completed in Dec 2016.<br>(3) completed in Dec 2017. |
| 1-2: JICA Expert Team develops draft bridge/culvert inspection formats.                                                       | Completed in Dec 2016.                                           |
| 1-3: JICA Expert Team develops Prototype Bridge Inspection Database & BMS.                                                    | Database developed in Jul 2017.<br>BMS developed in Aug 2018.    |
| 1-4: JICA Expert Team develops draft training materials for (1) bridge/culvert inspection and (2) bridge/culvert repair.      | Completed in Feb 2017.                                           |
| 1-5: BMU reviews and finalizes the above manuals, inspection formats, prototype and training materials.                       | Finalized in Sep 2018.                                           |

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## Output2

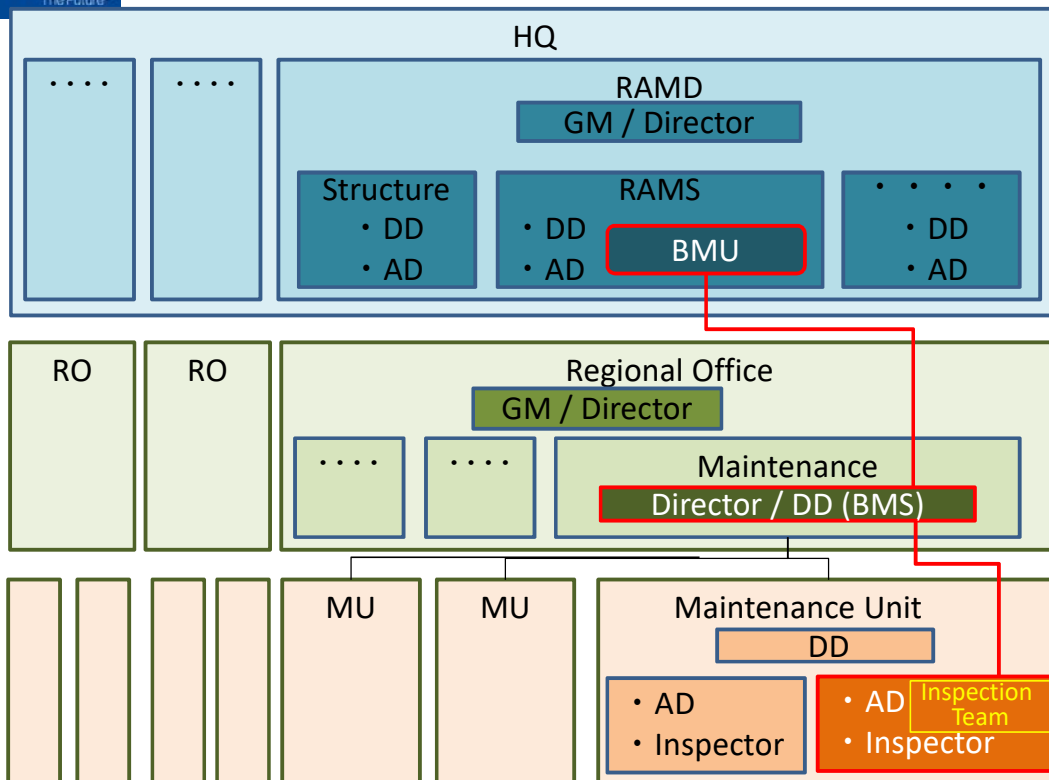
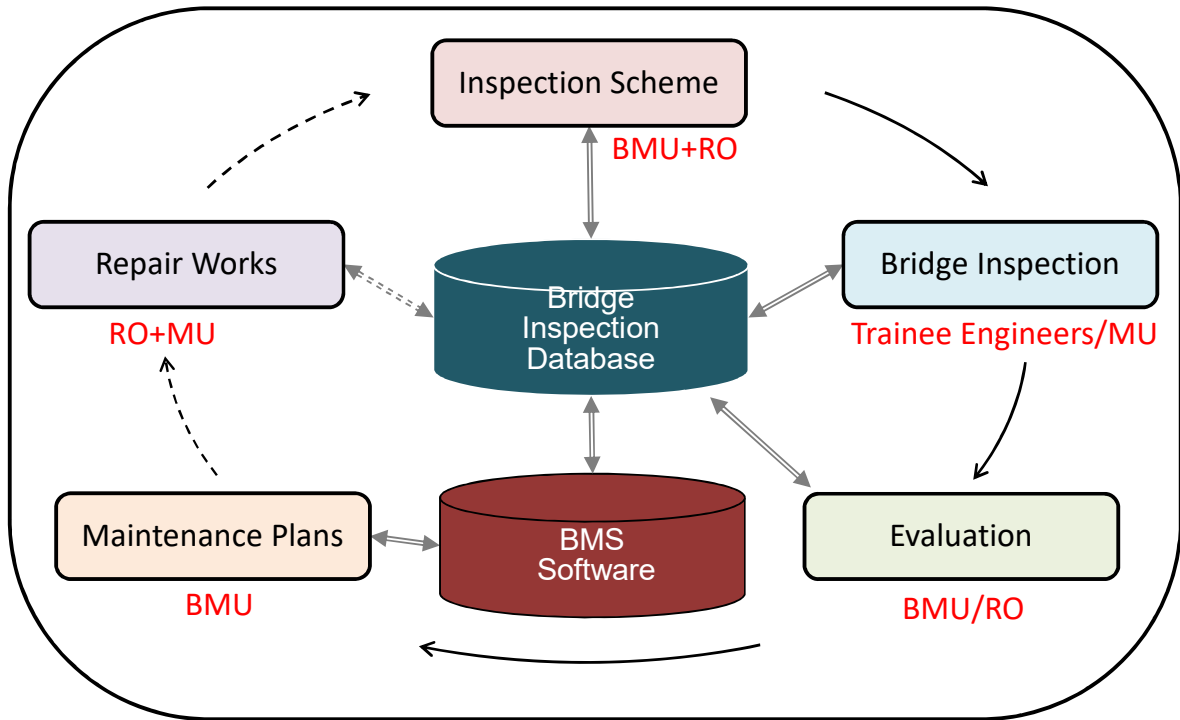
| Activities                                                                                                   | Acievement                                                                     |
|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Output 2: Bridge/culvert inspection in the model area is implemented after BMS training.                     |                                                                                |
| 2-1: JICA Expert Team provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.    | Completed in Nov 2018.                                                         |
| 2-2: BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training)                  | Inventory Survey Training in Feb 2018. Bridge Inspection Training in Apr 2018. |
| 2-3: Inventory Survey and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.    | Completed in Sep 2018.                                                         |
| 2-4: JICA Expert Team reviews the inspection results and ability, and advises BMU to enhance their capacity. | Completed in Oct 2018.                                                         |

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## Output3

| Activities                                                                                                                                                       | Acievement             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| Output 3: Bridge data of the model area is available with BMU at NHA headquarters and bridge maintenance plan is prepared according to the data.                 |                        |
| 3-1: JICA Expert Team implements BIDB & BMS Software Training for BMU.                                                                                           | Completed in Aug 2018. |
| 3-2: BMU analyzes Bridge Inspection Data of the model area included in database using BMS Software.                                                              | Completed in Nov 2018. |
| 3-3: BMU prepares the annual bridge/culvert maintenance plan including budget estimation based on the analysis of registered data in Bridge Inspection Database. | Completed in Nov 2018. |

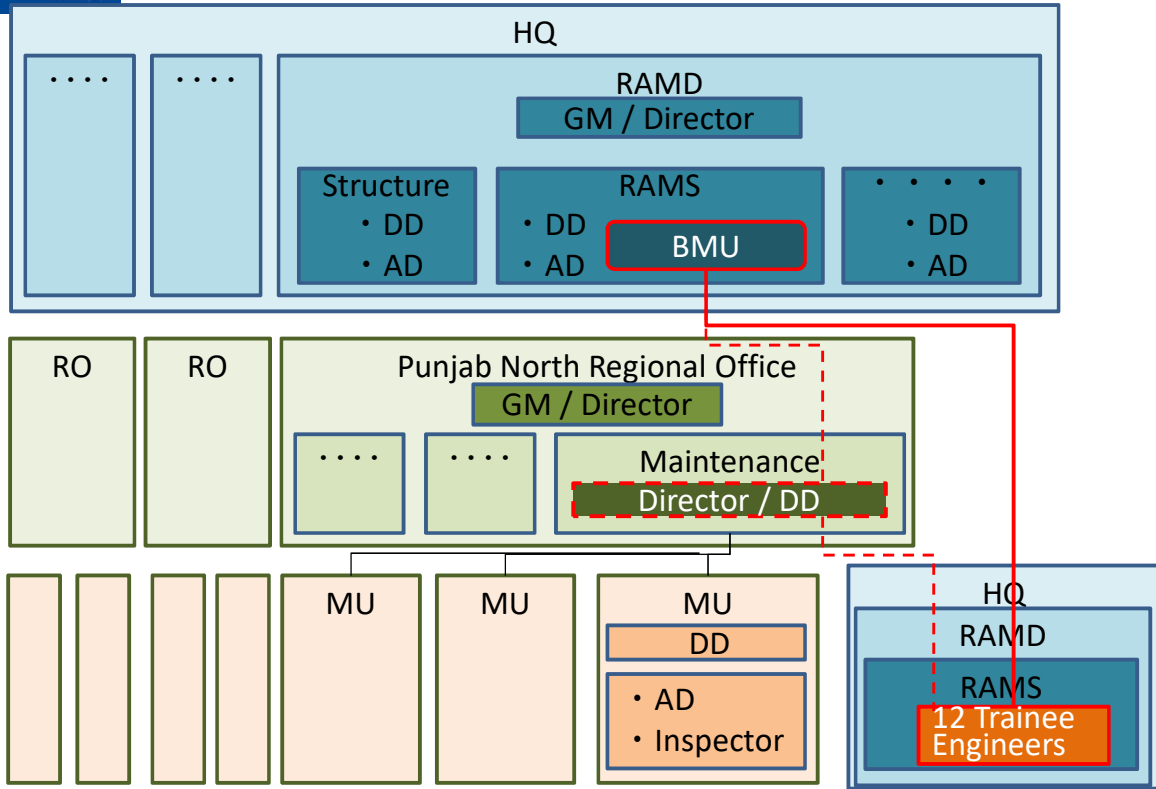
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## BMS Organization Structure (Short-term Plan)

Model Area: Rawalpindi & Wazirabad MU in Punjab North



BMS Organization

## BMS(Bridge Management System) Organization

| Pakistan - NHA                                                                                                                                           | Japan – JICA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Person in Charge</b><br>Mr. Arbab Ali Dhakan<br>Member (Engg. & Cord.)NHA                                                                             | JICA Pakistan Office<br>Chief Representative: Mr. Yasuhiro Tojo<br>Senior Representative: Mr. Akihiro Takashima<br>Representative: Ms. Kazuho Ujiie<br>Senior Program Officer: Ms. Naila Almas                                                                                                                                                                                                                                                                                                         |
| <b>Project Manager</b><br>Mr. Ikramus Saqlain Haider<br>GM (RAMD) NHA                                                                                    | JICA Head Office<br>Chief Representative: Mr. Shuntaro Kawahara<br>Representative: Mr. Kazunobu Takahashi                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Project Coordinator</b><br>Mr. Muhammad Asif Azam<br>Deputy Director (BMU- I ) NHA                                                                    | <b>Consultant Team</b><br>Project Manager/Bridge Inspection: Mr. Yukio IGO<br>Bridge Repair: Mr.Yoshiichi FUJIMOTO<br>BMS (System Design): Mr.Akio MORI<br>BMS (System Design Assistance): Mr.Syougo ABIRU<br>Capacity Development: Mr.Haruo TOMIYAMA<br>Capacity Development (Assistance): Ms.Kayo YONEZAWA<br>BMS (Specification Logic): Mr.Fumiatsu KAMITANI<br>BMS (Specification Logic Assistance): Mr.Ryou NAKAI<br>Project Monitoring: Mr.Kenichi TOMI<br>Program Coordinator: Ms.Kotoko YONEDA |
| <b>Counterpart Personnel</b><br>Mr. Ghulam Murtaza Simair<br>Deputy Director (BMU- II ) NHA<br><br>Mr. Sohaib Mansoor<br>Deputy Director (BMU- III ) NHA | Local Expert / Administrator: Ms.Momina Rauf                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>IT Engineer</b><br>Mr. M Nur-Ul-Eain<br>Assistant Director                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

# Project Schedule

## Plan of Operation

Project Title: The Project for Technical Assistance on Implementation of Bridge Management System in NHA

| Inputs                                                                                                                        | Year   | 2016 |    |     |    | 2017 |    |     |    | 2018 |    |     |    | 2019 |    |     |                                                                                | Achievement |
|-------------------------------------------------------------------------------------------------------------------------------|--------|------|----|-----|----|------|----|-----|----|------|----|-----|----|------|----|-----|--------------------------------------------------------------------------------|-------------|
|                                                                                                                               |        | I    | II | III | IV | I    | II | III | IV | I    | II | III | IV | I    | II | III | IV                                                                             |             |
| <b>Output 1: Manuals, Database and BMS developed for bridge inspection and bridge repair</b>                                  |        |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     |                                                                                |             |
| 1-1: JICA Expert Team develops draft manuals for (1) bridge/culvert inspection, (2) bridge/culvert repair and (3) data input. | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | (1) and (2) completed in Dec 2016.<br>(3) completed in Dec 2017.               |             |
| 1-2: JICA Expert Team develops draft bridge/culvert inspection formats.                                                       | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Completed in Dec 2016.                                                         |             |
| 1-3: JICA Expert Team develops Prototype Bridge Inspection Database & BMS.                                                    | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Database developed in Jul 2017.<br>BMS developed in Aug 2018.                  |             |
| 1-4: JICA Expert Team develops draft training materials for (1) bridge/culvert inspection and (2) bridge/culvert repair.      | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Completed in Feb 2016.                                                         |             |
| 1-5: BMU reviews and finalizes the above manuals, inspection formats, prototype and training materials.                       | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Finalizes in Sep 2018.                                                         |             |
| <b>Output 2: Bridge/culvert inspection in the model area is implemented after BMS training.</b>                               |        |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     |                                                                                |             |
| 2-1: JICA Expert Team provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.                     | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Completed in Apr 2018.                                                         |             |
| 2-2: BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training)                                   | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Inventory Survey Training in Feb 2018. Bridge Inspection Training in Apr 2018. |             |
| 2-3: Inventory Survey and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.                     | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Completed in Sep 2018.                                                         |             |
| 2-4: JICA Expert Team reviews the inspection results and ability, and advises BMU to enhance their capacity.                  | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Completed in Oct 2018.                                                         |             |

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# Project Schedule

| Inputs                                                                                                                                                           | Year   | 2016 |    |     |    | 2017 |    |     |    | 2018 |    |     |    | 2019 |    |     |                                                | Achievement |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|----|-----|----|------|----|-----|----|------|----|-----|----|------|----|-----|------------------------------------------------|-------------|
|                                                                                                                                                                  |        | I    | II | III | IV | I    | II | III | IV | I    | II | III | IV | I    | II | III | IV                                             |             |
| <b>Output 3: Bridge data of the model area is available with BMU at NHA headquarters and bridge maintenance plan is prepared according to the data.</b>          |        |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     |                                                |             |
| 3-1: JICA Expert Team implements BIDB & BMS Software Training for BMU.                                                                                           | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Completed in Nov 2018.                         |             |
| 3-2: BMU analyzes Bridge Inspection Data of the model area included in database using BMS Software.                                                              | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Completed in Dec 2018.                         |             |
| 3-3: BMU prepares the annual bridge/culvert maintenance plan including budget estimation based on the analysis of registered data in Bridge Inspection Database. | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Completed in Dec 2018.                         |             |
| <b>Training</b>                                                                                                                                                  |        |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     |                                                |             |
| Training in Japan                                                                                                                                                | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Jan 15th to 27th, 2017                         |             |
| Master Trainer Training                                                                                                                                          | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Feb 27th to Mar 17th, 2017                     |             |
| BMS Training (Inventory Survey)                                                                                                                                  | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Feb 1st to 2nd, 2018                           |             |
| BMS on the Job Training (Inventory Survey)                                                                                                                       | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Feb 5th to Apr 15nd, 2018                      |             |
| BMS Training (Bridge Inspection)                                                                                                                                 | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Apr 16th to 20th, 2018                         |             |
| BMS on the Job Training (Bridge Inspection)                                                                                                                      | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | May 3rd to Jun 1st, 2018                       |             |
| BMS Software Training                                                                                                                                            | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Aug 9th to 10th, 2018<br>Nov 8th to 14th, 2018 |             |
| Structural Mechanics Lecture                                                                                                                                     | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Sep 12th to 17th, 2018                         |             |
| Annual Maintenance Plan on the Job Training                                                                                                                      | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Nov 6th, 2018                                  |             |
| <b>Monitoring</b>                                                                                                                                                |        |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     |                                                |             |
| Joint Coordination Committee                                                                                                                                     | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     |                                                |             |
| Joint Monitoring                                                                                                                                                 | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     | Terminal Evaluation, Jan 15th to 28th.         |             |
| <b>Reports/Documents</b>                                                                                                                                         |        |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     |                                                |             |
| Draft Project Completion Report                                                                                                                                  | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     |                                                |             |
| Project Completion Report                                                                                                                                        | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     |                                                |             |
| <b>Public Relations</b>                                                                                                                                          |        |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     |                                                |             |
| Brochure & Web Portal                                                                                                                                            | Actual |      |    |     |    |      |    |     |    |      |    |     |    |      |    |     |                                                |             |

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## 2-Progress of Activities

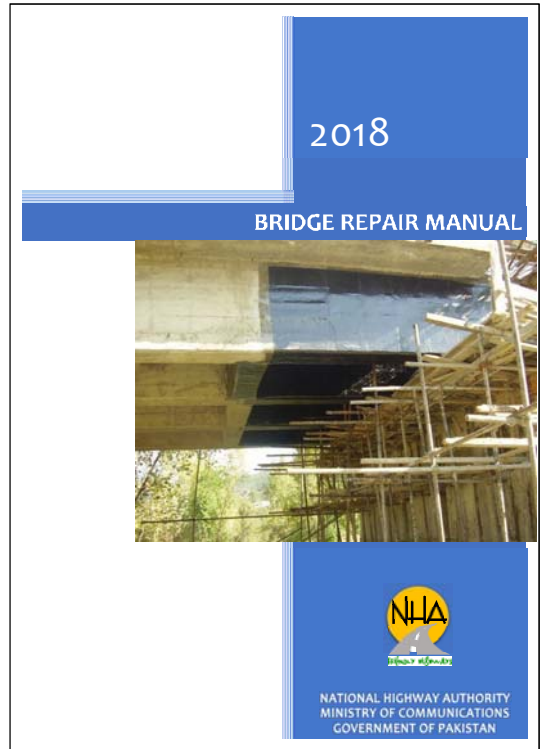
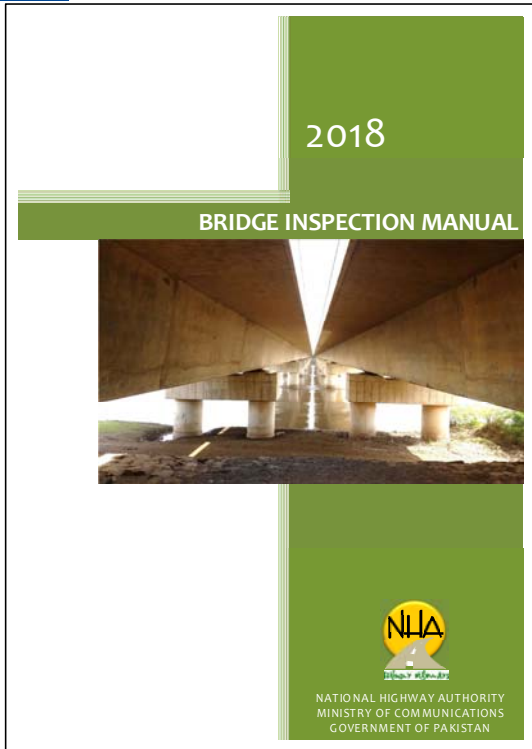
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### Output1

| Activities                                                                                                                    | Acievement                                                       |
|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Output 1:Manuals, Database and BMS developed for bridge inspection and bridge repair                                          |                                                                  |
| 1-1: JICA Expert Team develops draft manuals for (1) bridge/culvert inspection, (2) bridge/culvert repair and (3) data input. | (1) and (2) completed in Dec 2016.<br>(3) completed in Dec 2017. |
| 1-2: JICA Expert Team develops draft bridge/culvert inspection formats.                                                       | Completed in Dec 2016.                                           |
| 1-3: JICA Expert Team develops Prototype Bridge Inspection Database & BMS.                                                    | Database developed in Jul 2017.<br>BMS developed in Aug 2018.    |
| 1-4: JICA Expert Team develops draft training materials for (1) bridge/culvert inspection and (2) bridge/culvert repair.      | Completed in Feb 2017.                                           |
| 1-5: BMU reviews and finalizes the above manuals, inspection formats, prototype and training materials.                       | Finalized in Sep 2018.                                           |

# 1-1: JICA Expert Team develops draft manuals for (1) bridge/culvert inspection, (2) bridge/culvert repair and (3) data input.



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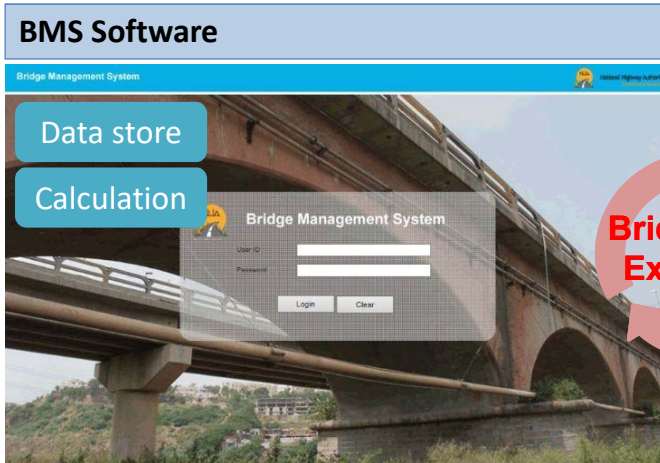
# 1-2: JICA Expert Team develops draft bridge/culvert inspection formats.

| [Periodical Inspection] Inspection Report Sheet 1-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |                           |                         |                        |                                  |                       |                                                               |                |                 | [Periodical Inspection] Inspection Report Sheet 1-3                                                                                       |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                   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  |       |  |   |                                                               |    |       |  |   |         |                           |           |       |  |   |       |  |        |                                      |   |        |                           |                         |       |                                  |    |       |  |       |                                                   |   |        |                           |       |       |  |   |                    |    |  |                                                                                                                                           |   |        |                           |           |       |  |   |          |    |       |  |    |        |                      |       |       |  |   |                                              |    |       |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |  |  |  |  |  |  |                     |  |                       |  |                       |  |                       |  |                 |                     |    |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------|-------------------------|------------------------|----------------------------------|-----------------------|---------------------------------------------------------------|----------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------|-----------------|-----------------------|--------------------|-----------------------|-----------------|-----------------|---------------------|----------------|-----------------------|------------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|----------|--------|-------------|-------|-------|----------------------|-----------------------|-----|------|----------|----------|---|---------|---------------------------|------------------|-------|--|---|-------|--|--------|--------------------------------------|---|--------|---------------------------|---------------------|-------|----------------------------------|----|-------|--|-------|-------------------------------------------------------------|---|--------|---------------------------|---------|-------|--|---|----------|----|-------|--|---|------|---------------------------|-------|-------|--|---|-------|--|--------|--------------------------------------|---|------------|--------------------|------|-------|--|---|---------------------------------------------------------------|----|-------|--|---|---------|---------------------------|-----------|-------|--|---|-------|--|--------|--------------------------------------|---|--------|---------------------------|-------------------------|-------|----------------------------------|----|-------|--|-------|---------------------------------------------------|---|--------|---------------------------|-------|-------|--|---|--------------------|----|--|-------------------------------------------------------------------------------------------------------------------------------------------|---|--------|---------------------------|-----------|-------|--|---|----------|----|-------|--|----|--------|----------------------|-------|-------|--|---|----------------------------------------------|----|-------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|---------------------|--|-----------------------|--|-----------------------|--|-----------------------|--|-----------------|---------------------|----|-----------------------|------------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|
| Bridge/Culvert Data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |                           |                         |                        | Inspection Summary               |                       |                                                               |                |                 | Inspection Summary                                                                                                                        |                 |                       |                 |                       | Member Handwriting |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                   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     |                 |                |                 |                |                 |                |
| Inspection Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Bridge/Culvert Name | ID                        | Project Name/Location   | Project/Understand No. | Inspection Date                  | Inspection No.        | Inspection Date                                               | Inspection No. | Inspection Date | Inspection No.                                                                                                                            | Inspection Date | Inspection No.        | Inspection Date | Inspection No.        | Inspection Date    | Inspection No.        | Inspection Date | Inspection No.  | Inspection Date     | Inspection No. |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                  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      |                 |                |                 |                |                 |                |
| <table border="1"> <tr> <th colspan="2">1. Bridge/Culvert Data</th> <th colspan="2">2. Inspection Summary</th> <th colspan="2">3. Inspection Summary</th> <th colspan="2">4. Member Handwriting</th> </tr> <tr> <td>Inspection Type</td> <td>Bridge/Culvert Name</td> <td>ID</td> <td>Project Name/Location</td> <td>Project/Understand No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> </tr> </table> |                     |                           |                         |                        |                                  |                       |                                                               |                |                 | 1. Bridge/Culvert Data                                                                                                                    |                 | 2. Inspection Summary |                 | 3. Inspection Summary |                    | 4. Member Handwriting |                 | Inspection Type | Bridge/Culvert Name | ID             | Project Name/Location | Project/Understand No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | <table border="1"> <tr> <th>Item No.</th> <th>Member</th> <th>Damage Type</th> <th>Price</th> <th>Cause</th> <th>Detail Investigation</th> <th>Classified Evaluation</th> <th>Job</th> <th>Unit</th> <th>Quantity</th> <th>Comments</th> </tr> <tr> <td>1</td> <td>support</td> <td>Spalling, R-bar corrosion</td> <td>15.14, 12.11, 10</td> <td>Other</td> <td></td> <td>M</td> <td>Other</td> <td></td> <td>70.000</td> <td>Patching without formwork unit is m2</td> </tr> <tr> <td>2</td> <td>others</td> <td>Spalling, R-bar corrosion</td> <td>16.20, 15.15, 17.18</td> <td>Other</td> <td>It is considered "Cd" is proper.</td> <td>Cd</td> <td>Other</td> <td></td> <td>1.000</td> <td>Cleaning and patching without formwork unit should be in m2</td> </tr> <tr> <td>3</td> <td>others</td> <td>Spalling, R-bar corrosion</td> <td>5.4.7.3</td> <td>Other</td> <td></td> <td>M</td> <td>Flashing</td> <td>m2</td> <td>6.340</td> <td></td> </tr> <tr> <td>4</td> <td>wall</td> <td>Spalling, R-bar corrosion</td> <td>3.1.2</td> <td>Other</td> <td></td> <td>M</td> <td>Other</td> <td></td> <td>25.000</td> <td>Patching without formwork unit is m2</td> </tr> <tr> <td>5</td> <td>government</td> <td>Damage of pavement</td> <td>10.8</td> <td>Other</td> <td></td> <td>M</td> <td>Patching and not repairing of pavement (C&amp;G ending &amp; Asphalt)</td> <td>m2</td> <td>3.500</td> <td></td> </tr> <tr> <td>6</td> <td>support</td> <td>Spalling, R-bar corrosion</td> <td>21.22, 23</td> <td>Other</td> <td></td> <td>M</td> <td>Other</td> <td></td> <td>24.000</td> <td>Patching without formwork unit is m2</td> </tr> <tr> <td>7</td> <td>others</td> <td>Spalling, R-bar corrosion</td> <td>22.27, 20.20, 22.35, 18</td> <td>Other</td> <td>It is considered "Cd" is proper.</td> <td>Cd</td> <td>Other</td> <td></td> <td>0.725</td> <td>Cleaning and patching without formwork unit is m2</td> </tr> <tr> <td>8</td> <td>others</td> <td>Water leakage of borehole</td> <td>33.34</td> <td>Other</td> <td></td> <td>B</td> <td>Special Inspection</td> <td>No</td> <td></td> <td>Efficiency due to poor drainage on top. Right also be due to poor m/s. However periodic inspection is required to know to possible cause.</td> </tr> <tr> <td>9</td> <td>others</td> <td>Spalling, R-bar corrosion</td> <td>26.30, 17</td> <td>Other</td> <td></td> <td>M</td> <td>Flashing</td> <td>m2</td> <td>6.600</td> <td></td> </tr> <tr> <td>10</td> <td>others</td> <td>Information and lock</td> <td>24.25</td> <td>Other</td> <td></td> <td>M</td> <td>Renewing a masonry structure (Brick Masonry)</td> <td>m3</td> <td>0.120</td> <td></td> </tr> </table> |  |  |  |  |  |  |  |  |  | Item No. | Member | Damage Type | Price | Cause | Detail Investigation | Classified Evaluation | Job | Unit | Quantity | Comments | 1 | support | Spalling, R-bar corrosion | 15.14, 12.11, 10 | Other |  | M | Other |  | 70.000 | Patching without formwork unit is m2 | 2 | others | Spalling, R-bar corrosion | 16.20, 15.15, 17.18 | Other | It is considered "Cd" is proper. | Cd | Other |  | 1.000 | Cleaning and patching without formwork unit should be in m2 | 3 | others | Spalling, R-bar corrosion | 5.4.7.3 | Other |  | M | Flashing | m2 | 6.340 |  | 4 | wall | Spalling, R-bar corrosion | 3.1.2 | Other |  | M | Other |  | 25.000 | Patching without formwork unit is m2 | 5 | government | Damage of pavement | 10.8 | Other |  | M | Patching and not repairing of pavement (C&G ending & Asphalt) | m2 | 3.500 |  | 6 | support | Spalling, R-bar corrosion | 21.22, 23 | Other |  | M | Other |  | 24.000 | Patching without formwork unit is m2 | 7 | others | Spalling, R-bar corrosion | 22.27, 20.20, 22.35, 18 | Other | It is considered "Cd" is proper. | Cd | Other |  | 0.725 | Cleaning and patching without formwork unit is m2 | 8 | others | Water leakage of borehole | 33.34 | Other |  | B | Special Inspection | No |  | Efficiency due to poor drainage on top. Right also be due to poor m/s. However periodic inspection is required to know to possible cause. | 9 | others | Spalling, R-bar corrosion | 26.30, 17 | Other |  | M | Flashing | m2 | 6.600 |  | 10 | others | Information and lock | 24.25 | Other |  | M | Renewing a masonry structure (Brick Masonry) | m3 | 0.120 |  | <table border="1"> <tr> <th colspan="2">1. Site Photographs</th> <th colspan="2">2. Member Handwriting</th> <th colspan="2">3. Member Handwriting</th> <th colspan="2">4. Member Handwriting</th> </tr> <tr> <td>Inspection Type</td> <td>Bridge/Culvert Name</td> <td>ID</td> <td>Project Name/Location</td> <td>Project/Understand No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> <td>Inspection Date</td> <td>Inspection No.</td> </tr> </table> |  |  |  |  |  |  |  |  |  | 1. Site Photographs |  | 2. Member Handwriting |  | 3. Member Handwriting |  | 4. Member Handwriting |  | Inspection Type | Bridge/Culvert Name | ID | Project Name/Location | Project/Understand No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. | Inspection Date | Inspection No. |
| 1. Bridge/Culvert Data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                     | 2. Inspection Summary     |                         | 3. Inspection Summary  |                                  | 4. Member Handwriting |                                                               |                |                 |                                                                                                                                           |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                 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              |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |
| Inspection Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Bridge/Culvert Name | ID                        | Project Name/Location   | Project/Understand No. | Inspection Date                  | Inspection No.        | Inspection Date                                               | Inspection No. | Inspection Date | Inspection No.                                                                                                                            | Inspection Date | Inspection No.        | Inspection Date | Inspection No.        | Inspection Date    | Inspection No.        | Inspection Date | Inspection No.  | Inspection Date     | Inspection No. |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                  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      |                 |                |                 |                |                 |                |
| Item No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Member              | Damage Type               | Price                   | Cause                  | Detail Investigation             | Classified Evaluation | Job                                                           | Unit           | Quantity        | Comments                                                                                                                                  |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                   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     |                 |                |                 |                |                 |                |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | support             | Spalling, R-bar corrosion | 15.14, 12.11, 10        | Other                  |                                  | M                     | Other                                                         |                | 70.000          | Patching without formwork unit is m2                                                                                                      |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                   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     |                 |                |                 |                |                 |                |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | others              | Spalling, R-bar corrosion | 16.20, 15.15, 17.18     | Other                  | It is considered "Cd" is proper. | Cd                    | Other                                                         |                | 1.000           | Cleaning and patching without formwork unit should be in m2                                                                               |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                   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     |                 |                |                 |                |                 |                |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | others              | Spalling, R-bar corrosion | 5.4.7.3                 | Other                  |                                  | M                     | Flashing                                                      | m2             | 6.340           |                                                                                                                                           |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                   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     |                 |                |                 |                |                 |                |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | wall                | Spalling, R-bar corrosion | 3.1.2                   | Other                  |                                  | M                     | Other                                                         |                | 25.000          | Patching without formwork unit is m2                                                                                                      |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                   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     |                 |                |                 |                |                 |                |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | government          | Damage of pavement        | 10.8                    | Other                  |                                  | M                     | Patching and not repairing of pavement (C&G ending & Asphalt) | m2             | 3.500           |                                                                                                                                           |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                   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     |                 |                |                 |                |                 |                |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | support             | Spalling, R-bar corrosion | 21.22, 23               | Other                  |                                  | M                     | Other                                                         |                | 24.000          | Patching without formwork unit is m2                                                                                                      |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                   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     |                 |                |                 |                |                 |                |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | others              | Spalling, R-bar corrosion | 22.27, 20.20, 22.35, 18 | Other                  | It is considered "Cd" is proper. | Cd                    | Other                                                         |                | 0.725           | Cleaning and patching without formwork unit is m2                                                                                         |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                   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  |       |  |   |                                                               |    |       |  |   |         |                           |           |       |  |   |       |  |        |                                      |   |        |                           |                         |       |                                  |    |       |  |       |                                                   |   |        |                           |       |       |  |   |                    |    |  |                                                                                                                                           |   |        |                           |           |       |  |   |          |    |       |  |    |        |                      |       |       |  |   |                                              |    |       |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |  |  |  |  |  |  |                     |  |                       |  |                       |  |                       |  |                 |                     |    |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | others              | Water leakage of borehole | 33.34                   | Other                  |                                  | B                     | Special Inspection                                            | No             |                 | Efficiency due to poor drainage on top. Right also be due to poor m/s. However periodic inspection is required to know to possible cause. |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                                                                                                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    |    |       |  |   |         |                           |           |       |  |   |       |  |        |                                      |   |        |                           |                         |       |                                  |    |       |  |       |                                                   |   |        |                           |       |       |  |   |                    |    |  |                                                                                                                                           |   |        |                           |           |       |  |   |          |    |       |  |    |        |                      |       |       |  |   |                                              |    |       |  |                                                                                                                                                                                                                       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                |                |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | others              | Spalling, R-bar corrosion | 26.30, 17               | Other                  |                                  | M                     | Flashing                                                      | m2             | 6.600           |                                                                                                                                           |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                   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  |       |  |   |                                                               |    |       |  |   |         |                           |           |       |  |   |       |  |        |                                      |   |        |                           |                         |       |                                  |    |       |  |       |                                                   |   |        |                           |       |       |  |   |                    |    |  |                                                                                                                                           |   |        |                           |           |       |  |   |          |    |       |  |    |        |                      |       |       |  |   |                                              |    |       |  |                                                                                                                                          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     |                 |                |                 |                |                 |                |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | others              | Information and lock      | 24.25                   | Other                  |                                  | M                     | Renewing a masonry structure (Brick Masonry)                  | m3             | 0.120           |                                                                                                                                           |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                   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     |                 |                |                 |                |                 |                |
| 1. Site Photographs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     | 2. Member Handwriting     |                         | 3. Member Handwriting  |                                  | 4. Member Handwriting |                                                               |                |                 |                                                                                                                                           |                 |                       |                 |                       |                    |                       |                 |                 |                     |                |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                 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              |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |
| Inspection Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Bridge/Culvert Name | ID                        | Project Name/Location   | Project/Understand No. | Inspection Date                  | Inspection No.        | Inspection Date                                               | Inspection No. | Inspection Date | Inspection No.                                                                                                                            | Inspection Date | Inspection No.        | Inspection Date | Inspection No.        | Inspection Date    | Inspection No.        | Inspection Date | Inspection No.  | Inspection Date     | Inspection No. |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                                                                                                                                                                                                                                                                                                                                  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   |       |  |   |                                                               |    |       |  |   |         |                           |           |       |  |   |       |  |        |                                      |   |        |                           |                         |       |                                  |    |       |  |       |                                                   |   |        |                           |       |       |  |   |                    |    |  |                                                                                                                                           |   |        |                           |           |       |  |   |          |    |       |  |    |        |                      |       |       |  |   |                                              |    |       |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |  |  |  |  |  |  |                     |  |                       |  |                       |  |                       |  |                 |                     |    |                       |                        |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |                 |                |

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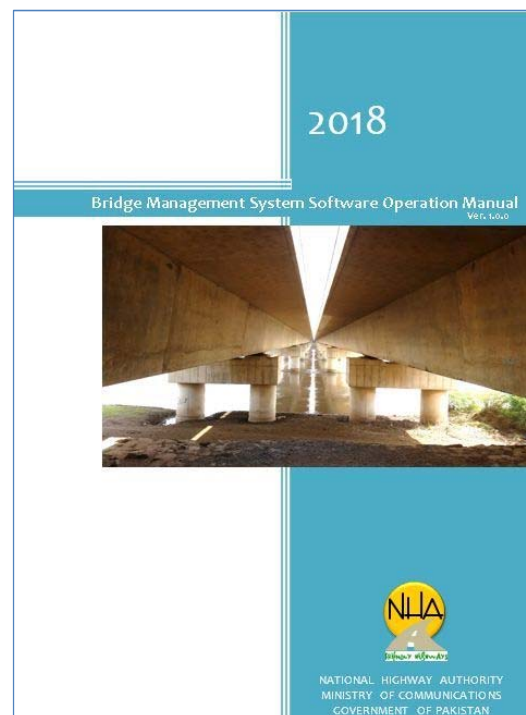
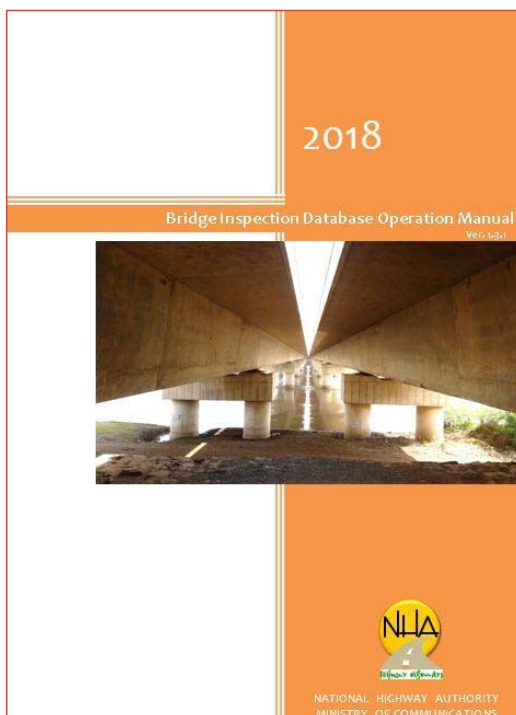
1-3: JICA Expert Team develops Prototype Bridge Inspection Database & BMS.



- To store and refer **all bridge data**
- To create **inspection plan list**
- To calculate **repair priority** and **repair plan list\***
- Mainly used by BMU through a web browser

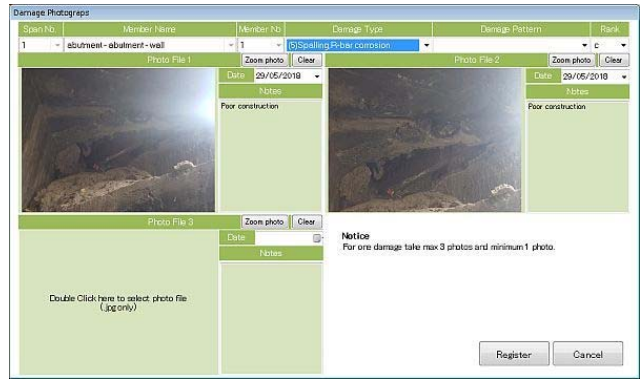
- To input or update **inventory data**
- To input **inspection results data**
- To input **repair and construction job results data**
- Mainly used by Inspectors on the PC

1-3: JICA Expert Team develops Prototype Bridge Inspection Database & BMS.





# Bridge Inventory Data Base Input System



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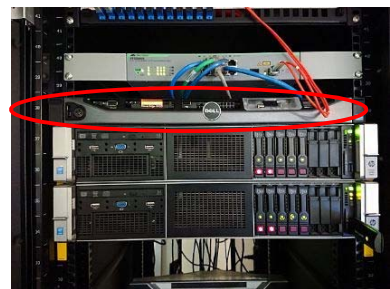
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# Install BMS Software on the server

## Install BMS Software by JICA Expert Team with OJT to BMU



## Install the BMS Server to server room in NHA



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1-4: JICA Expert Team develops draft training materials for (1) bridge/culvert inspection and (2) bridge/culvert repair.

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## 1- Basics of Bridge Engineering

~ Contents ~

1. Road Bridge Components
2. Types of Bridges
3. Substructure
4. Basics of Structural Mechanics
5. Bearing Support, Expansion Joint

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### 1. Road Bridge Components

- Components of a Road Bridge
- Road Width
- Names of each part of Bridge face

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### ➤ Component Parts of the Road Bridge

Figure-1, Figure-2 and Figure-3 & Figure-4 show the names of each parts of the bridge components, road width and bridge face.

Figure-2 Various length measurements in a Bridge

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■ 2 spans Slab Girder Bridge

Figure-1 Names of each component of a Bridge

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1-5: BMU reviews and finalizes the above manuals, inspection formats, prototype and training materials.

BMU has been revising the manuals, inspection formats, prototypes and training materials through the discussion with JICA Expert Team, Trainee Engineers and JWG members.

- (1) Feedback through Master Trainers' Training**
- (2) Localization by BMU**
- (3) Feedback on BMS training**
- (4) Comments and Opinions**
- (5) Finalization**

Currently in queue of Executive Board Meeting for approval.

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# Output2

| Activities                                                                                                   | Acievement                                                                     |
|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Output 2: Bridge/culvert inspection in the model area is implemented after BMS training.                     |                                                                                |
| 2-1: JICA Expert Team provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.    | Completed in Nov 2018.                                                         |
| 2-2: BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training)                  | Inventory Survey Training in Feb 2018. Bridge Inspection Training in Apr 2018. |
| 2-3: Inventory Survey and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.    | Completed in Sep 2018.                                                         |
| 2-4: JICA Expert Team reviews the inspection results and ability, and advises BMU to enhance their capacity. | Completed in Oct 2018.                                                         |

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2-1: JICA Expert Team provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.

Though BMS in NHA was initially considered to be implemented national-wide through Master Trainers, the training target changed from Master Trainers to Bridge Management Unit (BMU) as the scope was changed from national-wide to the model area. The BMU consists of three (3) civil engineers selected from the excellent candidates in the Master Trainer training attendees and one (1) IT engineer.

## (a) Bridge Management Unit (BMU)

| Category        | Position                   | Name                                  |
|-----------------|----------------------------|---------------------------------------|
| Civil Engineers | Deputy Director (BMU)- I   | Mr. Muhammad Asif Azam                |
|                 | Deputy Director (BMU)- II  | Mr. Ghulam Murtaza Simair             |
|                 | Deputy Director (BMU)- III | Mr. Sohaib Mansoor                    |
| IT Engineer     | Assistant Director(BMU)-IT | Mr. Ashfaq Ahmed<br>Mr. M Nur-UI-Eain |



2-1: JICA Expert Team provides on-the-job-training (OJT) which enables BMU to manage BMS training in NHA.

**(b) Trainee Engineers**

Under the situations that NHA has not been able to recruit new staff due to internal legal issues for almost ten years, NHA decided to hire 12 Trainee Engineers as the one-year contract employees, they have been working as Bridge Inspectors in the Project. The Trainee Engineers counted 10 because two (2) of them quitted after the interview.

Table 2-27 List of Trainee Engineers

|                  |                                                                                    |                         |                                                                                     |
|------------------|------------------------------------------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------|
| Abdur Rahman     |  | Shah Zaib Farooq        |  |
| Ashar Tariq      |  | Shahzeb Saleem          |  |
| Imran Shabbir    |  | Muhammad Shawaiz Hassan |  |
| Obaid Shahid Mir |  | Hussain Ahmed Abbas     |  |
| Safwan Naeem     |  | Akhonzada Safyan UI Haq |  |

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2-2: BMU implements BMS training (**Inventory Survey Training and Bridge Inspection Training**)

**1) Inventory Survey Training**

- In office training on February 1<sup>st</sup>. → On-site training on February 2<sup>nd</sup>

<Attendees>

(NHA)

- Counterpart side : Member (Planning) 1 person, BMU 3 persons
- Trainee Engineers : 11 persons
- MU : Wazirabad 4 persons  
Rawalpindi 2 persons
- Others : 1 persons

(JICA)

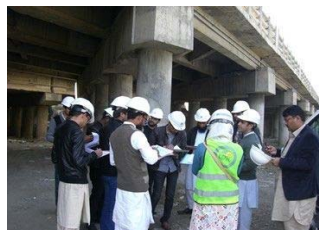
- JICA Expert Team : 2 persons

(Total)

- Total : 24 persons



Figures: Inventory Survey Training (in office)



Figures: Inventory Survey Training (on site)

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## 2-2: BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training)

### 2) Supplementary Inventory Survey Training

- In office training on February 14<sup>th</sup>, for 20 minutes
- Mr. Murtaza (BMU) made supplementary explanation on dimension measurement, skewed angle, etc.

<Attendees>

(NHA)

- Counterpart side : BMU 1 person
- Trainee Engineers : 7 persons

(JICA)

- JICA Expert Team side : 2 persons

(Total)

- Total : 10 persons



Figures: Supplementary Inventory Survey Training (in office)

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## 2-2: BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training)

### ◆ Bridge inspection Training

- Bridge Inspection Training was organized on 2 days lectures and 3 days field training to make it more practical training. And time for each team to announce the results of the inspection was also set up, and contents of the training that the participants can act on their own initiative was made.
- The purpose and significance of this training is to transfer knowledge, experience and know-how possessed by JICA Expert Team to BMU through training so that BMU can implement the same training continuously in the future. From this point of view, the members of BMU lectured as much as possible, and JICA Expert Team took a role to support them.
- In office training on April 16<sup>th</sup> and 17<sup>th</sup>, On-site training on April 18<sup>th</sup> to 20<sup>th</sup>



Figures: Bridge Inspection Training (in office)

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## 2-2: BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training)

[Attendees]

Counterpart side: BMU 2 persons

JICA Expert Team side: 6 persons

Trainee Engineers: 10 persons,

RO & MU (Punjab North, Punjab South) : 9 persons

Total: 27 persons

Table: Activity and Lecturer

| Date                   | Topics and Activity                                             | Main Lecturer                                              |
|------------------------|-----------------------------------------------------------------|------------------------------------------------------------|
| April 16 <sup>th</sup> | Presentation – Introduction of BMS, Summary of training program | Mr. Yukio Igo (JICA)                                       |
|                        | Lecture – Basics of Bridge engineering                          | Ms. Momina Rauf (JICA)                                     |
|                        | Lecture – Bridge Inspection Manual                              | Mr. Haruo Tomiyama (JICA)                                  |
|                        | Lecture – Bridge Inspection (Concrete structure)                | Mr. Sohaib Mansoor (BMU)                                   |
|                        | Test and Review – Bridge Engineering and Inspection             | Mr. Haruo Tomiyama (JICA)                                  |
| April 17 <sup>th</sup> | Lecture – Bridge Inspection (Others)                            | Mr. Haruo Tomiyama (JICA)                                  |
|                        | Lecture – Repair and strengthening                              | Mr. Ghulam Murtaza Simair (BMU)                            |
|                        | Lecture – How to fill out Inspection Sheet                      | Mr. Ghulam Murtaza Simair (BMU)                            |
|                        | Test and Review – Repairs and Inspection Sheet                  | Ms. Kayo Yonezawa (JICA)                                   |
| April 18 <sup>th</sup> | Site Inspection – Wah Garden PC Slab Girder                     | Mr. Akio Mori (JICA)                                       |
|                        | Evaluation and Input                                            | Mr. Sohaib Mansoor (BMU)                                   |
|                        | Review                                                          | Mr. Ghulam Murtaza Simair (BMU)<br>Mr. Kenichi Tpmi (JICA) |
| April 19 <sup>th</sup> | Site Inspection – Wah Garden RC Slab Girder                     | Mr. Akio Mori (JICA)                                       |
|                        | Evaluation                                                      | Mr. Sohaib Mansoor (BMU)                                   |
|                        | Review                                                          | Mr. Ghulam Murtaza Simair (BMU)<br>Mr. Kenichi Tpmi (JICA) |
| April 20 <sup>th</sup> | Site Inspection – Brick Masonry and Concrete Box Culvert        | Mr. Akio Mori (JICA)                                       |
|                        | Evaluation                                                      | Mr. Sohaib Mansoor (BMU)                                   |
|                        | Review                                                          | Mr. Ghulam Murtaza Simair (BMU)<br>Mr. Kenichi Tpmi (JICA) |
|                        | Examination                                                     | Mr. Haruo Tomiyama (JICA)                                  |

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## 2-2: BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training)



Figures: Bridge Inspection Training (on site)



Figures: Bridge Inspection Training (Data input and Presentation)

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## 2-2: BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training)

### Structural Mechanics Lecture

- A structural mechanics lecture was conducted in order to deepen the understanding of important structural matters to pay attention to at the time of inspection.
- In office training on September 12<sup>th</sup> to 17<sup>th</sup>

#### [Attendees]

- Counterpart side: BMU 2 persons
- JICA Expert Team side: 2 persons
- Trainee Engineers: 8 persons
- Total: 12 persons

#### [Topics]

| Times           | Date                          | Topics                                                                    |
|-----------------|-------------------------------|---------------------------------------------------------------------------|
| 1 <sup>st</sup> | September 12 <sup>th</sup> AM | Flow of structure design / Calculation of reaction force                  |
| 2 <sup>nd</sup> | September 13 <sup>th</sup> PM | Calculation of section force                                              |
| 3 <sup>rd</sup> | September 14 <sup>th</sup> PM | Geometrical moment of area / Geometrical moment of inertia / Neutral axis |
| 4 <sup>th</sup> | September 17 <sup>th</sup> AM | Calculation of stress level (Bending stress / Shearing stress)            |
| 5 <sup>th</sup> | September 17 <sup>th</sup> PM | Influence of flexural rigidity / Elasticity and plasticity                |

Figures: Accompanying and guidance to the site work

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## 2-2: BMU implements BMS training (Inventory Survey Training and Bridge Inspection Training)

**1. What is flexural rigidity?**

● What is flexural rigidity ?

Flexural rigidity is an amount that represents the difficulty of deformation of a member with respect to the bending moment and is generally expressed by EI. Here, E is Young's modulus (modulus of elasticity), and I is geometrical moment of inertia.

● It depends on the material and is determined by the cross sectional shape. It will be easy to imagine that it is harder to deform when using the harder material with the same cross-sectional shape, and that the member with the larger cross section is less deformable if it is the same material. However, with regard to the cross section, there is some shape that is resistant to bending deformation rather than simply increasing the cross sectional area. The amount that expresses this difficulty is I: Geometrical moment of inertia.

**3. Elasticity and plasticity**

● Transition of strain and stress distribution

| Situation | Whole section effective | After crack occurs | Rebar yielding - deformation progress | Compressive crush of concrete |
|-----------|-------------------------|--------------------|---------------------------------------|-------------------------------|
| Strain    |                         |                    |                                       |                               |
| Stress    |                         |                    |                                       |                               |

Figures: Structural Mechanics Lecture Materials



Figures: Structural Mechanics Lecture

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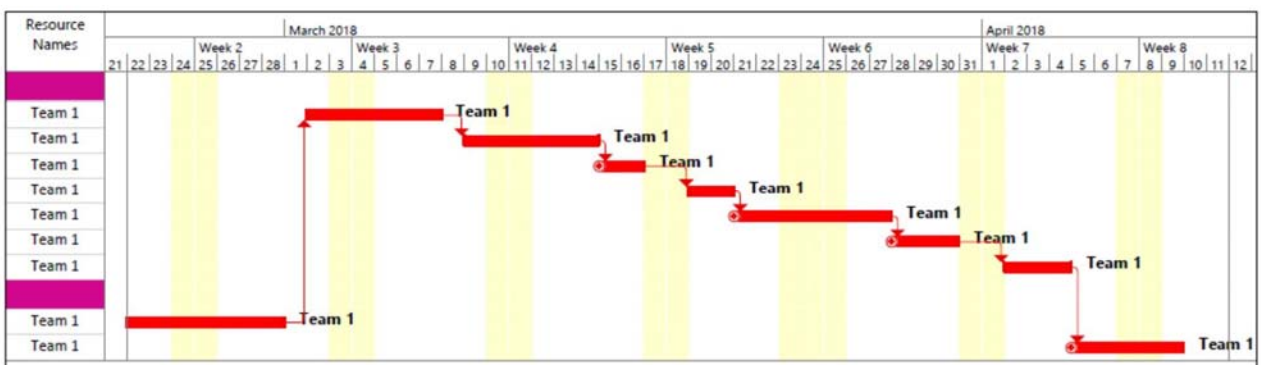
2-3: **Inventory Survey** and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.

### Inventory Survey

| Survey Team | Maintenance Unit | Trainee Engineers   | Contact Numbers |
|-------------|------------------|---------------------|-----------------|
| Team No.1   | LAHORE           | Safwan Naeem        | 03318727566     |
|             |                  | Ashar Tariq         | 03347721894     |
|             |                  | Shawez Hassan       | 03005093900     |
|             |                  | Imran               | 03127232007     |
| Team No.2   | WAZIRABAD        | Shahzeb Farooq      | 03235053321     |
|             |                  | Jawad Naeem         | 03455058505     |
|             |                  | Shahzeb Salim       | 03311160026     |
|             |                  | Akhunzada           |                 |
| Team No.3   | RAWALPINDI       | Abdur Rehman        | 03415179869     |
|             |                  | Ubaid               | 03325579996     |
|             |                  | Hussain Ahmed Abbas | 03353688147     |
|             |                  |                     |                 |

2-3: **Inventory Survey** and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.

| ID | Task Mode | Task Name                                                     | Bridges    | Culverts   | Duration | Start       | Finish      | Predecessors |
|----|-----------|---------------------------------------------------------------|------------|------------|----------|-------------|-------------|--------------|
| 1  |           | <b>WAZIRABAD MAINTENANCE UNIT</b>                             | <b>151</b> | <b>85</b>  |          |             |             |              |
| 2  |           | WZD-1: Narang Mandi More - Kala Shah Kaku (N5/M2 Interchange) | 14         | 0          | 4 days   | Fri 3/2/18  | Wed 3/7/18  | 18FS+1 day   |
| 3  |           | WZD-2: Kala Shah Kaku (N5/M2 Interchange) - Muridke           | 12         | 7          | 4 days   | Fri 3/9/18  | Wed 3/14/18 | 2FS+1 day    |
| 6  |           | WZD-5: Gujranwala Bypass                                      | 4          | 13         | 2 days   | Thu 3/15/18 | Fri 3/16/18 | 3            |
| 9  |           | WZD-8: Gujret Bypass (End) - Lala musa                        | 6          | 7          | 2 days   | Mon 3/19/18 | Tue 3/20/18 | 6            |
| 10 |           | WZD-9: Lala musa - Kharian                                    | 14         | 4          | 4 days   | Wed 3/21/18 | Tue 3/27/18 | 9            |
| 11 |           | WZD-10: Kharian - Dina                                        | 11         | 2          | 3 days   | Wed 3/28/18 | Fri 3/30/18 | 10           |
| 12 |           | WZD-11: Dina - Missa Kassowal                                 | 12         | 0          | 3 days   | Mon 4/2/18  | Wed 4/4/18  | 11           |
| 13 |           | <b>RAWALPINDI MAINTENANCE UNIT</b>                            | <b>104</b> | <b>176</b> |          |             |             |              |
| 18 |           | RWD-5: Tarnol - Taxila                                        | 10         | 21         | 5 days   | Thu 2/22/18 | Wed 2/28/18 |              |
| 26 |           | RWD-13: Khunda More - Jand                                    | 3          | 22         | 3 days   | Thu 4/5/18  | Mon 4/9/18  | 12           |



2-3: **Inventory Survey** and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.



2-3: **Inventory Survey** and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.

**Inventory Data Input**

**INVENTORY DATA ENTRY AT BMU OFFICE - NHA H/Q**

| TEAMS     | FULL DAYS (For Group) | PART TIME (Only one TE)   |
|-----------|-----------------------|---------------------------|
| Team No.1 | 1-Mar-2018            | 15-Mar-2018               |
|           | 8-Mar-2018            | 21-Mar-2018               |
|           | 10-Apr-2018           | 28-Mar-2018<br>5-Apr-2018 |
| Team No.2 | 28-Feb-2018           | 19-Mar-2018               |
|           | 12-Mar-2018           | 29-Mar-2018               |
|           | 11-Apr-2018           | 9-Apr-2018                |
| Team No.3 | 27-Feb-2018           | 13-Mar-2018               |
|           | 6-Mar-2018            | 27-Mar-2018               |
|           | 12-Apr-2018           | 2-Apr-2018<br>6-Apr-2018  |





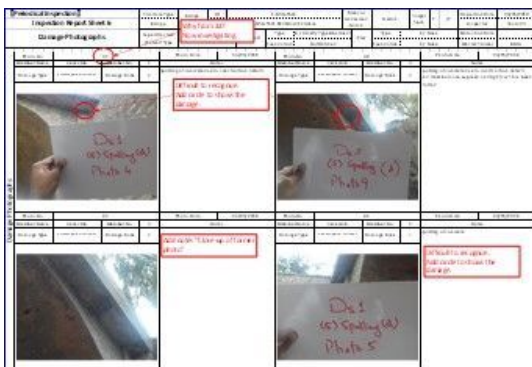
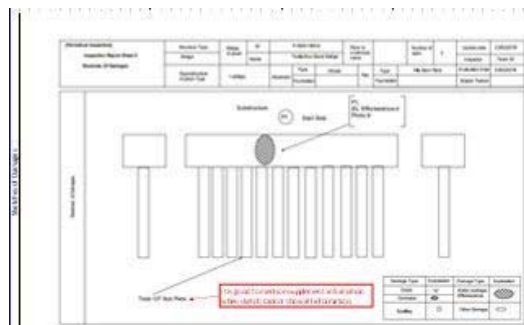
2-3: Inventory Survey and **Bridge Inspection** on-the-job-training (OJT) are implemented after BMS training.

**OJT of Bridge Inspection**

- JICA Expert Team confirmed and corrected the results of inspection, and commented on the items to be corrected / improved, urged the understanding of BMU and Trainee Engineers. This work continued through the exchange with e-mail also during the period when JICA Expert Team was not in Pakistan.

| Date       | Team 01(Plan)     |          |                  | Team 1(Implemented)               |            |                  |
|------------|-------------------|----------|------------------|-----------------------------------|------------|------------------|
|            | Bridge            | Span No. | Maintenance Unit | Bridge                            | Span No.   | Maintenance Unit |
| 03/05/2018 | PN5S 1581         | 1, 2, 3  | Rawalpindi       | PN5S 1581                         | 1, 2, 3, 4 | Rawalpindi       |
| 04/05/2018 | PN5S 1581         | 4, 5, 6  | Rawalpindi       | PN5S 1581                         | 5, 6, 7, 8 | Rawalpindi       |
| 05/05/2018 | Holiday           |          |                  | Holiday                           |            |                  |
| 06/05/2018 | Holiday           |          |                  | Holiday                           |            |                  |
| 07/05/2018 | Data Entry at HQ  |          |                  | Data Entry(No PC available)       |            |                  |
| 08/05/2018 | Data Entry at HQ  |          |                  | Data Entry of Span 1,2 P-N5S-1581 |            |                  |
| 09/05/2018 | P-N5N-1401+700    | 1        | Wazirabad        | P-N5N-1401+700                    | 1          | Wazirabad        |
|            | P-N5S-1403+220    | 1, 2     | Wazirabad        | P-N5N-1420+200                    | 1, 2       | Wazirabad        |
| 10/05/2018 | P-N5S-1403+220    | 3, 4     | Wazirabad        | P-N5N-1421+400                    | 1, 2       | Wazirabad        |
|            | P-N5N-1419+600    | 1        | Wazirabad        | P-N5N-1419+600                    | 1          | Wazirabad        |
| 11/05/2018 | P-N5N-1419+600    | 2        | Wazirabad        | P-N5N-1419+600                    | 2          | Wazirabad        |
|            | P-N5-1467+900     | 1, 2     | Wazirabad        | P-N5-1467+900                     | 1, 2       | Wazirabad        |
| 12/05/2018 | Holiday           |          |                  | Holiday                           |            |                  |
| 13/05/2018 | Holiday           |          |                  | Holiday                           |            |                  |
| 14/05/2018 | P-N5-1467+900     | 3, 4, 5  | Wazirabad        | P-N5-1467+900                     | 3, 4, 5    | Wazirabad        |
| 15/05/2018 | P-N5-1467+900     | 6, 7, 8  | Wazirabad        | P-N5-1467+900                     | 6, 7, 8    | Wazirabad        |
| 16/05/2018 | P-N5-1467+900     | 9, 10    | Wazirabad        | P-N5-1467+900                     | 9, 10      | Wazirabad        |
|            | P-N5N-1469+500    | 1        | Wazirabad        | P-N5N-1469+500                    | 1          | Wazirabad        |
| 17/05/2018 | P-N5N-1469+500    | 2, 3     | Wazirabad        | P-N5N-1469+500                    | 2, 3       | Wazirabad        |
|            | P-N5S-1469+500    | 1        | Wazirabad        | P-N5S-1469+500                    | 1          | Wazirabad        |
| 18/05/2018 | P-N5S-1469+500    | 2, 3     | Wazirabad        | P-N5S-1469+500                    | 2, 3       | Wazirabad        |
| 19/05/2018 | Holiday           |          |                  | Holiday                           |            |                  |
| 20/05/2018 | Holiday           |          |                  | Holiday                           |            |                  |
| 21/05/2018 | PN5N 1583         | 1        | Rawalpindi       | P-N5N-1592+200                    | 1, 2, 3    | Rawalpindi       |
|            | P-N5N-1593+200    | 1, 2     | Rawalpindi       | P-N5N-1592+200                    | 4, 5, 6    | Rawalpindi       |
| 22/05/2018 | P-N5N-1593+200    | 3, 4, 5  | Rawalpindi       | P-N5N-1592+200                    | 7, 8, 9    | Rawalpindi       |
| 23/05/2018 | P-N5N-1593+200    | 6, 7, 8  | Rawalpindi       | P-N5N-1592+200                    | 10         | Rawalpindi       |
| 24/05/2018 | P-N5N-1593+200    | 9, 10    | Rawalpindi       | P-N5S-1620+700                    | 1, 2       | Rawalpindi       |
|            | P-N5S-1606+950    | 1        | Rawalpindi       | P-N80-66+300                      | 1, 2, 3    | Rawalpindi       |
| 25/05/2018 | P-N5S-1606+950    | 2, 3, 4  | Rawalpindi       | P-N80-66+300                      | 1, 2, 3    | Rawalpindi       |
| 26/05/2018 | Holiday           |          |                  | Holiday                           |            |                  |
| 27/05/2018 | Holiday           |          |                  | Holiday                           |            |                  |
| 28/05/2018 | P-N5S-1620+700    | 1, 2, 3  | Rawalpindi       | P-N80-107+100                     | 1, 2, 3    | Rawalpindi       |
| 29/05/2018 | P-N5S-1623+300    | 1        | Rawalpindi       | P-N5S-1581                        | 3          | Rawalpindi       |
|            | P-N80-79+500      | 1, 2     | Rawalpindi       | P-N5S-1581                        | 9          | Rawalpindi       |
|            | P-N80-79+500      | 3, 4     | Rawalpindi       | P-N5S-1581                        | 10, 11     | Rawalpindi       |
| 30/05/2018 | P-N80-107+100     | 1        | Rawalpindi       | P-N5S-1581                        | 12         | Rawalpindi       |
| 31/05/2018 | P-N80-107+100     | 2, 3     | Rawalpindi       | P-N5-1573+500                     | 1          | Rawalpindi       |
| 01/06/2018 | Pedestrian Bridge | 1        | Rawalpindi       | P-N5-1573+500                     | 1          | Rawalpindi       |

2-3: Inventory Survey and **Bridge Inspection** on-the-job-training (OJT) are implemented after BMS training.



Figures: Examples of corrected Inspection Sheet

## 2-3: Inventory Survey and Bridge Inspection on-the-job-training (OJT) are implemented after BMS training.



Figures: Accompanying and guidance to the site work

## 2-4: JICA Expert Team reviews the inspection results and ability, and advises BMU to enhance their capacity.

| [Periodical Inspection] Inspection Report Sheet 1-3 |          |           |                                |                                         |                              |                                       |                       |                                                     |                                          |          | P-NS-1608-1950 (TEAM 03)<br>ONG Station Bridge                                                                                                                                                                                                                                       |                                |                             |                           | River of Underroad Name<br>Nuthah |                                                                                                                                                                                                                                                                                  | Number of Spans<br>4 |  | Inspection Date<br>31/05/2018 |  |
|-----------------------------------------------------|----------|-----------|--------------------------------|-----------------------------------------|------------------------------|---------------------------------------|-----------------------|-----------------------------------------------------|------------------------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-----------------------------|---------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--|-------------------------------|--|
| Inspection Summary                                  |          |           |                                |                                         |                              |                                       |                       |                                                     |                                          |          | Type<br>A / Gravity Type Abutment                                                                                                                                                                                                                                                    |                                | Type<br>B / Solid Wall Pier |                           | Evaluation Date<br>08/10/2018     |                                                                                                                                                                                                                                                                                  | Inspector            |  | Master Trainer                |  |
| No.                                                 | Span No. | Member    | Damage Type                    | Photo No.                               | Cause                        | Detail Investigation                  | Classified Evaluation | Job                                                 | Unit                                     | Quantity | Comments                                                                                                                                                                                                                                                                             | Detail or Follow-up Inspection |                             | Photo No.                 | Cause                             | Comment                                                                                                                                                                                                                                                                          |                      |  |                               |  |
| 1                                                   | 1        | deck slab | (5)Spalling,R-bar corrosion    | 26,29, 27,25, 24,23, 32,31, 39,40       | (D)Deterioration material    | Is Cs Proper? Comments are necessary. | Cs                    | Other                                               | Select something else. Other has no CSR. | 4.750    | Patching work should be done for Member 1 & 3 which are made of concrete while plastering should be done for the brickwork portion.                                                                                                                                                  |                                |                             |                           |                                   |                                                                                                                                                                                                                                                                                  |                      |  |                               |  |
| 2                                                   | 1        | deck slab | (5)Spalling,R-bar corrosion    | 31,35, 34,32, 30,33                     | (J)Other                     | Is Cs Proper? Comments are necessary. | Cs                    | Concrete for structure repair (With forms)          | m3                                       | 0.500    |                                                                                                                                                                                                                                                                                      |                                |                             |                           |                                   |                                                                                                                                                                                                                                                                                  |                      |  |                               |  |
| 3                                                   | 1        | deck slab | (6)Water leakage,efflorescence | 17,16, 15,14, 13,38, 21,24              | (J)Other                     |                                       | B                     | Extending a down pipe                               | m                                        | 1.300    |                                                                                                                                                                                                                                                                                      |                                |                             |                           |                                   |                                                                                                                                                                                                                                                                                  |                      |  |                               |  |
| 4                                                   | 1        | column    | (5)Spalling,R-bar corrosion    | 45,46, 47,48, 50,56                     | (D)Deterioration material    | Is Cs Proper? Comments are necessary. | Cs                    | Injecting with cement-based product (Cement Mortar) | m                                        | 1.000    |                                                                                                                                                                                                                                                                                      |                                |                             |                           |                                   |                                                                                                                                                                                                                                                                                  |                      |  |                               |  |
| 5                                                   | 1        | wall      | (5)Spalling,R-bar corrosion    | 2,9,8,6, 4,3,1, 2,10,7                  | (J)Other                     |                                       | B                     | Injecting with cement-based product (Cement Mortar) | m                                        | 1.000    |                                                                                                                                                                                                                                                                                      |                                |                             |                           |                                   |                                                                                                                                                                                                                                                                                  |                      |  |                               |  |
| 6                                                   | 1        | parapet   | (5)Spalling,R-bar corrosion    | 60,61, 58,59                            | (J)Other                     | Is Ep Proper? Comments are necessary. | Ep                    | Other                                               | Select something else. Other has no CSR. | 1.260    | Patching with forms                                                                                                                                                                                                                                                                  |                                |                             | 39,40                     | (J)Other Poor construction        | [Damage Condition]<br>[Basis of The Judgement]                                                                                                                                                                                                                                   |                      |  |                               |  |
| 7                                                   | 2        | deck slab | (5)Spalling,R-bar corrosion    | 62,65, 64,65, 66,67, 68,69              | (J)Other                     |                                       | Cd                    | Plastering                                          | m2                                       | 0.673    |                                                                                                                                                                                                                                                                                      |                                |                             |                           |                                   |                                                                                                                                                                                                                                                                                  |                      |  |                               |  |
| 8                                                   | 2        | deck slab | (6)Water leakage,efflorescence | 70,71                                   | (J)Other                     |                                       | B                     | Installing a down pipe in the superstructure        | No                                       | 4.000    | 2 down pipes on either side deck slabs for proper drainage                                                                                                                                                                                                                           |                                |                             |                           |                                   |                                                                                                                                                                                                                                                                                  |                      |  |                               |  |
| 9                                                   | 2        | column    | (5)Spalling,R-bar corrosion    | 75,72, 74,73, 76,77                     | (D)Deterioration of material |                                       | Cs                    | Plastering                                          | m2                                       | 1.625    |                                                                                                                                                                                                                                                                                      |                                |                             | 37,36,17,16, 15,14,13,3 & | (J)Other Water leakage            | [Damage Condition]<br>No rust water but water leakage and efflorescence is observed.<br>[Basis of The Judgement]<br>Remedial measure is not necessary at early stage as no rust water is seen and is not estimated to progress till the next inspection.<br><b>Good comments</b> |                      |  |                               |  |
| 10                                                  | 2        | parapet   | (5)Spalling,R-bar corrosion    | 78,79                                   | (J)Other                     | Is Ep Proper? Comments are necessary. | Ep                    | Other                                               | Select something else. Other has no CSR. | 0.630    | Patching with forms                                                                                                                                                                                                                                                                  |                                |                             |                           |                                   |                                                                                                                                                                                                                                                                                  |                      |  |                               |  |
| 1                                                   | D        | deck slab | (5)Spalling,R-bar corrosion    | 26,29,27,25, 24,23,22,2, 1,20,18,28, 19 | (D)Deterioration of material | Is Cs Proper? Comments are necessary. | Cs                    | Other                                               |                                          |          |                                                                                                                                                                                                                                                                                      |                                |                             |                           |                                   | [Damage Condition]<br>There are partial/sectional deficiencies in the stone masonry.<br>[Basis of The Judgement]                                                                                                                                                                 |                      |  |                               |  |
| 1                                                   | C        | deck slab | (5)Spalling,R-bar corrosion    | 31,35,34,32, 30,33                      | (J)Other Poor construction   |                                       | Cd                    | Plastering                                          | m2                                       |          | Reinforcement is visible at number of places and concrete has spalled out.<br>[Basis of The Judgement]<br>Rebar is corroded but it is not so serious. If it is left without treatment then further corrosion is expected which will damage the whole member.<br><b>Good comments</b> |                                |                             |                           |                                   |                                                                                                                                                                                                                                                                                  |                      |  |                               |  |



| Activities                                                                                                                                                       | Acievement             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| Output 3: Bridge data of the model area is available with BMU at NHA headquarters and bridge maintenance plan is prepared according to the data.                 |                        |
| 3-1: JICA Expert Team implements BIDB & BMS Software Training for BMU.                                                                                           | Completed in Aug 2018. |
| 3-2: BMU analyzes Bridge Inspection Data of the model area included in database using BMS Software.                                                              | Completed in Nov 2018. |
| 3-3: BMU prepares the annual bridge/culvert maintenance plan including budget estimation based on the analysis of registered data in Bridge Inspection Database. | Completed in Nov 2018. |

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### 3-1: JICA Expert Team implements BIDB & BMS Software Training for BMU.

#### 1) BMS Software operation training

- In office training on August 9<sup>th</sup>
- Outline explanation and Hands on operation training of BMS Software is implemented

<Attendees>

(NHA)

- Counterpart side : BMU 3 persons, others 3 persons

(JICA)

- JICA Expert Team side : 3 persons

(Total)

- Total : 9 persons



Figures: BMS Software operation training

## 3-1: JICA Expert Team implements BIDB & BMS Software Training for BMU.

### 2) BMS Software operation training (Prioritization and Annual maintenance plan)

- In office training on November 6<sup>th</sup>
- Discussion about prioritization and formulation of the annual maintenance plan is implemented, using BMS software.

<Attendees>

(NHA)

- Counterpart side : BMU 2 persons

(JICA)

- JICA Expert Team side : 3 persons

(Total)

- Total : 5 persons



Figures: BMS Software operation training  
(Prioritization and Annual Maintenance Plan)

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## 3-1: JICA Expert Team implements BIDB & BMS Software Training for BMU.

### 3) Additional training for system administration

- In office training on November 8<sup>th</sup>
- JICA Expert Team made the explanation and discussion about system administration, such as system configuration, how to backup and so on.

<Attendees>

(NHA)

- Counterpart side : BMU 1 person, Computer Bureau 1 person

(JICA)

- JICA Expert Team side : 2 persons

(Total)

- Total : 4 persons



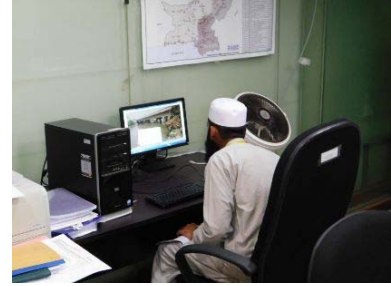
Figures: Addition training for system administration

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### 3-2: BMU analyzes Bridge Inspection Data of the model area included in database using BMS Software.

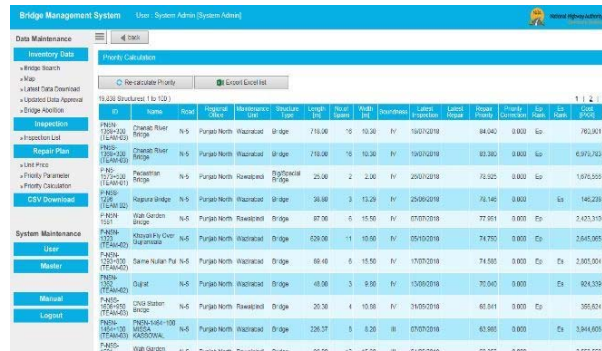
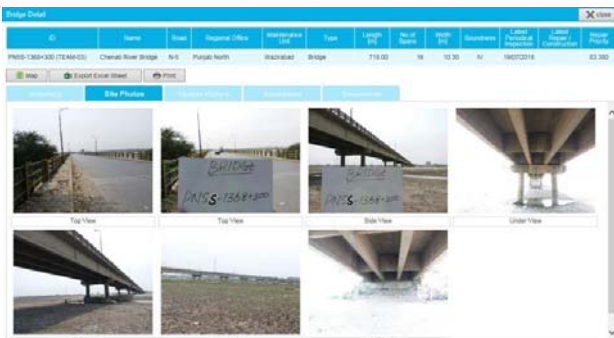
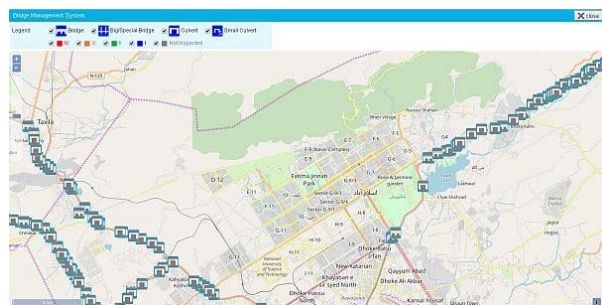
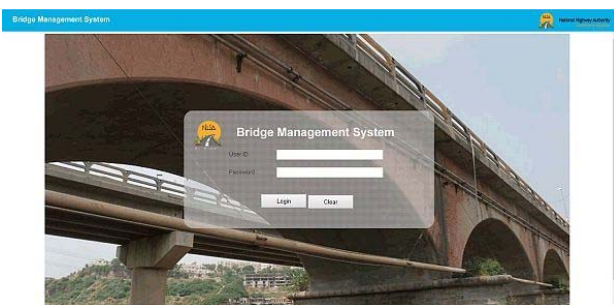
#### Input inventory data by TEs



#### Input inspection results data by TEs



### 3-2: BMU analyzes Bridge Inspection Data of the model area included in database using BMS Software.





3-3: BMU prepares the annual bridge/culvert maintenance plan including budget estimation based on the analysis of registered data in Bridge Inspection Database.

◆ **Concept of Repair Priority**

One of the main purpose of BMS Software is **to calculate the repair priority**.

When setting the repair priority in bridges, we consider "**soundness of the bridge**" and "**importance of the bridge**" as indicators.

"Soundness of bridges" relates to provision of safe transportation.

"Importance of bridges" relates to social losses in case of troubles in traffic.

Based on the score evaluation and weighting for each index/parameter such as the soundness of bridges and the importance of bridges, we calculate **the comprehensive point for each bridge**.

Weighting for each index is made adjustable.

**Priority Indexes in BMS Software**

- Soundness of bridge ( Soundness of bridge )
- Evaluation of members ( Soundness of bridge )
- Passage type ( Importance of bridge )
- Maximum span length ( Importance of bridge )
- Years of construction ( Deterioration of bridge )
- Cause of damage ( Deterioration of bridge )
- Characteristic of bridge ( Importance of bridge )
- Road type ( Importance of bridge )

3-3: BMU prepares the annual bridge/culvert maintenance plan including budget estimation based on the analysis of registered data in Bridge Inspection Database.

**Flexibility of Priority Calculation**

$$\text{Priority Score} = \sum ( [\text{indexes weight}] * [\text{score of each indexes}] )$$

| Index                   | Weight | Detail Settings |
|-------------------------|--------|-----------------|
| 1 Soundness of Bridge   | 60     | settings        |
| 2 Evaluation of Members | 20     | settings        |
| 3 Passage Type          | 5      | settings        |
| 4 Maximum Span Length   | 5      | settings        |
| 5 Years of Construction | 0      | settings        |
| 6 Cause of Damage       | 5      | settings        |

- Weight of each index can be varied with flexibility.

| Soundness of Bridge | Score |
|---------------------|-------|
| 1 I                 | 25    |
| 2 II                | 50    |
| 3 III               | 75    |
| 4 IV                | 100   |

- Score of each item in the indexes can also be varied with flexibility.

3-3: BMU prepares the annual bridge/culvert maintenance plan including budget estimation based on the analysis of registered data in Bridge Inspection Database.

Priority Calculation Results

Priority Calculation provide “repair priority score” and “approximate cost”

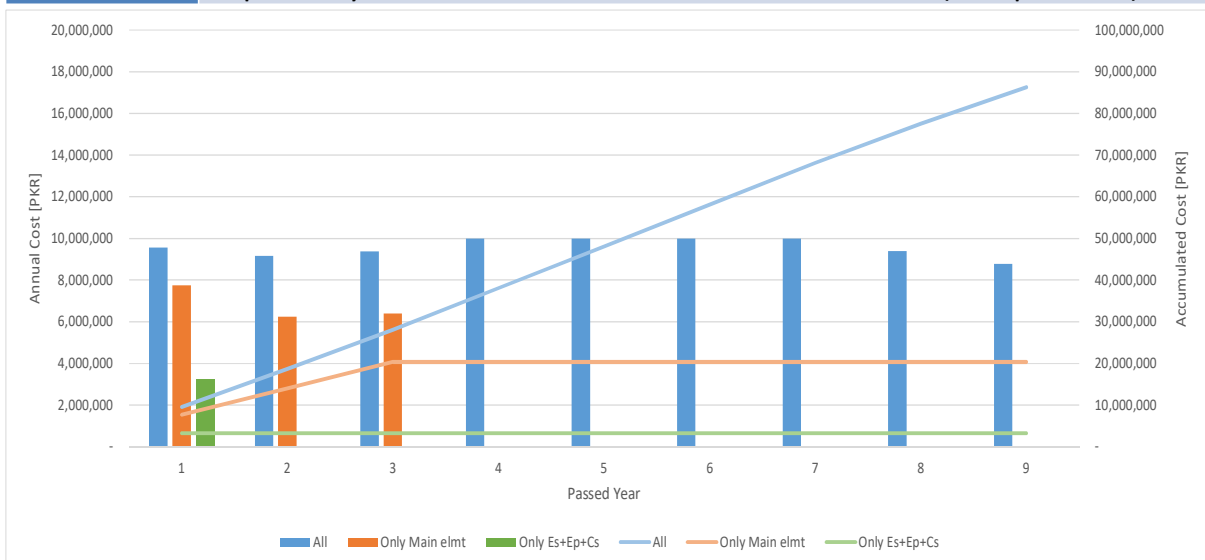
- Repair priority score is calculated from inspection and inventory data.

| ID                       | Name                        | Road | Regional Office | Maintenance Unit | Structure Type     | Length [m] | No. of Spans | Width [m] | Soundness | Latest Inspection | Latest Repair | Repair Priority | Priority Correction | Ep Rank | Es Rank | Cost [PKR] |
|--------------------------|-----------------------------|------|-----------------|------------------|--------------------|------------|--------------|-----------|-----------|-------------------|---------------|-----------------|---------------------|---------|---------|------------|
| PN5N-1368+300 (TEAM-03)  | Chenab River Bridge         | N-5  | Punjab North    | Wazirabad        | Bridge             | 718.00     | 16           | 10.30     | IV        | 18/07/2018        |               | 84.040          | 0.000               | Ep      |         | 760,901    |
| PN5S-1368+300 (TEAM-03)  | Chenab River Bridge         | N-5  | Punjab North    | Wazirabad        | Bridge             | 718.00     | 16           | 10.30     | IV        | 19/07/2018        |               | 83.380          | 0.000               | Ep      |         | 6,979,783  |
| P-N5-1573+500 (TEAM-01)  | Pedestrian Bridge           | N-5  | Punjab North    | Rawalpindi       | Big/Special Bridge | 25.00      | 2            | 2.00      | IV        | 26/07/2018        |               | 78.925          | 0.000               | Ep      |         | 1,676,556  |
| P-N5S-1296 (TEAM 02)     | Rajpura Bridge              | N-5  | Punjab North    | Wazirabad        | Bridge             | 38.80      | 3            | 13.29     | IV        | 25/06/2018        |               | 78.146          | 0.000               |         | Es      | 146,238    |
| P-N5N-1581               | Wah Garden Bridge           | N-5  | Punjab North    | Rawalpindi       | Bridge             | 97.00      | 6            | 15.50     | IV        | 07/07/2018        |               | 77.951          | 0.000               | Ep      |         | 2,423,310  |
| P-N5N-1323 (TEAM-02)     | Khayali Fly Over Gujranwala | N-5  | Punjab North    | Wazirabad        | Bridge             | 629.00     | 11           | 10.60     | IV        | 05/10/2018        |               | 74.750          | 0.000               | Ep      |         | 2,645,065  |
| P-N5N-1293+800 (TEAM-02) | Saime Nullah Pul            | N-5  | Punjab North    | Wazirabad        | Bridge             | 69.40      | 6            | 15.50     | IV        | 17/07/2018        |               | 74.588          | 0.000               | Ep      | Es      | 2,805,004  |
| PN5N-1362 (TEAM-02)      | Gujrat                      | N-5  | Punjab North    | Wazirabad        | Bridge             | 48.00      | 3            | 9.80      | IV        | 13/08/2018        |               | 70.040          | 0.000               |         | Es      | 924,339    |

- Approximate cost is calculated from estimated countermeasure in inspection and unit price of countermeasures (CSR)

3-3: BMU prepares the annual bridge/culvert maintenance plan including budget estimation based on the analysis of registered data in Bridge Inspection Database.

| Cases  | Description                                                         |
|--------|---------------------------------------------------------------------|
| Case 1 | Repair all deteriorated elements                                    |
| Case 2 | Repair only deteriorations on main elements                         |
| Case 3 | Repair only elements which has severe deterioration (Es, Ep and Cs) |



# 3-Vision for BMS by NHA



## Schedule

- During BMS Project**
- Model Area (jurisdiction of Rawalpindi MU and Wazirabad MU)
  - OJT of Inventory Survey in the model area
  - Bridge Inspection Training (April 16-April 20)
  - OJT of Bridge Inspection with typical 36 bridges + 5 culverts
  - BMS Software Training (August and November)
  - Draft AMP for bridge/culvert repair in the model area
  - present -----
  - Terminal evaluation (January 2019)
  - beyond project -----
  - Extend to national-wide (other than the model area)
  - Inventory Survey of all bridges and culverts
  - Bridge Inspection at least once in 5 years  
(all bridges and culverts > 2.0m)

# Important Assumption

“Changes of Risks and Actions for Mitigation” in JCC-5

[Important Assumption in Activities]

- BMS is continuously in use by NHA for preparation of bridge maintenance plan.
- BMU (Bridge Management Unit) is established in NHA headquarters.
- BMS organization is gradually established in NHA, who will implement BMS in a sustainable manner.

[Important Assumption in Outputs]

- NHA arranges adequate human resources for BMS implementation.
- NHA allocates enough budget to maintain and repair prioritized bridges in the annual maintenance plan.

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# NHA Strategies

Timeline Concept

| Term      | Short                            | Medium                                            | Long                                   |
|-----------|----------------------------------|---------------------------------------------------|----------------------------------------|
| Duration  | Dec 2018 – Feb 2020<br>15 months | Dec 2018 – May 2022<br>42 months                  | Jun 2022 –<br>permanent                |
| Target    | Inventory Survey (6RO)           | Inventory Survey (6RO)<br>Bridge Inspection (all) | Bridge Inspection<br>(once in 5 years) |
| Workforce | 12 Trainee Engineers             | 12 Trainee Engineers<br>Outsource (Consultants)   | 12 TEs<br>Outsource                    |

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# Outsource

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BMU will take charge of below procedures in Short-Term for Outsource implementation in Medium-Term.

- TOR (Terms of Reference)
- Qualification
- RFP (Request for Proposal)
- Award the contract
- BMS Training

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# Roles and Responsibilities

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## **[NHA]**

- BMS organization and adequate human resources in a sustainable manner.

## **[JICA]**

- Monitoring BMS progress and BMU activities.

## **[JICA Expert Team]**

- Project Completion Report & Terminal Evaluation in January 2019.

## **[BMU]**

- Seminar to disseminate BMS concept to inside/outside NHA.
- Brochure and NHA web portal.
- Outsource

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## **BRIDGE MANAGEMENT SYSTEM (BMS)**

- 1. Establishment of Bridge Management Unit (BMU).**
- 2. BMS Related Activities In NHA.**
- 3. Standardization / Authentication of BMS Operations In NHA.**
- 4. NHA's Future Plan for BMS Implementation.**
- 5. Annual Maintenance Plan (AMP)**

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### **1. ESTABLISHMENT OF BMU**

- NHA established Bridge Management Unit (BMU) in December 2017.
- In December 2017, 3X Deputy Directors were posted in BMU from other sections of NHA.
- BMU started its working in January 2018.
- In July 2018, One (1) Assistant Director (MIS) was also assigned to BMU for establishment of Database Server and related activities.
- In January 2018, 10X Trainee Engineers were hired for carrying out Bridge Inventory surveys and Inspections. Their appointment is for 1 year initially.

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## 2. BMS Related Activities in NHA:

### • **TRAININGS:**

#### ❖ **Inventory Survey:**

→ In February 2018, BMU along with JICA Experts conducted Inventory Survey Training for newly hired 10X Trainee Engineers and NHA's officers with Inspectors of Rawalpindi & Wazirabad maintenance units at NHA-HQ and on site.

#### ❖ **Bridge Inspection:**

• In April 2018, BMU along with JICA Experts conducted for trainees and officers of all Maintenance Units from Punjab (North) and Punjab (South) at NHA- HQ, HRTC and on Site.

#### ❖ **Structural Mechanics:**

• JICA Experts conducted Structural Mechanics training for BMU and Trainees in September 2018.

#### ❖ **BIDB and BMS Software Operation:**

• By JICA Expert Team in August 2018 for BMU.

#### ❖ **BMS Software Prioritization:**

• By JICA Expert Team in November 2018 for BMU.

#### ❖ **System Administration:**

• By JICA Expert Team in November 2018 for IT Engineer (BMU).

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## 2. BMS Related Activities in NHA:

### ■ **Bridge Inventory and Inspection Surveys:**

- Inventory Survey was conducted by the Trainee Engineers in the Model Area (Rawalpindi and Wazirabad Maintenance Units) in the month of April 2018. Inventory survey data of **200 Bridges** and **263 Culverts** was entered in the BIDB software and assessed.
- Bridge Inspection was carried out in the model area for the representative structures [**41 Nos, 36 Bridges & 5 Culverts**] in the Months of May and June 2018. The structures were selected in such a way to cover almost all types of structures that exist on NHA network.
- Inventory Survey has been started in the Lahore Maintenance Unit in end of November 2018, and is in progress to date. So far **45 Bridges** and **100 Culverts** have been inventoried.
- BMU is finalizing a short term, mid term and long term plan for the inventory and inspection survey of all the structures on NHA network.

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### **3. Standardization / Authentication of BMS Operations in NHA:**

- **The manuals** related to BMS operations were developed by the JICA expert team, which were then revised and finalized by BMU. Those manuals include, Bridge Inspection Manual, Bridge Repair Manual, BIDB Manual.
- **An SOP** (Standard Operating Procedure) document was developed by the BMU for standardization of all BMS activities in NHA.
- All such documents have forwarded for soliciting approval of NHA – Executive Board and it is expected that same will be approved in due course of time.
- It is expected that after approval of all such related documents from NHA – Executive Board, BMS operations and activities will be streamlined and necessary resources will be allocated to the whole operation on the entire NHA network.

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### **4. NHA's Future Plan for BMS Implementation:**

- NHA has faced a lot of problems since its beginning, one of which is shortage of technically trained manpower. Keeping in view the implementation of subject project (BMS) it is imperative that such problems are tackled in such a way that current operations are not derailed and goal of capacity building is achieved. Keeping in view the conundrums, short, medium and long term plans are prepared.

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## ACHIEVEMENTS

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### ACHIEVEMENTS

| Sr. No       | Regional Office/Maintenance Unit                                                         | Bridges    | Culverts   |
|--------------|------------------------------------------------------------------------------------------|------------|------------|
| <b>A</b>     | <b>PUNJAB NORTH REGION (INVENTORY SURVEY)</b>                                            |            |            |
| 1            | Rawalpindi Maintenance Unit                                                              | 74         | 155        |
| 2            | Wazirabad Maintenance Unit                                                               | 126        | 108        |
| 3            | Lahore Maintenance Unit <span style="color: red; font-size: small;">[In Progress]</span> | 45         | 100        |
| <b>TOTAL</b> |                                                                                          | <b>245</b> | <b>363</b> |
| <b>B</b>     | <b>INSPECTION IN MODEL AREA</b>                                                          |            |            |
| 1            | Rawalpindi Maintenance Unit                                                              | 25         | 5          |
| 2            | Wazirabad Maintenance Unit                                                               | 11         | 0          |
| <b>TOTAL</b> |                                                                                          | <b>36</b>  | <b>5</b>   |

- Resources: 12X Trainee Engineers [4 Teams]
- Time Period: 3 Months [Mar-Apr 2018, June-Jul 2018, Nov 2018]

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**SHORT TERM PLAN**  
**[Dec-2018 - Feb 2020]**

❖ Completion of Inventory Survey of six (6) Regional Offices;

- Resources: 12X Trainee Engineers **[4 Teams]**
- Time Period: 15 Months **[Dec 2018 – Feb 2020]**

| Sr. No       | Regional Office                      | Bridges      | Culverts     |
|--------------|--------------------------------------|--------------|--------------|
| 1            | Punjab North <b>[Lahore MU only]</b> | 77           | 241          |
| 2            | Punjab South                         | 446          | 2141         |
| 3            | Khyber Pakhtunkhwa                   | 520          | 1571         |
| 4            | Sindh North                          | 170          | 1535         |
| 5            | Sindh South                          | 304          | 1001         |
| 6            | Muzaffarabad                         | 98           | 235          |
| <b>TOTAL</b> |                                      | <b>1,615</b> | <b>6,724</b> |

**MEDIUM TERM PLAN**  
**[Dec-2018 - May 2022]**

❖ Procurement of Consultants for Inventory Survey in 3X Regional Offices and Inspection in 11X Regional Offices

- Time Period: 6 Months **[Dec 2018 – May 2019]**

❖ Consultants Training by BMU

- Time Period: 2 Months **[June– July 2019]**

| Sr | Tasks                                                         | Activity Duration | Finish Date | Time Lines |        |        |        |        |        |   |
|----|---------------------------------------------------------------|-------------------|-------------|------------|--------|--------|--------|--------|--------|---|
|    |                                                               |                   |             | Dec-18     | Jan-19 | Feb-19 | Mar-19 | Apr-19 | May-19 |   |
| 1  | Preparation of TOR                                            | 14                | 17-Dec-18   | ■          |        |        |        |        |        |   |
| 2  | Advertisement of EOI [Newspaper and Website]                  | 4                 | 21-Dec-18   | ■          |        |        |        |        |        |   |
| 3  | Receiving Response on EOI                                     | 15                | 05-Jan-19   |            | ■      |        |        |        |        |   |
| 4  | EOI Evaluation/Finalization of Shortlisting & RFP preparation | 21                | 26-Jan-19   |            | ■      |        |        |        |        |   |
| 5  | Invite proposals by issuing RFP                               | 4                 | 30-Jan-19   |            |        | ■      |        |        |        |   |
| 6  | Pre-Proposal Meeting                                          | 7                 | 06-Feb-19   |            |        | ■      |        |        |        |   |
| 7  | Submission oof Technical and Financial Proposals              | 10                | 16-Feb-19   |            |        | ■      |        |        |        |   |
| 8  | Evaluation of Technical Proposals                             | 15                | 03-Mar-19   |            |        | ■      |        |        |        |   |
| 9  | Opening of Financial Proposals                                | 1                 | 04-Mar-19   |            |        |        | ■      |        |        |   |
| 10 | Evaluation of Financial Proposals and Finalization of Ranking | 14                | 18-Mar-19   |            |        |        | ■      |        |        |   |
| 11 | Invitation of the first ranked consultant for Negotiations    | 4                 | 22-Mar-19   |            |        |        |        | ■      |        |   |
| 12 | Finalization of negotiations                                  | 7                 | 29-Mar-19   |            |        |        |        | ■      |        |   |
| 13 | Approval From Chairman NHA/Executive Board                    | 21                | 19-Apr-19   |            |        |        |        | ■      |        |   |
| 14 | Uploaded on PPRA Website                                      | 10                | 29-Apr-19   |            |        |        |        |        | ■      |   |
| 15 | Letter of Acceptance +Contract Signing                        | 10                | 08-May-19   |            |        |        |        |        |        | ■ |

## MEDIUM TERM PLAN

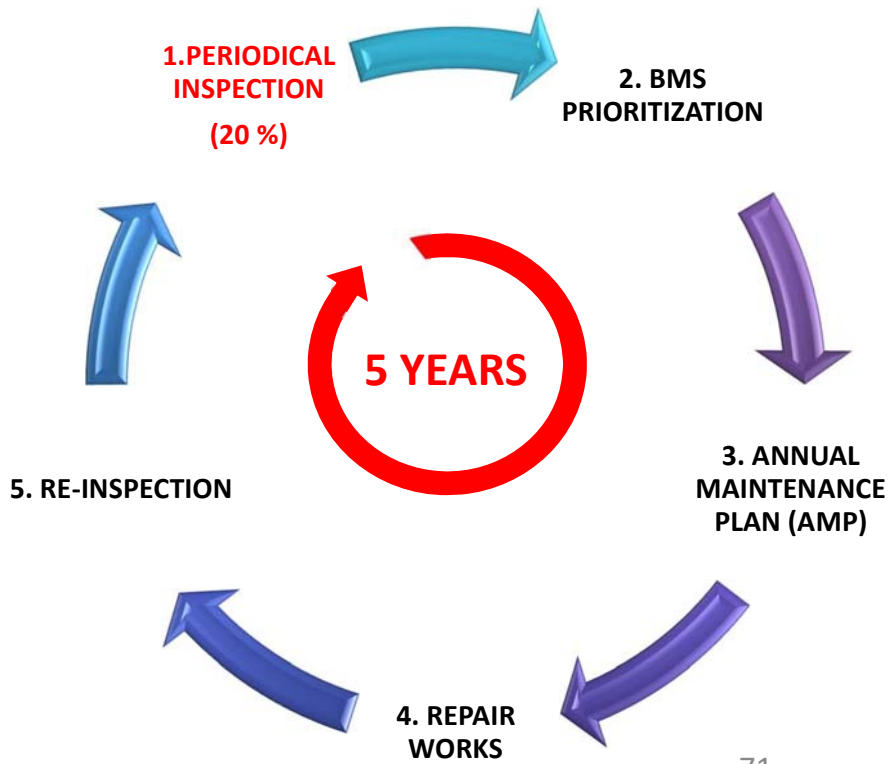
- Resources: **12X Trainee Engineers + Consultants**
- Time Period: **TE's [Mar-2020 to Dec-2021], Conslt [Aug-2019 to Dec 2021]**

| Sr. No                   | Regional Office             | Inventory Survey                                    |              | Inspection   |              |
|--------------------------|-----------------------------|-----------------------------------------------------|--------------|--------------|--------------|
|                          |                             | Bridges                                             | Culverts     | Bridges      | Culverts     |
| 1                        | Punjab North                | <b>Conducted already by TE's in Short-Term Plan</b> |              | TE's         | TE's         |
| 2                        | Punjab South                |                                                     |              | Consultants  | Consultants  |
| 3                        | Muzaffarabad                |                                                     |              | Consultants  | Consultants  |
| 4                        | Sindh North (Sukkur)        |                                                     |              | Consultants  | Consultants  |
| 5                        | Sindh South (Karachi)       |                                                     |              | Consultants  | Consultants  |
| 6                        | Kyber Pakhtunkhwa           |                                                     |              | Consultants  | Consultants  |
| 7                        | Northern Areas              | TE's                                                | TE's         | Consultants  | Consultants  |
| 8                        | Gilgit - Baltistan          | TE's                                                | TE's         | Consultants  | Consultants  |
| 9                        | Balochistan North (Quetta)  | Consultant                                          | Consultants  | Consultants  | Consultants  |
| 10                       | Balochistan South (Khuzdar) | Consultants                                         | Consultants  | Consultants  | Consultants  |
| 11                       | Balochistan West (Makran)   | Consultants                                         | Consultants  | Consultants  | Consultants  |
| 12                       | Motorways (Kalar Kahar)     | TE's                                                | TE's         | Consultants  | Consultants  |
| <b>Trainee Engineers</b> |                             | <b>792</b>                                          | <b>2928</b>  | <b>332</b>   | <b>27</b>    |
| <b>Consultants</b>       |                             | <b>1,743</b>                                        | <b>5,104</b> | <b>4,073</b> | <b>2,153</b> |
| <b>Grand Total</b>       |                             | <b>2,535</b>                                        | <b>8,032</b> | <b>4,405</b> | <b>2180</b>  |

## LONG TERM PLAN

- ❖ Inspection of 20% bridges and culverts in all regional offices annually
  - Procurement for outsourcing Inspection
  - Field Inspection & Data Entry (BIDB)
  - Collection of data from field office by BMU at NHA-H/Q
- ❖ BMS Prioritization
  - Uploading of Inspection data from BIDB to BMS
  - Review and Approval of the data by BMU
  - Prioritization of the structures
- ❖ Annual Maintenance Plan (AMP)
- ❖ Repair Works
  - Procurement for Repair Works
  - Execution of Repair Works
- ❖ Re-Inspection after execution of repair works

**LONG TERM**  
**BRIDGE MANAGEMENT CYCLE**



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**Annual Maintenance  
Plan (AMP)**

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## 5. Draft Annual Maintenance Plan (Structures):

The detailed inspection in the model area has been carried out and after it is established that an amount of 86.72 Million will be required for complete repair of all inspected bridges in the model area. It is understandable that it will be difficult to achieve complete budget for all the repairs in one year, therefore some planning calculations have been done in order to propose a draft maintenance plan.

### ❖ Sample 1:

- It is established that if all the repairs are to take place in the cycle of 5 years an allocation of about 17.34 Million will be required for the model area only. That will be possible if an overall budget allocation for the entire NHA Network is available in the Annual Maintenance Plan.

### ❖ Sample 2:

- In view of above a second calculation is prepared on the basis of 9 year repair cycle, which will require an allocation of a realistic 9.66 million for the model area and an allocation of 1400 Million for the entire NHA network.

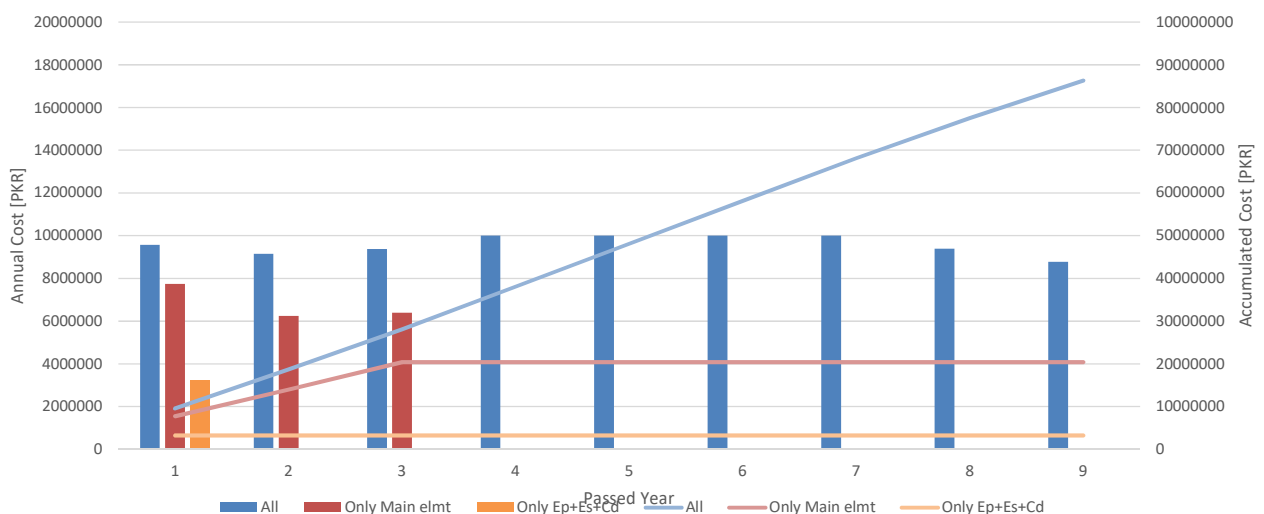
### ❖ Sample 3 & 4:

- Sample three has been prepared for calculation of budget requirement for repair of most critical elements and for repair of Ep, Es, & Cs classified evaluations respectively.

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## 5. Draft Annual Maintenance Plan (Structures):

- These calculations can be customized and tailored according to a varying degree of situations and requirements.
- A graph showing different calculations is given here as an example.



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