

(19) MM with GM (RAMD)_ 2018/11/8

Minutes of Meeting

Date	November 08, 2018 16:30-18:00
Attendees	<p>JICA Expert Team Yukio Igo Akio Mori Ryo Nakai Momina Rauf</p> <p>NHA Ikramus Saqlain Haider /GM (RAMD) Muhammad Asif Azam /DD(BMU) Ghulam Murtaza Simair /DD(BMU)</p>
Discussion	<ul style="list-style-type: none"> • 4 permanent cars will not be allocated to BMU. Trainee engineers will get transportation when they need it according to inventory survey plan. The previous procedure will be followed for getting survey vehicles. BMU will prepare and submit a plan for inventory survey. • GM (RAMD) has instructed Mr. Asif to put up the case of hiring of 4 additional TEs. • The agenda for JCC-6 must be finalized before date confirmation and agenda of final report should be a part of JCC. • Tentatively, the date for seminar is 30th November, time is 10:30 am to 2:00 pm and it will be held at NHA Auditorium. GM (RAMD) will confirm about availability of Chairman later. • GM (RAMD) has instructed BMU to make Annual Maintenance Plan in the model area based on 41 inspected bridges and culverts, and to present it in the Seminar.. • The IT Engineer in BMU is Mr. Ashfaq but due to reasons, Mr. Asif has proposed that Mr. Noor (Computer Bureau) should be concerned IT Engineer. GM RAMD has instructed Mr. Asif to prepare a document for switching the IT Engineer in BMU to Mr. Noor. • The short term plan is Inventory Survey in Lahore MU and in Pujab South. • The long term plan for Bridge Inspection is after Punjab North, Punjab south will be completed followed by road N5, Indus Highway and N-70. • With currently present 8 TEs, the inventory survey of entire NHA network will take 3.5 years approximately. GM RAMD suggested that if 4 new Trainee Engineers are hired, 4 of them can simultaneously work on Bridge Inspection while 8 of them work on Inventory Survey.

	<ul style="list-style-type: none">• Mr Sadaqat Ullah (from Computer Bureau) has told that BMS portal will be prepared after completion of Road Maintenance portal which is currently in progress.• Chairman has given some comments about draft of brochure. GM (RAMD) asked Mr. Asif to discuss the draft brochure with him on Friday.
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(20) MM with GM (RAMD)_ 2018/11/16

Minutes of Meeting

Date	November 16, 2018 12:30-13:00
Attendees	<p>JICA Expert Team Yukio Igo Haruo Tomiyama Momina Rauf</p> <p>NHA Ikramus Saqlain Haider /GM (RAMD) Sohaib Mansoor /DD(BMU) Ghulam Murtaza Simair /DD(BMU)</p>
Documents	<ul style="list-style-type: none"> • To Do List for BMS Project (dated on November 16th, 2018)
Discussion	<ul style="list-style-type: none"> • All of Trainings and OJTs by JICA Expert Team have been implemented. • The AMP for the model area is about to be completed soon. • The working paper for manuals and SOP is sent to Executive Board and listed in the queue, however, it may or may not be presented in November. • The case of 4 Trainee Engineers is processed and interviews will be held next week. Moreover, there will be 1 year contract extension of already present TEs. • Two cars are arranged for use by BMS staff and will be made available whenever needed. • GM has told that Final Report needs to be discussed on Monday (Nov 19th). • Mr. Sohaib is preparing next plan for 2 years. GM has asked to squeeze the plan to 15 months to make it in line with the extended contract of TEs (i.e. short-term plan for 15 months till February 2020 with 12 TEs, long-term plan for national-wide Bridge/Culvert Inspection on once in 5 years basis). If more resources are required, BMU will discuss with GM (RAMD). • JCC-6 will be held on 3rd Dec at 10:30 am. BMU will make necessary preparation. • Seminar will be held on 29th Nov at 10:30 am. • BMU will prepare Long term plan after discussion with GM (RAMD). The short-, mid- and long-term plan will be presented both in JCC-6 and Seminar.

(21) JCC-6_2018/12/3

**MINUTES OF MEETINGS
OF
6TH JOINT COORDINATION COMMITTEE
ON
THE PROJECT FOR TECHNICAL ASSISTANCE ON IMPLEMENTATION OF
BRIDGE MANAGEMENT SYSTEM IN NHA**

Joint Coordination Committee (hereinafter referred to as “JCC”) meeting on the Project for Technical Assistance on Implementation of Bridge Management System in NHA (hereinafter referred to as “the Project”) was held on the 3rd December, 2018 with attendance of JCC members representing the National Highway Authority (hereinafter referred to as “NHA”), the Japan International Cooperation Agency (hereinafter referred to as “JICA”) and members of the JICA Experts (hereinafter referred to as “the Experts”) to discuss schedule and progress of the Project based on the 6th Project Monitoring Sheet submitted by the Experts on the 3rd December, 2018.

As a result of the discussions, JCC members mutually accepted the issues as follows;

Islamabad, 3rd December, 2018

高嶋 幸博

Akihiro Takashima
Senior Representative
Japan International
Cooperation Agency

Arbab Ali Dhakan

Arbab Ali Dhakan
Member (Engineering
Coordination)
National Highway Authority
Islamic Republic of Pakistan

伊藤 有希夫

Yukio IGO
Project Manager /
Bridge Inspection
JICA Expert

Issues

Brief Explanation of the Project

GM (RAMD) described the summary of progress of the Project since its beginning. The BMS training was initially carried out for NHA engineers working in field offices (MUs and ROs). However, considering the non-availability and capability of bridge inspectors in MUs and ROs, later on the concept was modified to establish a Bridge Management Unit (BMU) in RAMD dedicated for BMS and hire 12 Trainee Engineers to conduct inventory survey and bridge inspection in model area (Punjab North Region) only. Thus, the Experts trained BMU and TEs.

Progress of the Project (after JCC-5)

Mr. Yukio Igo, Bridge Inspection Expert explained the progress of the Project after JCC-5. The major points of his presentation were as follows;

- In addition to Bridge Inspection Manual, Bridge Repair Manual and BIDB Operation (data input) Manual, two additional manuals i.e. BMS Software Operation and BMS Software Administration Manual were recently developed by the Expert.
- BMS Software was finalized as ver.1.0.0.26 in November 2018.
- BMU has conducted BMS training in NHA.
- Bridge inspection has been conducted after inventory survey in Model Area.
- The Experts implemented BIDB & BMS training for BMU.
- BMU has analyzed registered data in BIDB and prepared draft Annual Maintenance Plan.
- Short-term, Medium-term and Long-term plans on BMS were explained.
- All the activities from the Experts have been completed and now only terminal evaluation is left.

Hiring of 4 Additional Trainee Engineers

As only 8 Trainee Engineers are currently working for BMS project, NHA confirmed that 4 additional Trainee Engineers will be hired (on or before 12th December, 2018) to achieve the required strength of 12 Trainee Engineers for BMS.

Sustainability of BMS in NHA

GM (RAMD) added that it was previously committed to JICA that NHA will provide 1 x Assistant Director and 1 x Inspector in each MU exclusively for BMS. Considering the current situation, it is not possible to allocate this huge number of human resources for BMS. The BMU will be kept intact for at least 5 years and number of 12 Trainee Engineers will be continuously maintained by NHA. Member (EC) assured of his support for sustainable BMS in NHA.

Short, Medium and Long Term Plan

DD (BMU) described short, medium and long term plan. Short-term plan to continue inventory survey in several provinces will be entirely covered by 12 TEs while Medium-term plan will be shared among TEs and the consultants (outsource) where inventory survey and periodical bridge inspection (condition assessment) of all bridges and culverts (>2.0m) on NHA network will be carried out. P&CA section of NHA will prepare the tendering documents for hiring of consultants and it is agreed that national-wide (global) consultants will be hired who can conduct survey in entire NHA network. Once the consultants are selected, BMU will conduct training of inventory survey, bridge inspection and BMS to the consultants.

2/2/18

In Long-term plan, 20% of all the bridges and culverts (>2.0m) will be inspected per year and based on Annual Maintenance Plan, repair works will be performed. GM (RAMD) told that NHA has enough budget to conduct inspection by hiring the Consultant in addition to TEs.

Progress in Short term plan:

Representative (JICA) enquired when and who will proceed the procedures for repair of structures which were inspected in the model area. For that, DD (BMU) explained a draft Budget Plan of 41 inspected structures based on BMS. This will be included in NHA's Annual Maintenance Plan (2018-19). Once the plan is approved, Regional Office will start necessary procedures for repair of structures.

JICA Requests

JICA requested about the necessary actions to be taken by NHA as follows;

1. The manuals and SOP for BMS should be approved by the NHA Executive Board during the Project.
2. The Seminar should be arranged before the Experts leave in order to disseminate BMS concept and future plan which was developed through this Project not only to NHA staff but also to consulting and construction companies. Chairman is required to attend the opening speech.
3. NHA must keep BMU active even after the Project completion for sustainable implementation of BMS in NHA.
4. JICA will quarterly monitor the Project progress. For that, NHA is requested to prepare future implementation plan with targets set for each quarter.

Approval of Manuals and SOP

Member (EC) will make efforts to get the SOP and all the manuals approved from NHA Executive Board by the end of December, 2018.

Seminar

NHA committed to arrange seminar before 12th December which is the last working day of JICA Experts in Pakistan. Meanwhile, the brochures and web portal should also be prepared.

Terminal Evaluation

The Experts informed that terminal evaluation of the Project is scheduled in January 2019. The Experts requested NHA to allocate 2 NHA engineers other than BMU (RAMD) as third-party evaluators who will coordinate and work in collaboration with Terminal Evaluation Expert. Member (EC) agreed to allocate two NHA engineers with terminal evaluation experts.

Future Support for Software

GM (RAMD) and BMU requested JICA for their support in case if some problem persists in BIDB and BMS software that could not be solved by NHA itself. JICA responded that JICA will consider if any problem occurs in future.

Closing remarks by Member (Engg & Coord)

Member (EC) ended the meeting by expressing his gratitude to JICA and the Experts.

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Actions to be taken

1. NHA will arrange seminar regarding BMS before 12th December, 2018.
2. NHA must get the SOP and all Manuals approved from Executive Board by the end of December, 2018.
3. NHA must keep intact BMS organization (BMU and 12 TEs) for sustainability of Bridge Management System in NHA.
4. NHA must urgently start the procurement process for hiring of consultant to commence inventory and inspection of structures on NHA network (medium-term plan)
5. NHA will conduct interviews for hiring of 4 TEs on or before 12th December, 2018.
6. NHA will submit the quarterly progress reports to JICA Pakistan Office (in relation with future implementation plan) for at least two years after the project completion

Appendix A

List of Attendees

Attachments

Project Monitoring Sheets

END

2/1/18

List of Attendees**1. NHA Side**

No.	Name	Organization	Position
1	Mr. Arbab Ali Dhakan	NHA HQ	Member (Engg. & Coord)
2	Mr. Ikramus Saqlain Haider	NHA HQ	GM (RAMD)
3	Mr. Muhammad Suleman Raza	NHA HQ	Director (Design)
4	Mr. Sohaib Mansoor	NHA HQ	DD (BMU)
5	Dr. Muhammad Asif Azam	NHA HQ	DD (BMU)
6	Mr. Ghulam Murtaza Simair	NHA HQ	DD (BMU)
7	Mr. Muhammad Nur-ul-Ain	NHA HQ	AD (IT) BMU

2. JICA Side

No.	Name	Organization	Position
1	Mr. Akihiro Takashima	JICA Pakistan Office	Senior Representative
2	Ms. Kazuho Ujiie	JICA Pakistan Office	Representative
3	Ms. Naila Almas	JICA Pakistan Office	Senior Program Officer

3. Experts Side

No.	Name	Organization	Position
1	Mr. Yukio Igo	JICA Expert Team	Project Manager/Bridge Inspection Expert
2	Mr. Haruo Tomiyama	JICA Expert Team	Capacity Development Expert
3	Mr. Kenichi Tomi	JICA Expert Team	Project Monitoring Expert
4	Ms. Momina Rauf	JICA Expert Team	Local Administrator

v-L 4/2.

4.3 Seminar_2018/12/10



**NATIONAL HIGHWAY AUTHORITY
PLANNING WING**

Office of the General Manager (RAMD)

28 Mauve Area, G-9/1, Islamabad

Phone No. 051-9032815, Fax No. 051-9261208

No.1 (44) GM (RAMD)/NHA/2018/279

December 05, 2018

**All Concerned,
(Distribution List Attached).**

Subject: BRIDGE MANAGEMENT SYSTEM, ORIENTATION AND APPRAISAL SEMINAR.

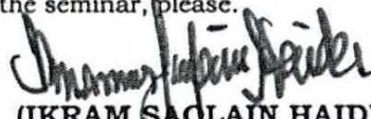
Bridges are a vital components of transportation system as their failure or disruption can cause excessive public and private losses. Most of existing bridges in service were constructed to handle less traffic with lighter loading than prevalent. Today's ever increasing traffic volume on ageing infrastructure is reducing the remaining service life rapidly. This situation requires accurate and advance structural monitoring.

2. NHA is in process of development and implementation of Bridge Management System on its network with the technical assistance of Japan International Cooperation Agency (JICA). The Japanese bridge experts of M/s Pacific Consultants (Pvt) Ltd have provided technical assistance to NHA in preparation of an outline of Bridge Management System.

3. In continuation to above and in order to disseminate relevant information about "**Bridge Management System**" a one day seminar is being arranged on 10th December 2018 at Auditorium, NHA – HQ. The details and schedule of seminar are:

Time	Topic	Speaker
10:00 to 10:30	Registration	
10:30 to 10:45	Welcome Speech	Member (Engg. Coord:)
10:45 to 11:00	Welcome Speech	JICA Representative
11:00 to 11:15	BMS (Introduction)	Ikram Saqlain Hyder, GM (RAMD)
11:15 to 11:35	BMS (Project Details & Progress)	Mr. Yukio Igo, JICA Expert
11:35 to 11:55	BMS (Inventory Survey, Inspection)	Mr. H. Tomiyama, JICA Expert
11:55 to 12:15	Tea Break	
12:15 to 12: 45	BMS (Manuals & Software)	Mr. Asif Azam, DD (BMU)
12:45 to 01:15	BMS (Future Plan)	Mr. Sohaib Mansoor, DD (BMU)
01:15 to 01:45	BMS (Prioritization, Budget Allocation)	Mr. GM Simair, DD (BMU)

4. Considering the importance of the event we would cordially request your good self and your staff to grace the occasion by participating in the seminar, please.


(IKRAM SAQLAIN HAIDER)
General Manager (RAMD)

Copy To:

- Member (EC) NHA – HQ, Islamabad.
- SPS to Chairman NHA.
- Representative JICA Pakistan.
- ✓ JICA Expert Team.
- In-Charge Auditorium (With a request to make necessary arrangements)



**NATIONAL HIGHWAY AUTHORITY
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Office of the General Manager (RAMD)

28 Mauve Area, G-9/1, Islamabad

Phone No. 051-9032815, Fax No. 051-9261208

Distribution:

- Dr. Shafiq Khan, Executive Director (HRTC) NHA – Burhan.
- Mr. Muhammed Azam, Director (P&CA) NHA-HQ.
- Mr. Jahanzaib Niazi, Director (P&CA) NHA-HQ.
- Dr. Asim Inam, Director (Design-Pavements), NHA-HQ.
- Mr. Muhammed Suleman Raza, Director (Design), NHA-HQ.
- Mr. Muhammed Ishtiaque, Director (Planning) NHA - HQ.
- Mr. Aftabullah Babar, Deputy Director (Structures) NHA - HQ.
- Mr. Khuwaja Hamid Mushtaque, Deputy Director (P& CA) NHA - HQ.
- Mr. Tarique Riaz, Deputy Director (Design) NHA – HQ.
- Mr. Javed Akhtar, Deputy Director (M&I) NHA-HQ.
- Mr. Lubna Tabbasum, Deputy Director (Design - Motorways) NHA - HQ.
- Mr. Asif Azam, Deputy Director (BMU-I) NHA - HQ.
- Mr. Sohaib Mansoor, Deputy Director (BMU-II) NHA - HQ.
- Mr. Ghulam Murtaza Simair, Deputy Director (BMU-III) NHA - HQ.
- Mr. Syed Muhammed Zaier Abbas Zaidi, Deputy Director (Planning) NHA - HQ.
- Mr. Ans Farrukh, Assistant Director (Maint: / Monitoring) NHA - HQ.
- Mr. Hasan khalil, Assistant Director (Design-GIS) NHA - HQ.
- Mr. Asad Munir, Assistant Director (P&CA) NHA - HQ.
- Mr. Saad Asif, Assistant Director (P&CA) NHA-HQ.
- Lt. Col (R) Dr Muhammed Iqbal, Structural Expert.
- Col. (R) Iqbal Haq, Structural Expert.
- Representative of M/s Nespak (Pvt) Limited.
- Representative of M/s Zeerak (Pvt) Limited.
- Representative of M/s Finite Engineering (Pvt) Limited.



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

Project Details & Progress

Seminar

December 10th 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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Agenda

Time	Topic	Speaker
10:00 to 10:30	Registration	
10:30 to 10:45	Welcome Speech	Member (Engg: Coord:)
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01:15 to 01:45	BMS (Prioritization, Budget Allocation)	Mr. GM Simair, DD (BMU)

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Contents

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2-Project Progress	
3-Future Visions	

1-Project Outline

Project Outline

(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)

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Project Purpose & Overall Goal

Project Purpose (in the Project duration)

Annual bridge maintenance plan

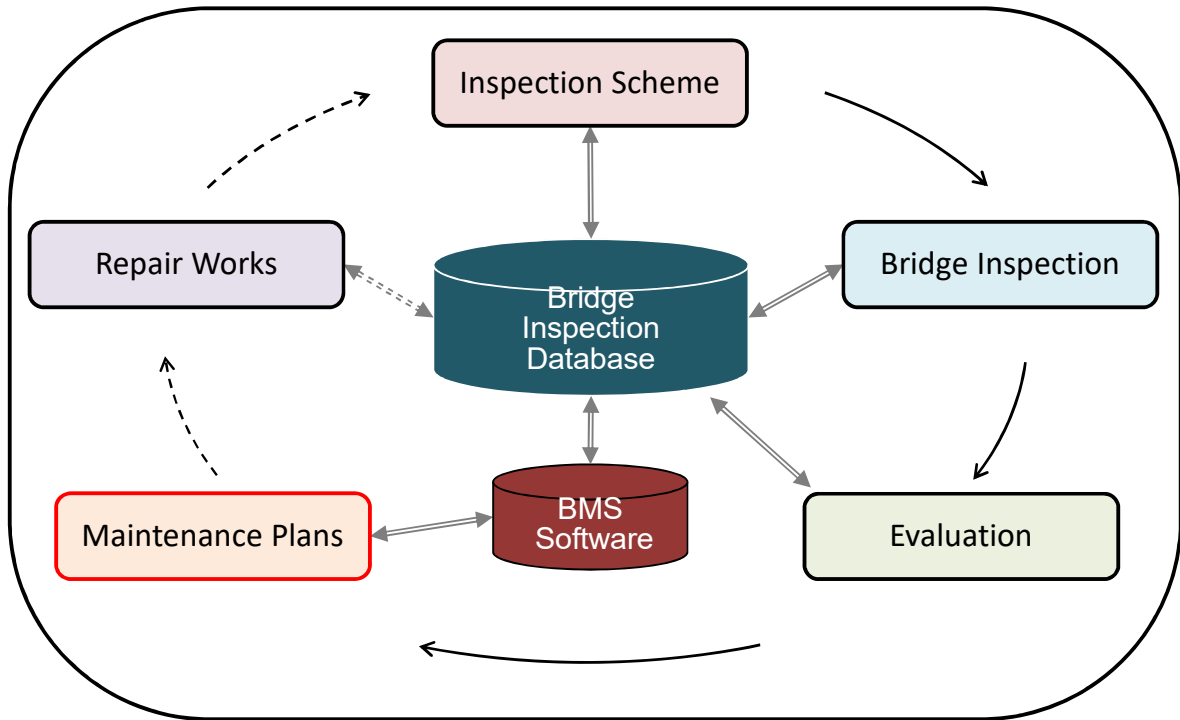
prepared on the basis of the latest bridge inspection data of the model area.

Overall Goal (after the Project)

Bridge inspection & maintenance status improved on the bridges of National Highways in the model area.

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Concept of BMS in NHA



Output1 Tools

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. (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. 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.

Output2 Training

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.

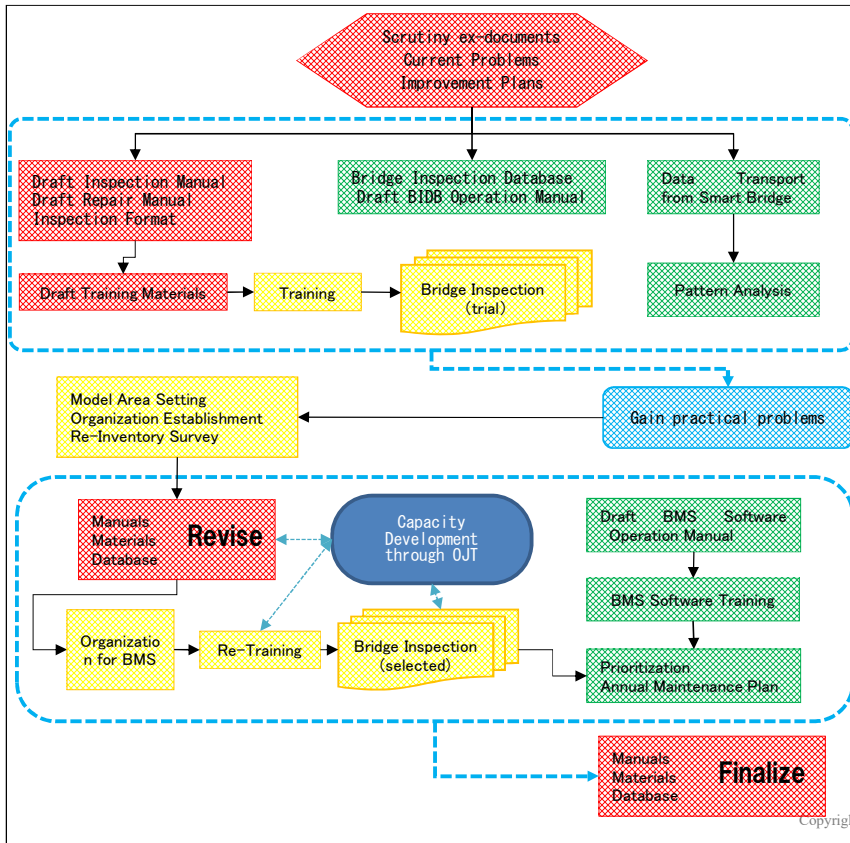
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Output3 BMS Software

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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Flowchart



Project 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	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4							
Ex-documents		█																																									
Manuals, Formats & Materials					█																																						
Bridge Inspection Database					█																																						
BMS Software																																											
Master Trainer Training		█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█							
Bridge Inspection																																											
Organization Establishment																																											
Bridge Inventory																																											
BMS Training & OJT																																											
BMU Training & OJT																																											
Reporting																																											
Joint Coordination Committee		█																																									
Questionnaires																																											
Flood																																											
Ramadan																																											

Remarks : █ Preparatory █ in Pakistan □ in Japan

△—△ Reporting

BMS Project Organization

Pakistan - NHA	Japan – JICA
Person in Charge Mr. Arbab Ali Dhakan Member (Engg. & Cord.)NHA	JICA Pakistan Office Chief Representative Mr. Yasuhiro Tojo Senior Representative Mr. Akihiro Takashima Representative Ms. Kazuho Ujiie Senior Program Officer Ms. Naila Almas
Project Manager Mr. Ikramus Saqlain Haider GM (RAMD) NHA	JICA Head Office Chief Representative Mr. Shuntaro Kawahara Representative Mr. Kazunobu Takahashi
Project Coordinator Mr. Muhammad Asif Azam Deputy Director (BMU- I) NHA	JICA Expert Team (Pacific Consultants Co. Ltd.) Project Manager/Bridge Inspection Mr. Yukio IGO Bridge Repair Mr.Yoshiichi FUJIMOTO BMS (System Design) Mr.Akio MORI BMS (System Design Assistance) Mr.Syougo ABIRU Capacity Development Mr.Haruo TOMIYAMA Capacity Development (Assistance) Ms.Kayo YONEZAWA BMS (Specification Logic) Mr.Fumiatsu KAMITANI BMS (Specification Logic Assistance)Mr.Ryou NAKAI Project Monitoring Mr.Kenichi TOMI Program Coordinator Ms.Kotoko YONEDA
Counterpart Personnel Mr. Ghulam Murtaza Simair Deputy Director (BMU- II) NHA Mr. Sohaib Mansoor Deputy Director (BMU- III) NHA	
IT Engineer Mr. M Nur-UI-Eain Assistant Director NHA	Local Expert / Administrator Ms.Momina Rauf

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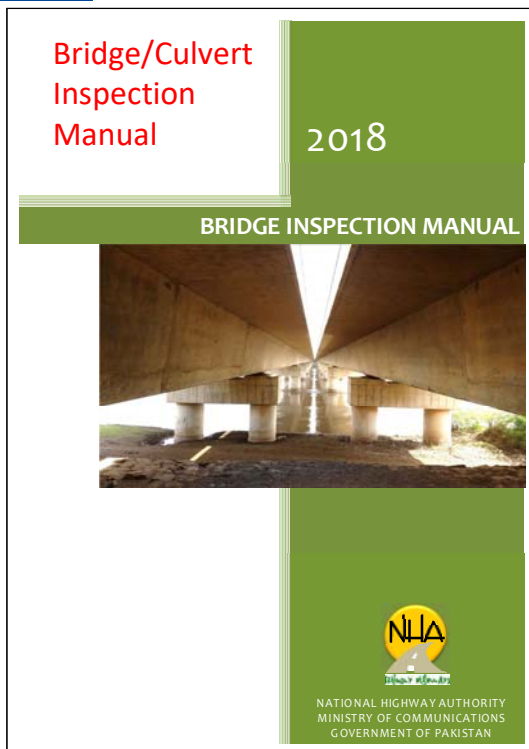
2-Project Progress

Output1 Tools

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. (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. BMS developed in Aug 2018.
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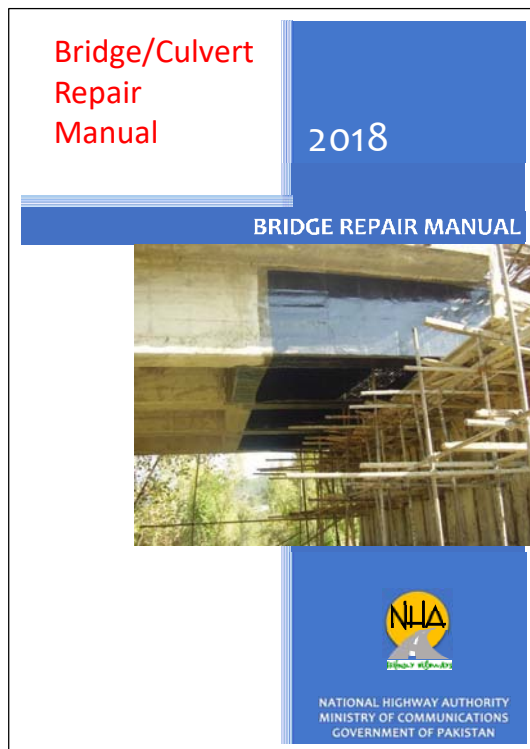
1-1: (1) Bridge/Culvert Inspection Manual



Preface

1. A glance at NHA, its road network and structures
 2. Bridge management system in general
 3. Types of inspection and inspection procedure
 4. Method of inspection
 5. Types of damage
 6. Damage rank
 7. Classified evaluation
 8. Soundness diagnosis of bridge / culvert
 9. Criteria for damage rank and classified evaluation
 10. Remedial measure
 11. BMS record
- Attachment-1 : Description of common terms
Attachment-2 : Inspection report sheet
Appendix-1 : Important points during periodical inspection
Appendix-2 : How to fill out inspection report sheet
Appendix-3 : Member numbering
Appendix-4 : Example of damage, cause and evaluation
Appendix-5 : Masonry inspection

1-1: (2) Bridge/Culvert Repair Manual



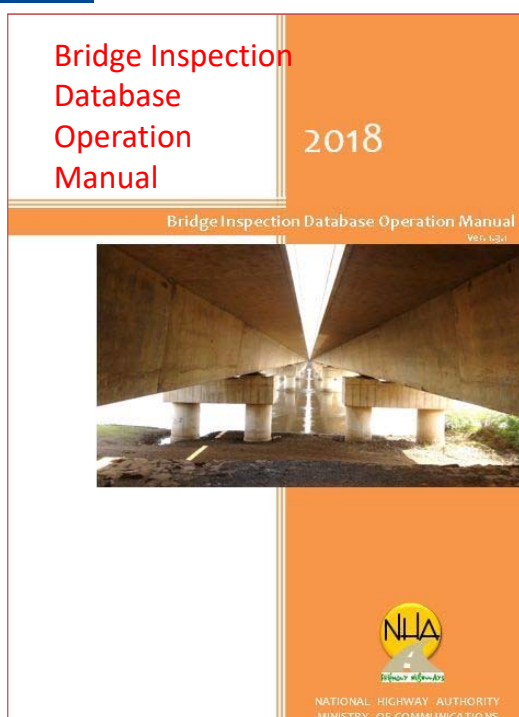
Preface

1. Anticipated modes of concrete deficiencies & deterioration
2. Typical damages on bridge structures
3. Concrete repair method selection
4. Typical concrete repair procedures
5. Repair procedure explanation
6. Structural strengthening & stabilization

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1-1: (3) BIDB Operation (data input) Manual



1. Purpose and applicability
2. Glossary
3. Overview of BIDB
4. Installing BIDB
5. Settings
6. Data synchronization
7. Importing bridge data
8. Display bridge data
9. Update inventory
10. Registering inspection results
11. Registering repair and construction jobs
12. Exporting bridge data
13. Uploading bridge data to BMS
14. FAQ

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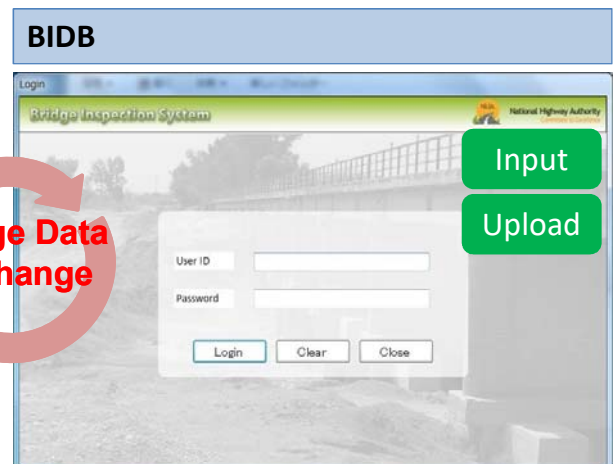
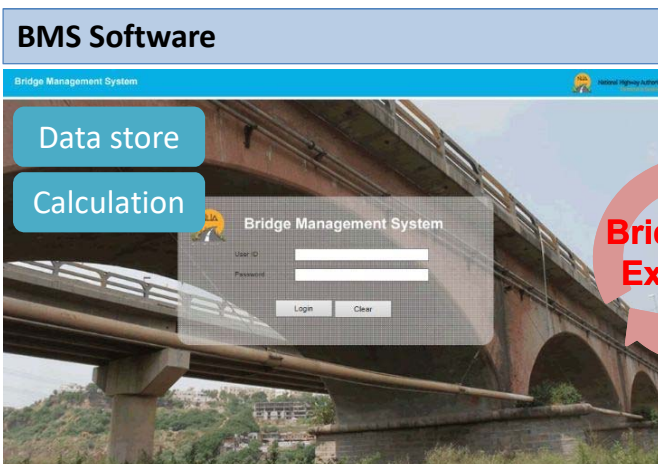
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1-2: Inspection Formats

[Periodical Inspection] Inspection Report Sheet 1-1										[Periodical Inspection] Inspection Report Sheet 1-3																						
Bridge/Culvert Data					Inspection Summary					Inspection Summary					Inspection Summary																	
Structure Type	Bridge Name	ID	Project Name/Location	Inspector	Inspection Date	Inspection Time	Inspection Duration	Inspection Status	Inspection Notes	Span No.	Member	Damage Type	Area (sqm)	Case	Detail Investigation	Classification	Job	Unit	Quantity	Comments	Span No.	Member	Damage Type	Area (sqm)	Case	Detail Investigation	Classification	Job	Unit	Quantity	Comments	
Concrete	1	Support	Spalling & bar corrosion	15.14	Other		M	Other		70.000	Patching without formwork unit is m2	10	1	Support	Spalling & bar corrosion	15.14	Other		M	Other		70.000	Patching without formwork unit is m2
Concrete	2	Others	Spalling & bar corrosion	16.30	Other	It is considered "Cd" is proper.	Cd	Other		1.000	Clearing and patching without formwork unit should be m2	10	2	Others	Spalling & bar corrosion	16.30	Other	It is considered "Cd" is proper.	Cd	Other		1.000	Clearing and patching without formwork unit should be m2
Concrete	3	Others	Spalling & bar corrosion	5.473	Other		M	Flashing	m2	6.340		10	3	Others	Spalling & bar corrosion	5.473	Other		M	Flashing	m2	6.340	
Concrete	4	Wall	Spalling & bar corrosion	3.1.2	Other		M	Other		25.000	Patching without formwork unit is m2	10	4	Wall	Spalling & bar corrosion	3.1.2	Other		M	Other		25.000	Patching without formwork unit is m2
Concrete	5	pavement	Damage of pavement	10.8	Other		M	Patching and re-laying of pavement (Cold mixing & Asphalt)	m2	3.500		10	5	pavement	Damage of pavement	10.8	Other		M	Patching and re-laying of pavement (Cold mixing & Asphalt)	m2	3.500	
Concrete	6	Support	Spalling & bar corrosion	21.22	Other		M	Other		24.000	Patching without formwork unit is m2	10	6	Support	Spalling & bar corrosion	21.22	Other		M	Other		24.000	Patching without formwork unit is m2
Concrete	7	Others	Spalling & bar corrosion	16.29	Other	It is considered "Cd" is proper.	Cd	Other		0.725	Clearing and patching without formwork unit is m2	10	7	Others	Spalling & bar corrosion	16.29	Other	It is considered "Cd" is proper.	Cd	Other		0.725	Clearing and patching without formwork unit is m2
Concrete	8	Others	Water leakage of borehole	33.34	Other		B	Special Inspection	No		Inspection due to poor drainage on top. Right also be done to pour and, however periodic inspection is required to know to probable cause.	10	8	Others	Water leakage of borehole	33.34	Other		B	Special Inspection	No		Inspection due to poor drainage on top. Right also be done to pour and, however periodic inspection is required to know to probable cause.
Concrete	9	Others	Spalling & bar corrosion	26.36	Other		M	Flashing	m2	6.600		10	9	Others	Spalling & bar corrosion	26.36	Other		M	Flashing	m2	6.600	
Concrete	10	Others	Settlement and sink	24.25	Other		M	Reinforcing a masonry structure (Brick Masonry)	m3	0.120		10	10	Others	Settlement and sink	24.25	Other		M	Reinforcing a masonry structure (Brick Masonry)	m3	0.120	

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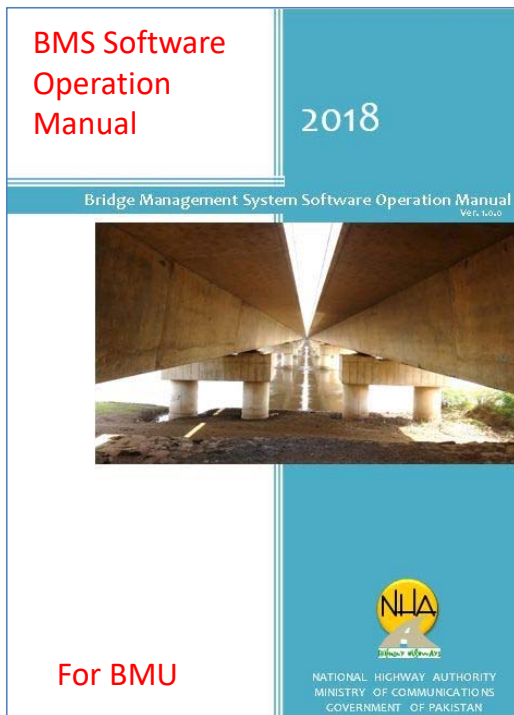
1-3: BMS Software & Bridge Inspection Database



- 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': BMS Software Operation Manual

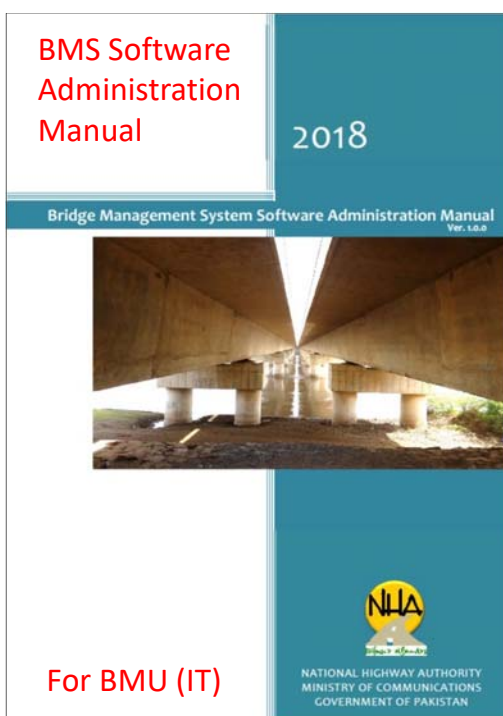


1. Purpose and applicability
2. Glossary
3. Overview of BMS software
4. Start and log in/out BMS software
5. Bridge research
6. Inspection list
7. Repair plan
8. CSV download
9. User maintenance
10. Master maintenance
11. Manual

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1-3': BMS Software Administration Manual

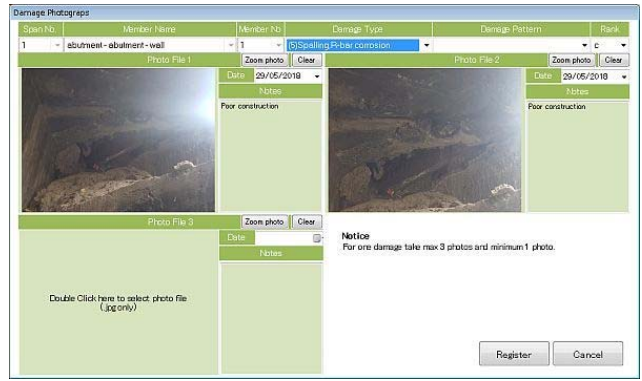


1. Purpose and applicability
2. Glossary
3. Overview of BMS software and BIDB
4. Server administration
5. BMS software modification
6. BIDB modification
7. Update manuals
8. BMS software installation
9. System restoration to another server

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1-3: BIDB Input System

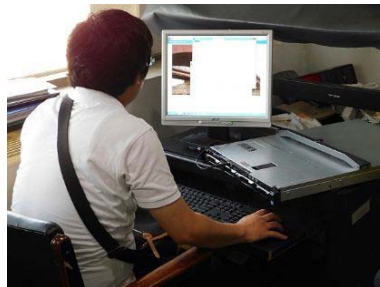


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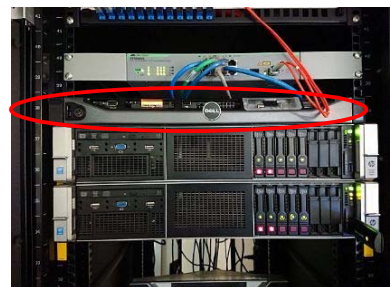
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1-3': BMS Software Installation to the Server

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: Training Materials

- Bridge Engineering (1)-(2)
- Bridge Inspection Manual
- Bridge Inspection (1)-(3)
- Repair of Concrete Structures
- Repair for Others
- How to fill out Inspection Sheet
- Extra Training for filling out Inspection Report Sheets
- Example of Inspection Report Sheets with Comments
- Inspection Sheet (Shahia Bridge)
- Inspection Sheet (Wah Garden Bridge)
- Data Input by BIDB
- Inventory Survey Training
- Supplementary material for Inventory Survey
- BMS Software Training
- Structural Mechanics
- Daily Test (Day 1-2)
- Examination



1-4: Training Materials

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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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Figure-1 Names of each component of a Bridge

1-5: BMU has **Reviewed and Finalized**

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 Trainings**
- (2) **Localization** by BMU**
- (3) Comments & Opinions from in/outside NHA**

Currently in queue of Executive Board Meeting for approval.

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1-5': Expert Team has **Localized** themselves.



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Output2 Training

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: On-the-job-training (OJT) for BMU

Purpose: To enable BMU to manage BMS Training.

(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. M Nur-UI-Eain

2-1: On-the-job-training (OJT) for BMU

(b) Trainee Engineers

NHA decided to hire 12 TEs.
One-year contract
Work as Bridge Inspectors.

10 TEs, now 8 TEs.

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: BMS training (Inventory Survey)

1) Inventory Survey Training

- In office training on February 1st. → On-site training on February 2nd

<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)

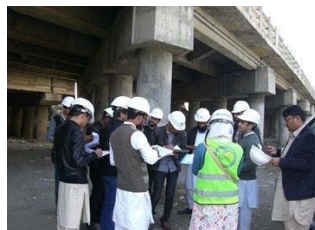
- JICA Expert Team : 2 persons

(Total)

- Total : 24 persons



Figures: Inventory Survey Training (in office)



Figures: Inventory Survey Training (on site)

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1 Day: in-office training
1 Day: on-site training

2-2: BMS training (Inventory Survey)

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)

2-2: BMS training (Bridge Inspection)

[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

2 Days: in-office training
3 Days: on-site training

Table: Activity and Lecturer

Date	Topics and Activity	Main Lecturer
April 16 th	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 th	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 th	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 th	Review	Mr. Ghulam Murtaza Simair (BMU)
	Site Inspection – Wah Garden RC Slab Girder	Mr. Kenichi Tpmi (JICA)
	Evaluation	Mr. Akio Mori (JICA)
April 20 th	Review	Mr. Sohaib Mansoor (BMU)
	Site Inspection – Brick Masonry and Concrete Box Culvert	Mr. Ghulam Murtaza Simair (BMU)
	Evaluation	Mr. Kenichi Tpmi (JICA)
	Examination	Mr. Haruo Tomiyama (JICA)

2-2: BMS training (Bridge Inspection)

◆ 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.
- In office training on April 16th and 17th, On-site training on April 18th to 20th



Figures: Bridge Inspection Training (in office)

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2-2: BMS training (Bridge Inspection)



Figures: Bridge Inspection Training (on site)



Figures: Bridge Inspection Training (Data input and Presentation)

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2-2: BMS training (Bridge Inspection)

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 st	September 12 th AM	Flow of structure design / Calculation of reaction force
2 nd	September 13 th PM	Calculation of section force
3 rd	September 14 th PM	Geometrical moment of area / Geometrical moment of inertia / Neutral axis
4 th	September 17 th AM	Calculation of stress level (Bending stress / Shearing stress)
5 th	September 17 th PM	Influence of flexural rigidity / Elasticity and plasticity

Figures: Accompanying and guidance to the site work

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2-2: BMS training (Bridge Inspection)

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.

• 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

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2-3: Inventory Survey OJT

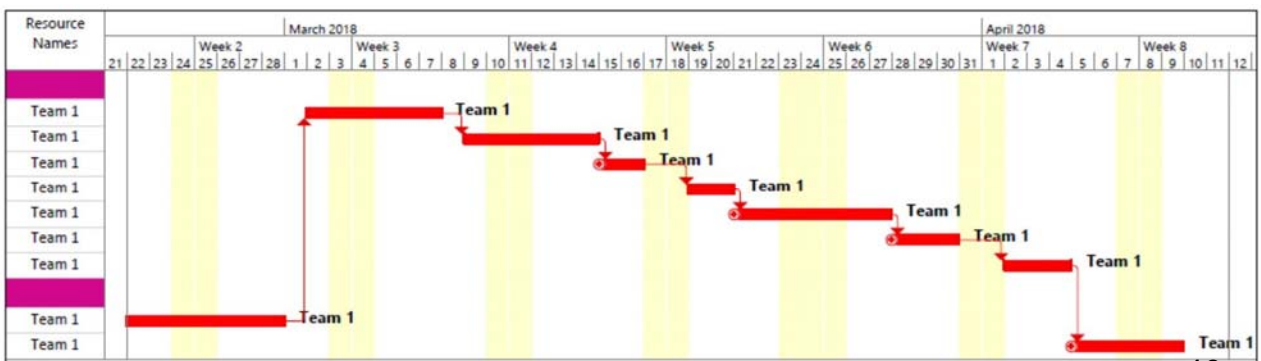
■ Teaming

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 OJT

■ Planning of Schedule

ID	Task Mode	Task Name	Bridges	Culverts	Duration	Start	Finish	Predecessors
1		WAZIRABAD MAINTENANCE UNIT	151	85				
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		RAWALPINDI MAINTENANCE UNIT	104	176				
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 OJT

■Supervising Daily Progress



2-3: Inventory Survey OJT

■Planning of Data Entry Schedule

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 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 6-Apr-2018



2-3: Bridge Inspection OJT

■ Progress Management

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-N5N-1592+200	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			

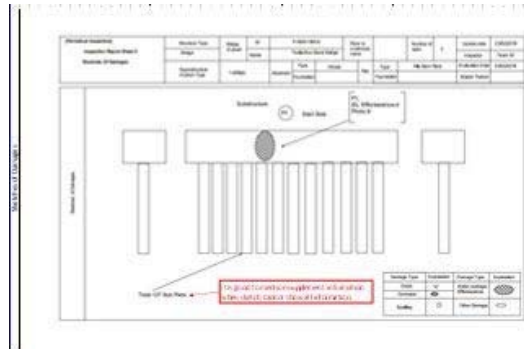
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2-4: Bridge Inspection OJT

■ Advices on Inspection Reports

Project Information									
Inspection Summary									
No.	Span	Span No.	Span Length	Span Type	Span Status	Span Condition	Span Rating	Span Remarks	Span Action
1	PN5S 1581	1,2,3	1581	Concrete	Good	OK	3		
2	PN5S 1581	4,5,6	1581	Concrete	Good	OK	3		
3	PN5S 1581	7,8,9	1581	Concrete	Good	OK	3		
4	PN5S 1581	10,11	1581	Concrete	Good	OK	3		
5	PN5S 1581	12	1581	Concrete	Good	OK	3		
6	PN5S 1581	13	1581	Concrete	Good	OK	3		
7	PN5S 1581	14	1581	Concrete	Good	OK	3		
8	PN5S 1581	15	1581	Concrete	Good	OK	3		
9	PN5S 1581	16	1581	Concrete	Good	OK	3		
10	PN5S 1581	17	1581	Concrete	Good	OK	3		



Project Information									
Inspection Summary									
No.	Span	Span No.	Span Length	Span Type	Span Status	Span Condition	Span Rating	Span Remarks	Span Action
1	PN5S 1581	1,2,3	1581	Concrete	Good	OK	3		
2	PN5S 1581	4,5,6	1581	Concrete	Good	OK	3		
3	PN5S 1581	7,8,9	1581	Concrete	Good	OK	3		
4	PN5S 1581	10,11	1581	Concrete	Good	OK	3		
5	PN5S 1581	12	1581	Concrete	Good	OK	3		
6	PN5S 1581	13	1581	Concrete	Good	OK	3		
7	PN5S 1581	14	1581	Concrete	Good	OK	3		
8	PN5S 1581	15	1581	Concrete	Good	OK	3		
9	PN5S 1581	16	1581	Concrete	Good	OK	3		
10	PN5S 1581	17	1581	Concrete	Good	OK	3		

Project Information									
Inspection Summary									
No.	Span	Span No.	Span Length	Span Type	Span Status	Span Condition	Span Rating	Span Remarks	Span Action
1	PN5S 1581	1,2,3	1581	Concrete	Good	OK	3		
2	PN5S 1581	4,5,6	1581	Concrete	Good	OK	3		
3	PN5S 1581	7,8,9	1581	Concrete	Good	OK	3		
4	PN5S 1581	10,11	1581	Concrete	Good	OK	3		
5	PN5S 1581	12	1581	Concrete	Good	OK	3		
6	PN5S 1581	13	1581	Concrete	Good	OK	3		
7	PN5S 1581	14	1581	Concrete	Good	OK	3		
8	PN5S 1581	15	1581	Concrete	Good	OK	3		
9	PN5S 1581	16	1581	Concrete	Good	OK	3		
10	PN5S 1581	17	1581	Concrete	Good	OK	3		

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Figures: Examples of corrected Inspection Sheet

2-3: Bridge Inspection OJT

■ On-site OJT



Figures: Accompanying and guidance to the site work

2-4: Review of the Inspection Results

[Periodical Inspection] Inspection Report Sheet 1-3											P-INS-1608-1950 (TEAM 03) ONG Station Bridge				River of Underroad Name Nuthah		Number of Spans 4		Inspection Date 31/05/2018	
Inspection Summary											Type A / Gravity Type Abutment		Pair		Type B / Solid Wall Pier		Evaluation Date 08/10/2018			
											Foundation		Not Defined		Foundation		Not Defined			
No.	Span No.	Member	Damage Type	Photo No.	Cause	Detail Investigation	Classified Evaluation	Job	Unit	Quantity	Comments									
1	1	deck slab	(5)Spalling, R-bar corrosion	26,29, 27,25, 24,23, 32,31, 39,40	(f)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, 77,39, 17,16, 15,14, 13,38, 21,24	(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, 51,55	(f)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, 14,31, 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									
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	(f)Deterioration of material		Cs	Plastering	m2	1.625										
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									
											Detail or Follow-up inspection		Photo No.		Cause		Comment			
											sf		39,40		g)Other Poor construction		[Damage Condition] [Basis of The Judgement]			
													37,36,17,16,15,14,13,3 &		g)Other Water leakage		[Damage Condition] No rust water but water leakage and efflorescence is observed. [Basis of The Judgement] Remedial measure is not necessary at early stage as no rust water is seen and is not estimated to progress till the next inspection. Good comments			
													26,29,27,25,24,23,22,2,1,20,18,28,19		f)Deterioration of material		[Damage Condition] There are partial/sectional deficiencies in the stone masonry. [Basis of The Judgement]			
													31,35,34,32,30,33		g)Other Poor construction		[Damage Condition] Reinforcement is visible at number of places and concrete has spalled out. [Basis of The Judgement] 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. Good comments			

Output3 BMS Software

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: BMS Software Training for BMU

■BMS Software Operation

- In office training on August 9th
- 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



Figures: BMS Software operation training

3-1: BMS Software Training for BMU

■Prioritization & AMP

- In office training on November 6th
- 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



Figures: BMS Software operation training (Prioritization and Annual Maintenance Plan)

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3-1: BMS Software Training for BMU

■System Administration

- In office training on November 8th
- 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



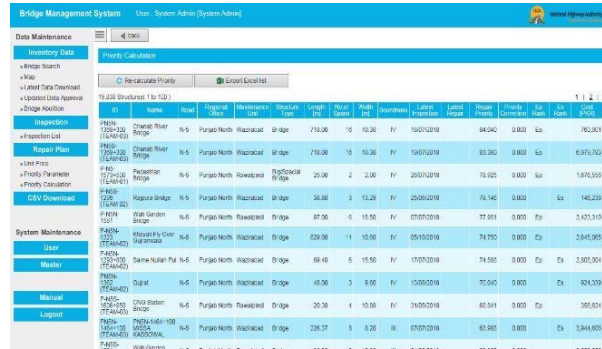
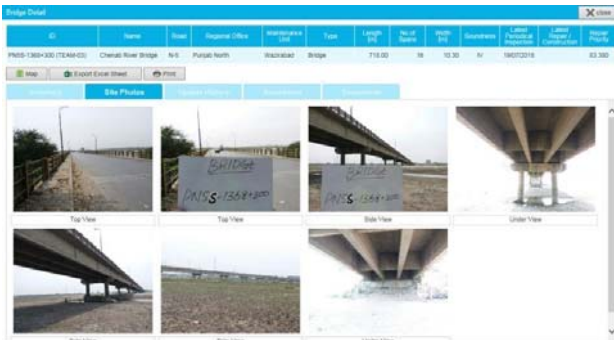
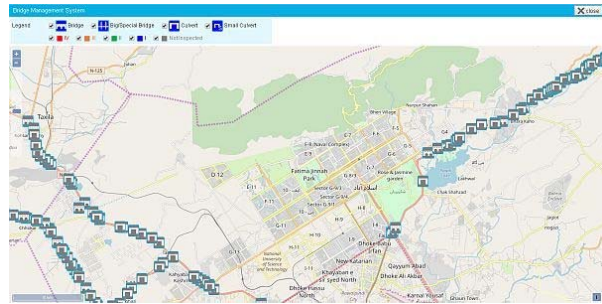
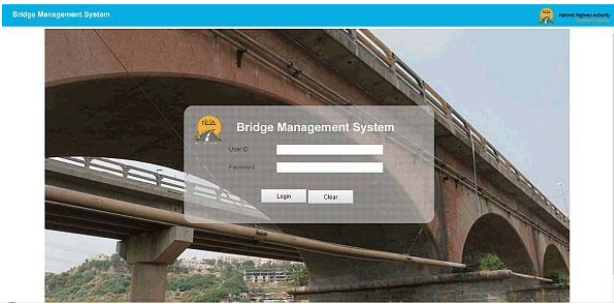
Figures: Addition training for system administration

A4-180

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3-2: BMU analyzes Bridge Inspection Data



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3-3: Annual Bridge/Culvert Maintenance Plan

◆ 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)

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3-3: Annual Bridge/Culvert Maintenance Plan

Flexibility of Priority Calculation

$$\text{Priority Score} = \sum ([\text{indexes weight}] * [\text{score of each indexes}])$$

Bridge Management System User : System Admin [System Admin]

Data Maintenance

Inventory Data

» Bridge Search

» Map

» Latest Data Download

» Updated Data Approval

» Bridge Abolition

Inspection

» Inspection List

Repair Plan

» Unit Price

» Priority Parameter

» Priority Calculation

CSV Download

System Maintenance

Priority Indexes

Default_01 Load Add New Setting

Loaded Setting: Default_01 Save Cancel

Weight total is 100

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.

Bridge Management System User : System Admin [System Admin]

Data Maintenance

Inventory Data

» Bridge Search

» Map

» Latest Data Download

» Updated Data Approval

» Bridge Abolition

Inspection

» Inspection List

Repair Plan

» Unit Price

» Priority Parameter

» Priority Calculation

CSV Download

Priority Parameter - Soundness of Bridge

Loaded Setting: Default_01

Save Cancel

Score Settings are 0 to 100

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: Annual Bridge/Culvert Maintenance Plan

Priority Calculation Results

Priority Calculation provide "repair priority score" and "approximate cost"

Bridge Management System User : System Admin [System Admin]

Data Maintenance

Inventory Data

» Bridge Search

» Map

» Latest Data Download

» Updated Data Approval

» Bridge Abolition

Inspection

» Inspection List

Repair Plan

» Unit Price

» Priority Parameter

» Priority Calculation

CSV Download

System Maintenance

Priority Calculation

Re-calculate Priority

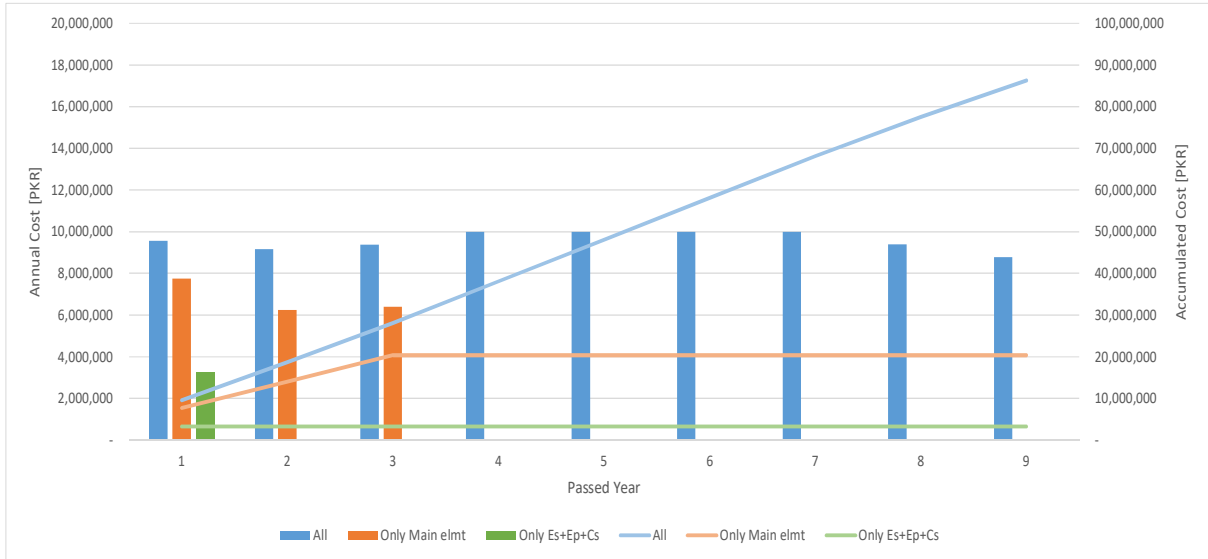
19,838 Structures(1 to 100)

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	824,339

- Repair priority score is calculated from inspection and inventory data.
- Approximate cost is calculated from estimated countermeasure in inspection and unit price of countermeasures (CSR)

3-3: Annual Bridge/Culvert Maintenance Plan

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)



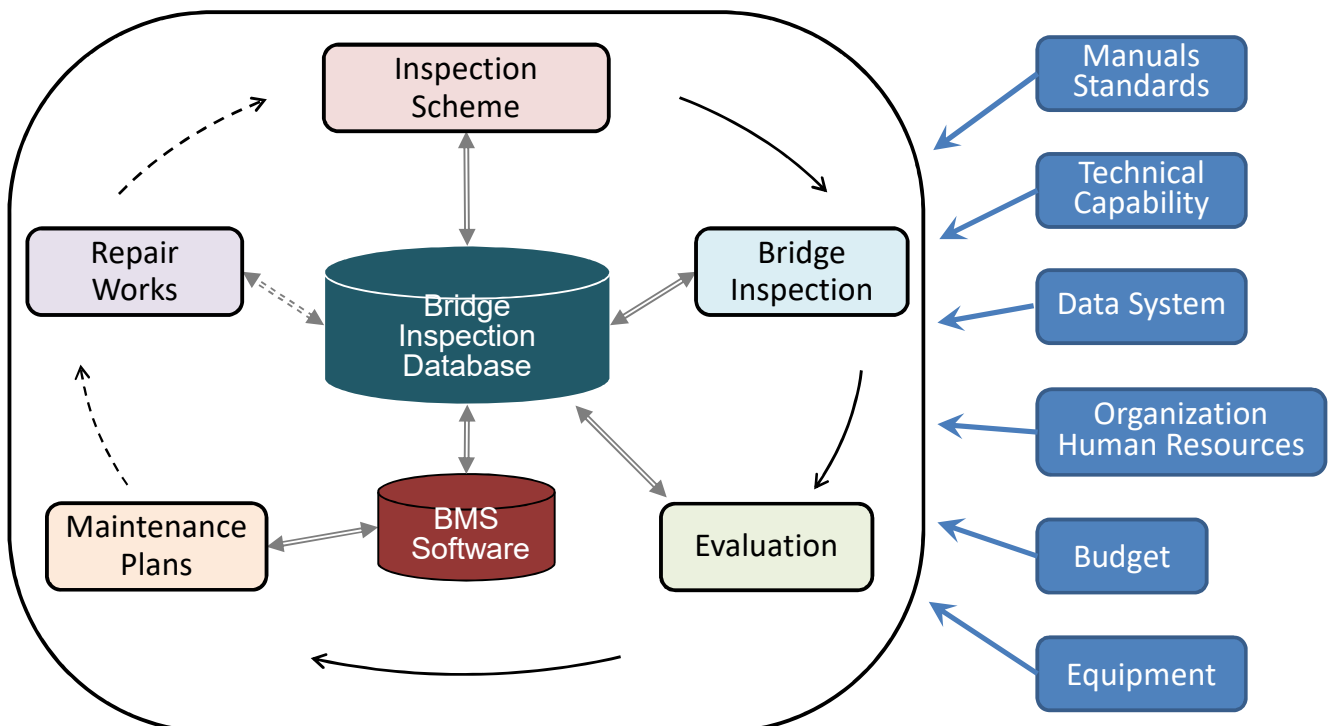
3-Future Visions

Schedule

- During BMS Project
- BMS Training for Trainee Engineers
 - Inventory Survey in the model area
 - Bridge Inspection of the typical 36 bridges + 5 culverts
 - BMS Software Training
 - Draft AMP for bridge/culvert repair in the model area
 - present -----
 - Terminal evaluation (January 2019)
 - beyond project -----
 - Inventory Survey (all bridges and culverts in NHA)
 - Bridge Inspection (all bridges and culverts > 2.0m)

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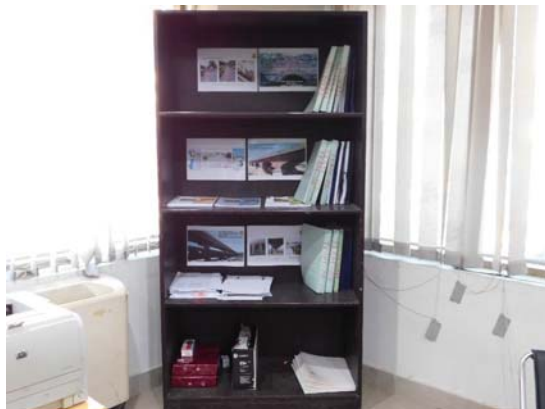
Concept of BMS in NHA



Project Room (G25)



Project Room (G25)



NHA Strategies

Timeline Concept

Term	Short	Medium	Long
Duration	Dec 2018 – Feb 2020 15 months	Dec 2018 – May 2022 42 months	Jun 2022 – permanent
Target	Inventory Survey (6RO)	Inventory Survey (6RO) Bridge Inspection (all)	Bridge Inspection (once in 5 years)
Workforce	12 Trainee Engineers	12 Trainee Engineers Outsource (Consultants)	12 TEs Outsource

Message for NHA

From JICA Expert Team

- This Project for **Technical Assistance** will end soon.
- However, this is NOT the end, but just the start of NHA BMS.
- BMS of NHA, by NHA, for NHA
- Ask not what BMS can do for you.
Ask what you can do for BMS.

Thank you so much for
allowing us to make a presentation.



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

BMS(Inventory Survey, Inspection) Seminar

December 10th 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-Outline of Inventory Survey and Inspection

2-What is Inventory Survey?

3-How to carry out Periodical Inspection

1-Outline of Inventory Survey and Inspection

3

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Purpose of Inspection

Why is Bridge / Culvert Inspection necessary?

- Bridges/Culverts that are designed and constructed appropriately are **fundamentally tough, beautiful and durable**, if proper maintenance are carried out and required repair is timely done.
- Bridges/Culverts can suddenly fall down** if maintenance is not proper.
- When a bridge/culvert falls down, the **NHA network**, which is responsible for 80% of domestic traffic, **will collapse** and have a tremendous impact on logistics.
- A huge budget is necessary** to replace bridges/culverts after they have been seriously damaged. **Timely repair** work not only protects users' safety but also extends the life of bridges/culverts and **avoids significant future cost increases**.
- It is necessary to inspect and **grasp the current status of bridges/culverts** to provide proper remedial measures timely.

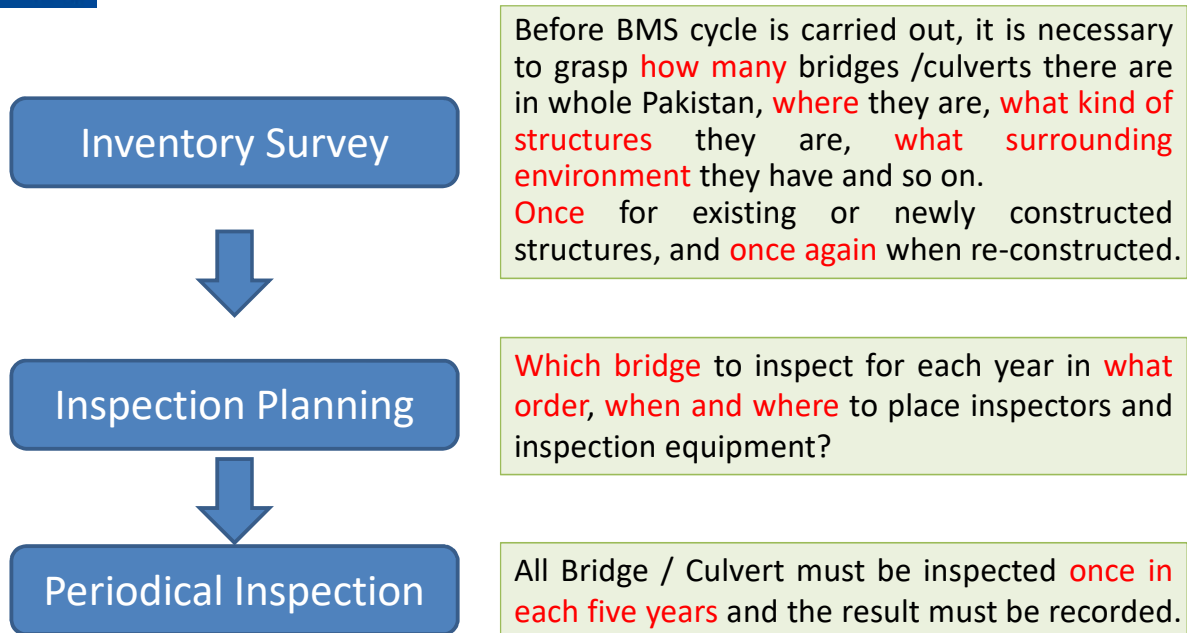
Type of Inspection

Type of Inspection	Frequency
Periodical Inspection	Once in five years
Routine Inspection	Twice in a year
Special Inspection	During repair planning of priority structures in a particular year. Immediately following an event.
Initial Inspection	After completion of construction or major repair works
Detail Investigation	After Detail Investigation that Master Trainers orders
Repair Job	After Repair Job done
Maintenance Job	After Maintenance Job done
Construction Job	After Construction done

In **periodical inspection**, **inspectors** collect inventory data and carry out inspection of all Bridge / Culvert on NHA network, fill out Inspection Report Sheet and **register data to Bridge Inspection Data Base (BIDB)** . **BMU** check, approve and **register them to BMU software**.

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Steps of Periodical Inspection



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2-What is Inventory Survey?

7

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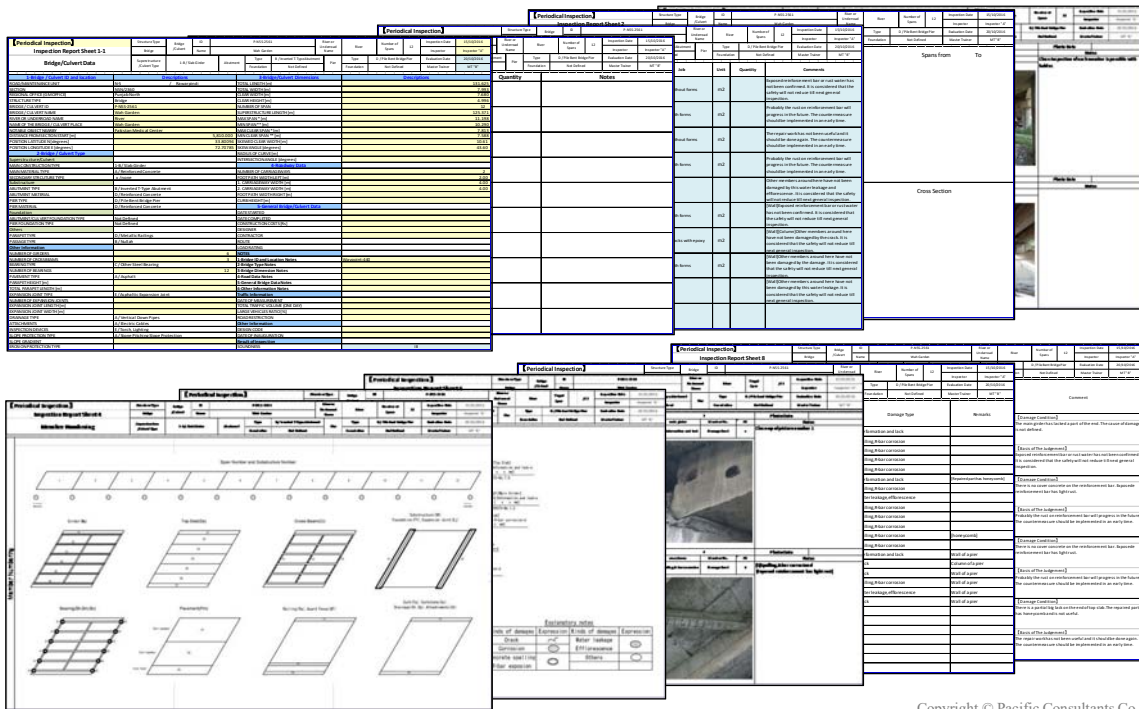
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What is Inventory Survey?

- "Inventory Data" means the basic data of Bridge / Culvert.
- "Inventory data" is all the underlying data in bridge / culvert maintenance, and its collection and organization is an important work to be done first.

Inspection Report Sheet

- 10 kinds of inspection Sheets (Sheet 1-1 ~ Sheet 8) are prepared for Bridge / Culvert inspection. **“Inventory data” are recorded in Sheet 1-1, 2, 3.**



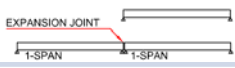
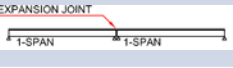
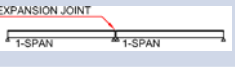
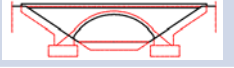

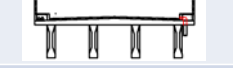






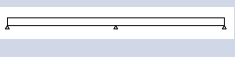
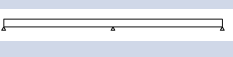



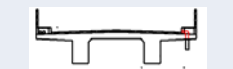






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Inventory data (Sheet 1-1)

【Periodical Inspection】 Inspection Report Sheet 1-1		Structure Type	Bridge / Culvert	ID	P-NSS-1581 (TEAM-01)		River or Underroad Name	Number of Spans	12	Inspection Date	04/05/2018
Bridge/Culvert Data		Bridge	Culvert	Name	Wah Garden Bridge					Inspector	Team 3
		Superstructure	1-B / Slab Girder	Abutment	Type	B / Inverted T-Type Abutment	Pier	Type	V / Varies	Evaluation Date	05/10/2018
				Foundation				Foundation		Master Trainer	
1-Bridge / Culvert ID and location		Descriptions		3-Bridge/Culvert Dimensions				Descriptions			
ROAD/MAINTENANCE UNIT		N-S / Rawalpindi		TOTAL LENGTH / TOTAL SPAN LENGTH [m]				98.000			
SECTION		Punjab North		TOTAL WIDTH / CULVERT LENGTH, SKEW [m]				15.600			
REGIONAL OFFICE (GM OFFICE)		AZZ Mega store		CLEAR WIDTH [m]				15.350			
STRUCTURE TYPE		11,000.000		CLEAR HEIGHT [m]				5.000			
BRIDGE / CUI		33.80094		NUMBER OF S				12			
BRIDGE / CUI		72.70785		SUPERSTRUCT				125.371			
RIVER OR LIN				MAX SPAN * [m]				10.040			
NAME OF THE BRIDGE / CULVERT				MIN SPAN [m]				9.350			
NOTABLE OBJECT NEARBY				MIN CLEAR SPAN ** [m]				6.425			
DISTANCE FROM ROUTE START [km]				SKEWED CLEAR WIDTH [m]				5.941			
POSITION LATITUDE N [degrees]				SKEW ANGLE [degrees]				45.00			
POSITION LONGITUDE E [degrees]				RADIUS OF CURVE [m]							
2-Bridge / Culvert Type				INTERSECTION ANGLE [degrees]				90.00			
Superstructure/Culvert		1-B / Slab Girder		4-Roadway Data							
MAIN CONSTRUCTION TYPE		A / Reinforced Concrete		NUMBER OF CARRIAGEWAYS				1			
MAIN MATERIAL TYPE				FOOT PATH W				1.20			
SECONDARY STRUCTURE TYPE				1. CARRIAGEW				13.50			
Substructure		B / Inverted T-Type Abutment		2. CARRIAGEW							
ABUTMENT TYPE		D / Reinforced Concrete		FOOT PATH WIDTH RIGHT [m]				1.34			
ABUTMENT MATERIAL		V / Varies		CURB HEIGHT [m]				1.05			
PIER TYPE		D / Reinforced Concrete		5-General Bridge/Culvert Data							
PIER MATERIAL				DATE STARTED							
Foundation				DATE COMPLETED							
ABUTMENT/CULVERT FOUNDATION TYPE				CONSTRUCTION COSTS [Rs]							
PIER FOUNDATION TYPE				DESIGNER							
Others				CONTRACTOR							
PARAPET TYP				ROUTE							
PASSAGE TYP				LOAD RATING							
Other Inform				NOTES							
NUMBER OF CROSSBEAMS		6		1-Bridge ID and Location Notes							
NUMBER OF BEARINGS		3		2. ROADWAY							
BEARING TYPE		A / Neoprene Bearing Pads		3. ROADWAY							
NUMBER OF BEARINGS		144		4. ROADWAY							
PAVEMENT TYPE		A / Asphalt		5. ROADWAY							
PARAPET HEIGHT [m]		1.000		General Data and Other Information							
TOTAL PARAPET LENGTH [m]		94.400		6-Urner information notes				electric cables, water pipes(attachments)			
EXPANSION JOINT TYPE		F / Steel Plate Expansion Joint		Traffic Information							
NUMBER OF EXPANSION JOINTS		13		DATE OF MEASUREMENT							
EXPANSION JOINT LENGTH [m]		17.600		TOTAL TRAFFIC VOLUME (ONE DAY)							
EXPANSION JOINT WIDTH [m]		0.080		LARGE VEHICLES RATIO [%]							
DRAINAGE TYPE		A / Vertical Down Pipes		ROAD RESTRICTION							
ATTACHMENTS		V / Several		Other Information							
INSPECTION DEVICES		G /UBIT Under Bridge Inspection Crane (Aerial Work Platform)		DESIGN CODE							
SLOPE PROTECTION TYPE		F / Stone Masonry Retaining Wall		DATE OF INAUGURATION							
SLOPE GRADIENT		90.00		Result of Inspection							
EROSION PROTECTION TYPE				SOUNDNESS				III			

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Main construction Type in Sheet 1-1

Type	1-A / Slab	1-B / Slab Girder	1-Bb / Box Cross-section	1-C / Slab Arch
Construction				
Cross-section				
Picture				
Type	2-A / Continuous Slab	2-B / Continuous Slab Girder	2-Bb / Continuous Box Cross-section	2-C / Continuous Slab Arch
Construction				
Cross-section				
Picture				

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Abutment Type in Sheet 1-1



Gravity Type Abutment



Inverted T-type Abutment



Rigid-Frame Abutment

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Pier Type in Sheet 1-1



Hammerhead Pier



Solid Wall Pier



Rigid Frame Pier

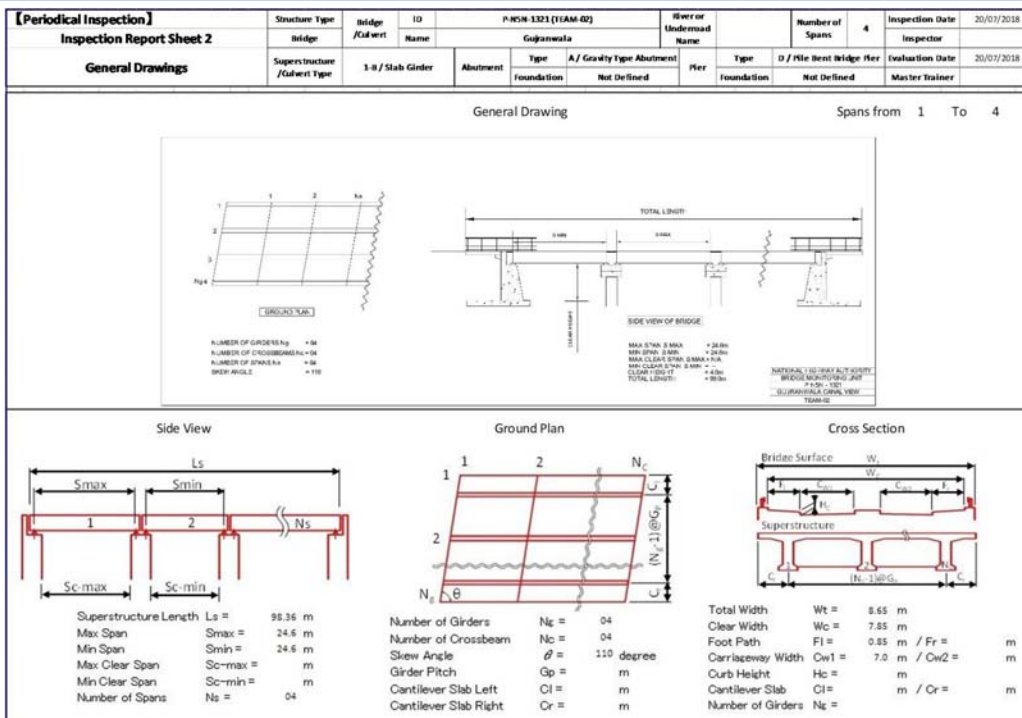


Pile Bent Bridge Pier

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General Drawing (Sheet 2)





Sheet 2 (General Drawing) complements visually the “Inventory Data” of Sheet 1-1.



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Site Photographs (Sheet 3)

Sheet 3 (Site Photographs) complements visually the "Inventory Data" of Sheet 1-1.

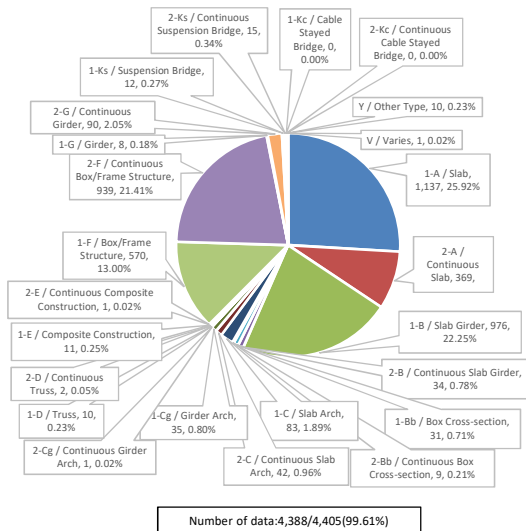
[Periodical Inspection]		Structure Type		ID	P-NON-1321 (TEAM-02)		River or Underroad Name	Number of Spans	Inspection Date				
Inspection Report Sheet 3		Bridge / Culvert	Name		Gujranwala			4	20/07/2018				
Site Photographs		Superstructure / Culvert Type	Abutment	Type	A / Gravity Type	Abutment	Pier	D / Pile Bent Bridge	Pier				
		1-B / Slab Girder		Foundation	Not Defined			Not Defined	Master Trainer				
Photo No.	1	Photo Date			21/03/2018		Photo No.	2	Photo Date		21/03/2018		
Span No.	1	Notes					Span No.	4	Notes				
Subject	Top View						Subject	Side View					
													
Photo No.	3	Photo Date			21/03/2018		Photo No.	4	Photo Date		21/03/2018		
Span No.	4	Notes					Span No.	4	Notes				
Subject	Under View						Subject	Side View					
													

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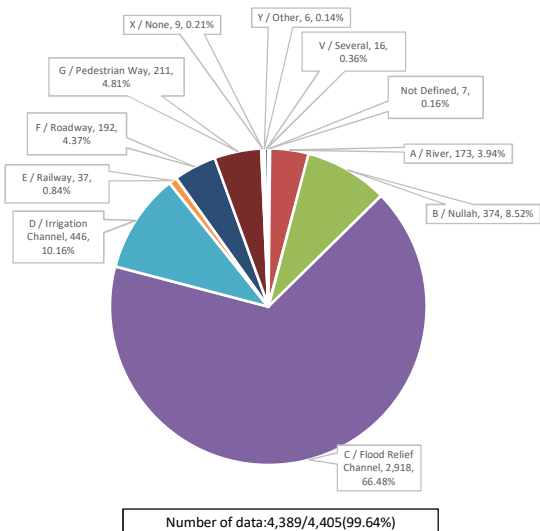
Utilization of inventory data

Collected inventory data of bridges / culverts in NHA make it possible to plan inspection / maintenance.

Main Construction Type (Bridge) [Whole NHA]



Passage Type (Bridge) [Whole NHA]



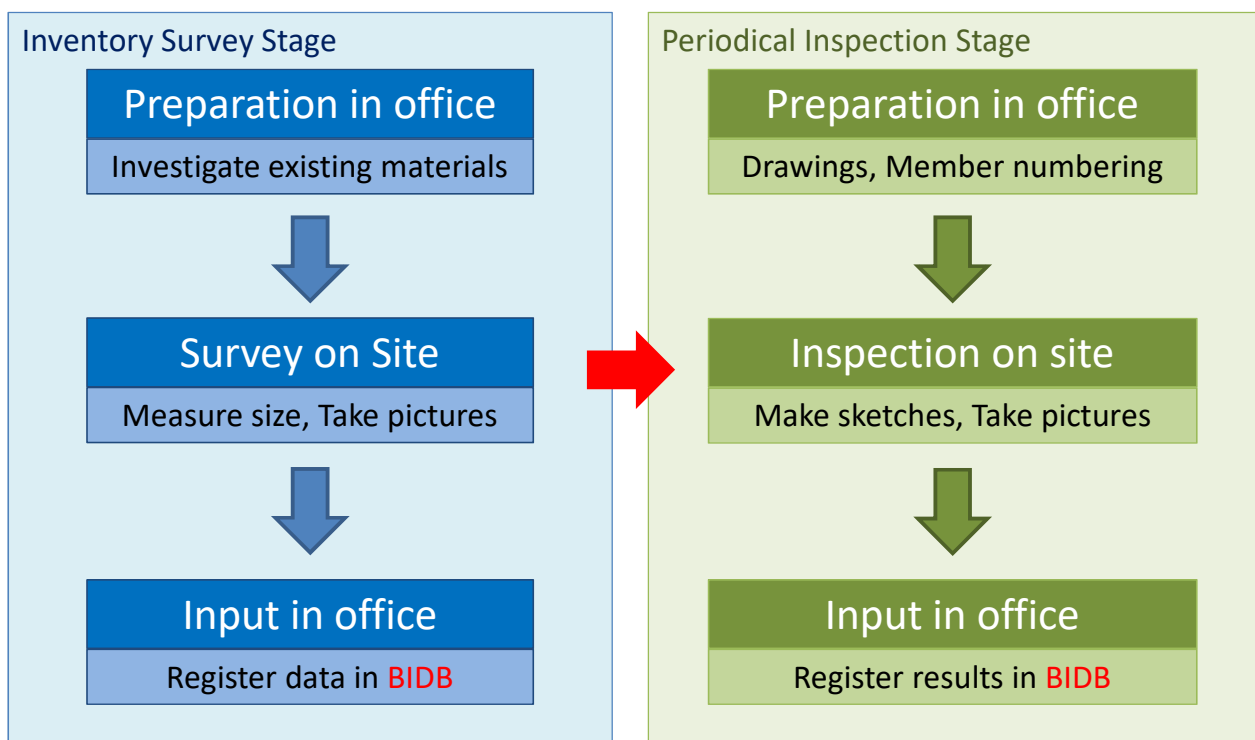
Current inventory data include many incorrect information, all data must be updated.

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3-How to carry out Periodical Inspection

17

Steps of Inspection



Steps of Evaluation

Inspection result will be evaluated in three steps that are “Damage Rank”, “Classified Evaluation” and “Soundness Diagnosis”.

Damage Rank



Classified Evaluation



Soundness Diagnosis

Evaluation to **each damage part**
Determined in **5 stages (a, b, c, d, e)**
It shows the **current status of damage** and is decided according to the criteria in Manual.

Evaluation to **each member**
Determined in **9 stages (A, B, Cd, Cs, Ep, Es, M, Sd, Sf)**
It shows the **countermeasure level** and is decided not only according to Damage Rank but also considering **the cause, environment, possibility of progress** and so on.

Evaluation to **each Bridge/Culvert**
Determined in **four stages (I, II, III, IV)**
It shows the final confirmed **status and countermeasure to be taken of each Bridge/Culvert**, and is decided referring to the **worst Classified Evaluation**.

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The criteria for deciding Classified Evaluation

The criteria and examples for deciding Classified Evaluation

Classified Evaluation	Timing to take measure	Status of damage	Example of damage condition
Es	Emergently (right now)	Quite dangerous status of structure	<ul style="list-style-type: none"> Some rebar fractured and lost strength significantly Vertical large vibration by traffic load
Ep		Quite dangerous status for passengers or others	<ul style="list-style-type: none"> Entire lack of parapet Possible falling of concrete pieces above cross road
Cs	Before next inspection (within 5 years)	Dangerous status of structural safety	<ul style="list-style-type: none"> Reduction of main rebar cross section area in main member Unusual vertical vibration by traffic load that leads to destruction of main member
Cd		Dangerous status of structural durability	<ul style="list-style-type: none"> Light rust without cross section area reduction of main rebar in main member Reduction of rebar cross section area in secondary member
B	After next inspection (after 5 years)	Non-dangerous status for the time being	<ul style="list-style-type: none"> Light rust without cross section area reduction of rebar in secondary member Small crack or small lack that doesn't lead to corrosion of rebar immediately
A	unnecessary	No problem	<ul style="list-style-type: none"> No damage

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Criteria for Damage Rank

Damage Types are sorted to 17 types and criteria for Damage Rank to each Damage Type is shown in Manual.

An extract from the criteria for Damage Rank of "Crack"

[Damage Rank]

Damage Rank of Crack is decided according to below table. It is decided with the combination of each damage size (size of crack and density of crack).

Table 9.4.1 : Damage Rank for Crack

Rank	Size of crack	density of crack
a	No damage	
b	Small	Small
c	Small	Big
d	Medium	Small
	Medium	Big
e	Big	Small
	Big	Big

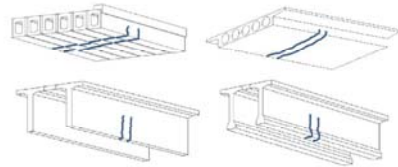
Table 9.4.2 : Size of crack

Class	Appearance and condition
Big	Width is big (RC : 0.3mm or more) (PC : 0.2mm or more)
Medium	Width is medium (RC : 0.2mm or more, less than 0.3mm) (PC : 0.1mm or more, less than 0.2mm)
Small	Width is small (RC : less than 0.2mm) (PC : less than 0.1mm)

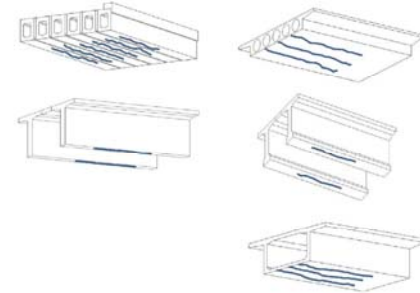
Table 9.4.3 : Density of crack

Class	Appearance and condition
Big	Space is small (Less than 0.5m)
Small	Space is big (0.5m or more)

1) Vertical crack near center of span



2) Longitudinal crack bottom of girder



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Criteria for Classified Evaluation

Criteria for Classified Evaluation to each Damage Type is also shown in Manual.

An extract from the criteria for Classified Evaluation of "Crack"

Table 9.4.7 : Classified Evaluation for Crack

Classified Evaluation	Description
Es	<p>[Emergency remedial measure is necessary to enhance strength] This class should be decided when the structural safety is damaged and there is a risk to falling of bridge / culvert. Serious crack is defined by its location, width and length. Major crack types are shown below.</p> <ul style="list-style-type: none"> Shear crack at girder Shear crack at bearing seat Crack occurred by chloride damage at center of span (Generally, it is a rare case that bridge / culvert falls due to bending moment cracks but cracks due to chloride damage rapidly progress because damage of steel rapidly progress.) <p>In this case, it is necessary to consider restricting traffic.</p>
Ep	<p>[Emergency remedial measure is necessary] Person or vehicle can be damaged by crack. For example, flakes of concrete fall on road. In this case, it is necessary to hit concrete tip so it falls down.</p>
Sd, Sf	<p>[Detail or follow-up survey is necessary] If the cause of crack cannot be defined or an abnormal crack compared with same condition bridge (constructed on same route and in same period) is confirmed, it is necessary to research the cause by detail inspection (Sd).</p> <p>i. Alkali-silica reaction If following damage are confirmed, it is necessary to apply non-destructive test.</p> <ul style="list-style-type: none"> 2 direction alligator crack (Space between cracks is small and generally width is large) Bleeding of alkali-silica gel along small crack Crack occurred along R-bar or PC cable <p>Even if alkali-silica reaction is confirmed by non-destructive test, there is no countermeasure which can perfectly repair without replace. Therefore, if confirmed, classified evaluation can be changed to Sf.</p> <p>ii. Chloride damage If following damages are confirmed, it is necessary to measure the volume of contained salt in concrete.</p> <ul style="list-style-type: none"> Located near sea Anti-freezing salts in winter Concrete contained sea sand Crack width is large and serious corrosion of R-bar or PC cable
M	<p>[Maintenance work] None</p>
B, Cd, Cs	<p>[Remedial measure is necessary] Classified evaluation should be decided according to the type of crack and level of damage. If crack type is not serious and crack width is small, evaluate as B. Others classifications are Cd or Cs.</p> <ul style="list-style-type: none"> Cracks due to loading are classified to flexural cracks and shear cracks. Shear cracks are more serious than flexural cracks because they may cause brittle fracture to collapse the bridge. So, it is important to identify properly the type of crack according to the location and pattern. In the case of alkali-silica reaction, classified evaluation usually should be Cd or Cs, because crack width is generally big. If big crack occurs at the area where shear and flexural stress is large, it is evaluated as Cs. Remedial measure should be decided according to the result of residual expansion test. In the case of chloride damage, if damage is small and salt volume is small (generally less than 1g/m²), it is B. If salt volume is larger, it should be Cd or Cs. If damage occurs at the area where shear and flexural stress is large, it is evaluated as Cs. In other case it is Cd. Remedial measure should be applied according to volume of contained salts.

[Reference for filling out comments]

Comments should be filled in Inspection Sheet referring to below table.



Table 9.4.8 : Reference for crack

Location of damage	Typical cause	Predictive effect for structure
General concrete members	<ul style="list-style-type: none"> Shortage of design strength Shear crack by an earthquake load Freeze and thaw Shortage of pre-stressing force Shortage of concrete compaction Poor curing Temperature stress Dry shrinkage Poor quality of concrete Cold joint with poor place concrete Settlement of temporary support Early removing formwork Unequal settlement Carbonation, chloride damage, trouble of aggregate such as ASR 	<ul style="list-style-type: none"> Progress of crack due to stress excess Decrease of load bearing capacity R-bar corrosion due to crack Occurrence of water leakage, efflorescence

Even for the same Damage Rank, Classified Evaluation can be different if cause, environment, or possibility of progress are different. The criteria for judging various cases are shown in Manual.



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Example of Damage Rank and Classified Evaluation

Typical damage	Superstructure Cracks due to loading
	<p>Damage Rank d(medium, big) Pattern 1)</p> <p>Classified Evaluation B</p> <p>Transverse cracks occurred near the center of slab girder. (RC: Size = 0.2 mm(medium); Space = 0.2 m(big))</p> <ul style="list-style-type: none"> The cause is bending moment and shrinkage. But crack width is not so big. It is unnecessary to repair soon. <p>Cause is bending moment, and the width is not so big.</p>
	<p>Damage Rank d(big, small) Pattern 6)</p> <p>Classified Evaluation Cs (Es)</p> <p>Diagonal crack occurs at web at support. (RC: Size > 0.3 mm(big); Space > 0.5 m(small))</p> <ul style="list-style-type: none"> The cause is shearing force. Damage is big. It is necessary to repair soon. If the crack width is moving by live load, emergency action is necessary. <p>Cause is shearing forth, and the width is so big.</p>

Same Damage Rank, but different Classified Evaluation.

Example of Damage Rank and Classified Evaluation

Typical damage	Spalling, R-bar corrosion on Bridges
	<p>Damage Rank e</p> <p>Classified Evaluation Cs, Es, Sd</p> <p>Spalling occurs on girders, exposed R-bar has heavy rust and some of them are fractured.</p> <ul style="list-style-type: none"> The cause seems to chloride attack. It is necessary to repair early. And detail survey is necessary to measure the volume and the depth of salt. If the deformation is moving hard by live load, emergency action is necessary (Es). <p>Remedial measure: Patching without forms after rust proofing and carbon sheets method</p>
	<p>Damage Rank e</p> <p>Classified Evaluation Cd (Ep)</p> <p>Repaired part is floated again. Repair work was not seemed to be proper.</p> <ul style="list-style-type: none"> If a person / vehicle under the bridge can be damaged by falling concrete, evaluation should be "Ep". It should be hit and dropped off <p>Cause is poor construction, and the damage is not so serious.</p>

Same Damage Rank, but different Classified Evaluation.

Criteria for Soundness Diagnosis

CLASS		REPAIR METHOD
I	Good	No damages and no functional problems in a structure.
II	Stage of Preventive Maintenance	The damage which does not currently affect the basic function of structure had better to be repaired in the view of preventing to progress to serious condition in future.
III	Stage of Immediate Measure	The remedial measure should be implemented in an early time because safety of structure probably has reduced
IV	Stage of Unsafe	Emergent remedial action is required, because safety of structure is probably damaged , or it is possible to injure persons or vehicles .

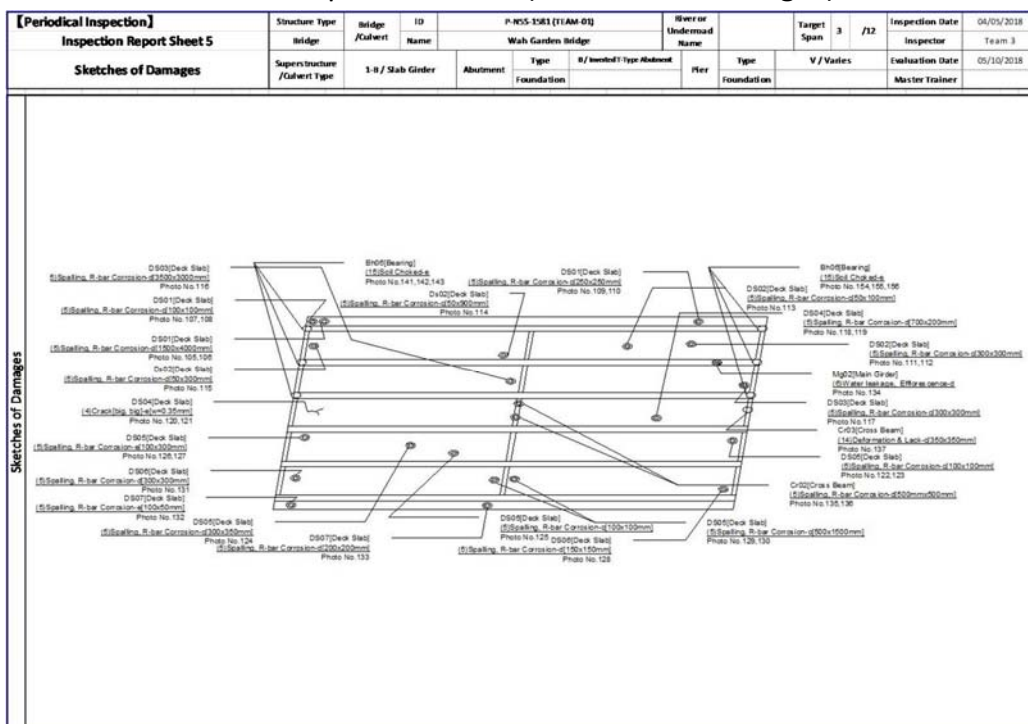
Soundness Diagnosis is usually determined by worst Classified Evaluation. But, it can be changed considering comprehensively all damages in a whole Bridge/Culvert.

Worst Classified Evaluation	Soundness Diagnosis
A, B, M	I
Cd, Sd, Sf	II
Cs	III
Es, Ep	IV

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Examples of Inspection result

An example of Sheet 5 (Sketches of Damages)



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Examples of Inspection result

An example of Sheet 5 (Sketches of Damages)

[Periodical Inspection]		Structure Type	Bridge / Culvert	ID	P-NSS-1581 (TEAM-01)		River or Underpass	Target	Inspection Date	
Inspection Report Sheet 5		Bridge	Name	Wah Garden Bridge	Wah Garden Bridge		Wah Garden Bridge	4	04/05/2018	
Sketches of Damages		Superstructure / Culvert Type	1-B / Slab Girder	Abutment	Type	# / Inverted T-Type Abutment	Pier	Type	V / Varies	Evaluation Date
		Foundation	Foundation	Foundation	Foundation	Foundation	Foundation	Foundation	Foundation	Master Trainer





Inspection Report Sheet	Structure Type	Bridge	ID	P-NSS-1581		River or Underpass	Target	Inspection Date	
05	Bridge	Name	Wah Garden Bridge	Wah Garden Bridge		Wah Garden Bridge	4	04-05-18	
Superstructure / Culvert Type	Bridge	Abutment	Type	# / Inverted T-Type Abutment	Pier	Type	V / Varies	Evaluation Date	Inspector
	Bridge	Foundation	Foundation	Foundation	Foundation	Foundation	Foundation	05/10/2018	Team 3

The purpose of the sketch is to show the location of damages. Hand drawing is also OK.

Examples of Inspection result

An example of Sheet 6 (Damage Photographs)

[Periodical Inspection]		Structure Type	Bridge / Culvert	ID	P-NSS-1581 (TEAM-01)		River or Underpass	Target	Inspection Date	
Inspection Report Sheet 6		Bridge	Name	Wah Garden Bridge	Wah Garden Bridge		Wah Garden Bridge	4	04/05/2018	
Damage Photographs		Superstructure / Culvert Type	1-B / Slab Girder	Abutment	Type	# / Inverted T-Type Abutment	Pier	Type	V / Varies	Evaluation Date
		Foundation	Foundation	Foundation	Foundation	Foundation	Foundation	Foundation	Foundation	Master Trainer

Photo No.	152	Photo Date	04/05/2018	Photo No.	153	Photo Date	04/05/2018
Member Name	deck slab	Member No.	1	Member Name	crossbeam	Member No.	3
Damage Type	Water leakage/efflorescence	Damage Rank	d	Notes	Notes	Notes	Notes
efflorescence due to water leakage.				insufficient bond between girder and cross beam, it is in critical condition, needs detailed inspection			
							
Photo No.	154	Photo Date	04/05/2018	Photo No.	155	Photo Date	04/05/2018
Member Name	main girder	Member No.	2	Member Name	main girder	Member No.	2
Damage Type	Water leakage/efflorescence	Damage Rank	d	Damage Type	Distressed road and vibration	Damage Rank	e
efflorescence due to water leakage.				The bearing pad seems to be crushed needs detailed inspection each time a vehicle passes over an unusual sound is heard			
							

"Notes" complement the status of damages to evaluate properly.

Examples of Inspection result

An example of Sheet 8 (Damaged Member List)

[Periodical Inspection]										Structure Type		Bridge / Culvert		ID		P-NSS-1583 (TEAM-01)		River or Underroad Name		Number of Spans		Inspection Date					
Inspection Report Sheet 8										Bridge		Name		Wah Garden Bridge						12		04/05/2018					
Damaged Member List										Superstructure / Culvert Type		1-B / Slab Girder		Abutment		Type		B / Inverted T-Type Abutment		Pier		Type		V / Varies		Evaluation Date	
										Foundation												09/10/2018					
Span No. / Member	Member Type			Damage Rank			Classified Evaluation										Photo No.	Cause	Comment								
	Name	Code	No.	Max. Min.	Necessity of Repair Work				Necessity of Emergency Action				Necessity of Maintenance Work		Necessity of Detail or Follow-up Investigations												
					B	Cd	Cs	Ep	Es	M	Sd	Sf															
4	C	deck slab	Ds	4	d	d	(4)Crack												179	g)Other Shrinkage	[Damage Condition] [Basis of The Judgement]						
4	C	deck slab	Ds	4	d	c	(5)Spalling, Rebar corrosion												171,172,174,175,176	g)Other Poor construction	[Damage Condition] The damage seems severe. [Basis of The Judgement] Bars are exposed which indicated lack of load transfer to the structure. If the damage is left without remedial measure, it might lead to serious damage in near future.						
4	C	deck slab	Ds	4	d	d	(6)Water leakage,efflorescence												173,177	g)Other Water leakage	[Damage Condition] [Basis of The Judgement]						
4	C	deck slab	Ds	5	c	c	(4)Crack												181	g)Other Shrinkage	[Damage Condition] [Basis of The Judgement]						

“Comments” show the reason why the Classified Evaluation selected.

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Presentation
on

FUTURE PLANS

by

Bridge Management Unit (BMU)
RAMD, NHA Islamabad

BRIDGE MANAGEMENT SYSTEM (BMS)

December 10, 2018

Contents

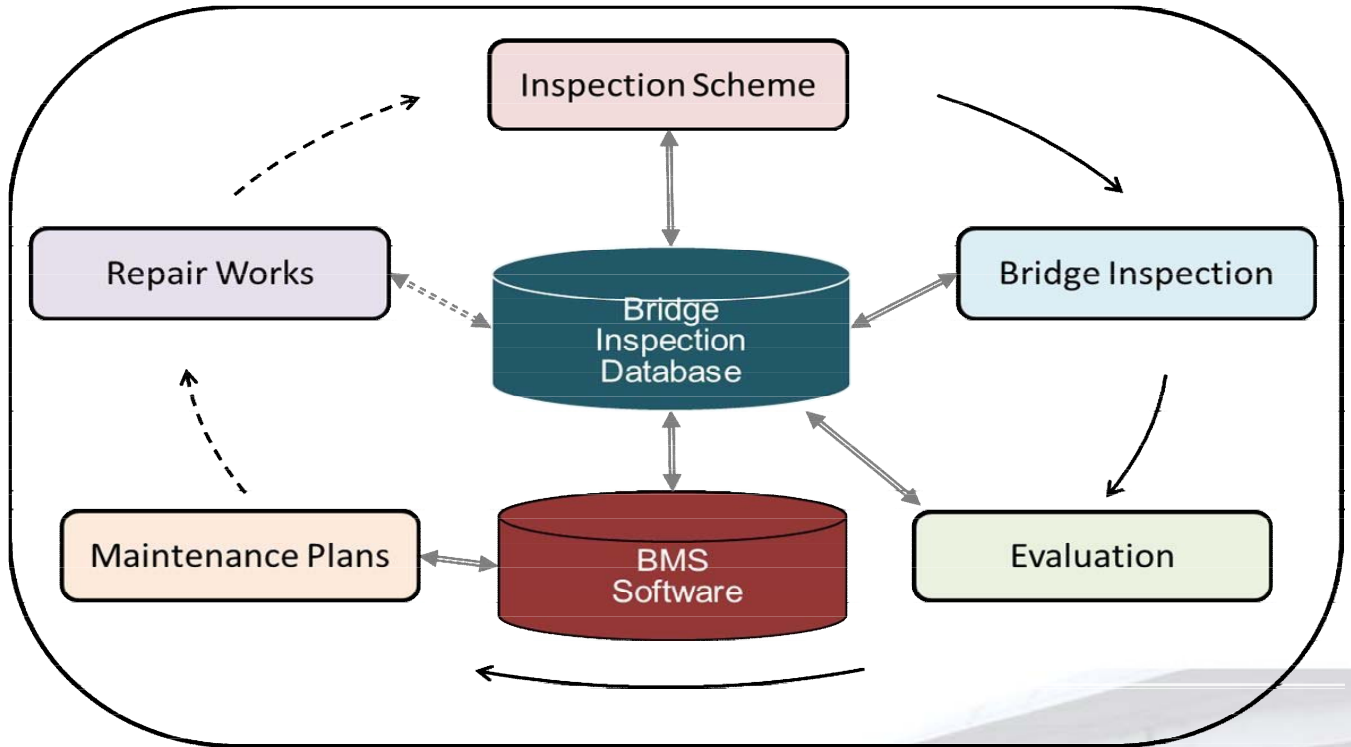
1. BMS OPERATIONS

2. CURRENT ACTIVITIES & RESOURCE MANAGEMENT

3. SHORT TERM, MEDIUM TERM & LONG TERM
PLANS

1. BMS OPERATIONS

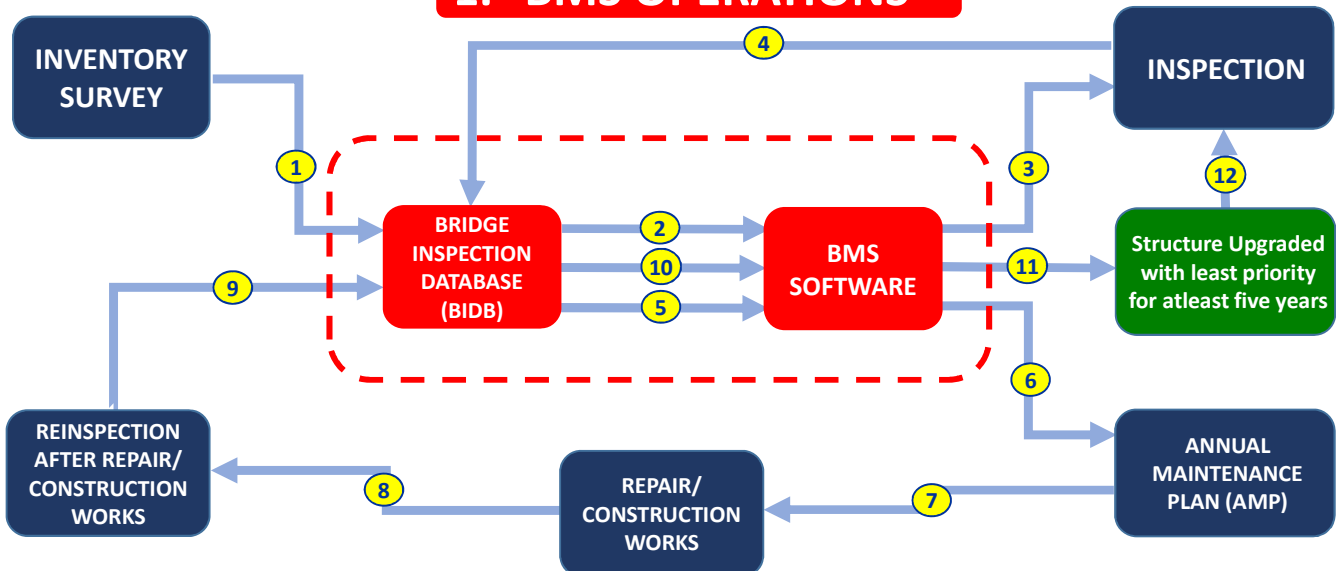
The Concept



Bridge Management Unit, NHA Islamabad

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1. BMS OPERATIONS



1. Inventory Survey data entry in Inventory part (Sheet 1-1, 2 & 3) of BIDB software
2. After checking, the inventory survey data is uploaded from BIDB to BMS Server
3. Inspection Plans are prepared for conducting inspection
4. Inspection data is added as inspection part (sheet 1-2, 1-3, 4, 5, 6, 7, 8) in BIDB software
5. After checking, the inspection data it is uploaded from BIDB to BMS Server
6. BMS processing for prioritization as per the set parameters for preparation of AMP
7. Based on AMP repair/construction works will be executed
8. Re-inspection will be done only for repair/construction works
9. Re-Inspection done and the data is added as latest inspection added to the same file in BIDB software
10. After checking & reviewing the re-inspection data, it is uploaded from BIDB to BMS Server
11. Priority become lower as severity levels of damage ranks, classified evaluation and soundness of the structure changes
12. Periodical Inspection of the structure will be planned within five years after first inspection

2. CURRENT ACTIVITIES & RESOURCES

- Resources: 12X Trainee Engineers **[4 Teams]**
- Time Period: 3 Months **[Mar-Apr 2018, June-Jul 2018, Nov 2018]**

Sr. No	Regional Office/Maintenance Unit	Bridges	Culverts
--------	----------------------------------	---------	----------

A PUNJAB NORTH REGION (INVENTORY SURVEY)

1	Rawalpindi Maintenance Unit	74	155
2	Wazirabad Maintenance Unit	126	108
3	Lahore Maintenance Unit [In Progress]	45	100
TOTAL		245	363

B INSPECTION IN MODEL AREA

1	Rawalpindi Maintenance Unit	25	5
2	Wazirabad Maintenance Unit	11	0
TOTAL		36	5



2. CURRENT ACTIVITIES & ACHIEVEMENTS

INVENTORY SURVEY IN RAWALPINDI AND WAZIRABAD MUs



2. CURRENT ACTIVITIES & ACHIEVEMENTS

INSPECTION OF STRUCTURES IN MODEL AREA



2. CURRENT ACTIVITIES & ACHIEVEMENTS

DATA ENTRY IN BRIDGE INSPECTION DATABASE (BIDB) SOFTWARE

Input inventory data by TEs



Input inspection results data by TEs



2. CURRENT ACTIVITIES & ACHIEVEMENTS

PRIORITIZATION OF PILOT PROJECT FOR ANNUAL MAINTENANCE PLAN

Bridge Management System User: System Admin [System Admin] National Highway Authority

Data Maintenance < back

Inventory Data

Priority Calculation

Re-calculate Priority Export Excel list

19,838 Structures (1 to 100)

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	E-p Rank	E-s Rank	Cost (PKR)	Evaluation	Map
PNSN-1368+300 (TEAM-03)	Chenab River Bridge	N-5	Punjab North	Wazirabad	Bridge	718.00	16	10.30	IV	18/07/2018		89.860	0.000	Ep		780,901	Evaluation	
PNS-1368+300 (TEAM-03)	Chenab River Bridge	N-5	Punjab North	Wazirabad	Bridge	718.00	16	10.30	IV	19/07/2018		89.530	0.000	Ep		8,979,783	Evaluation	
P-NS-1573+500 (TEAM-01)	Pedestrian Bridge	N-5	Punjab North	Rawalpindi	Big/Special Bridge	25.00	2	2.00	IV	28/07/2018		88.025	0.000	Ep		1,676,556	Evaluation	
P-NSS-1296 (TEAM-02)	Rajpura Bridge	N-5	Punjab North	Wazirabad	Bridge	38.80	3	13.29	IV	25/09/2018		87.287	0.000	Es		146,238	Evaluation	
P-NSN-1581	Wah Garden Bridge	N-5	Punjab North	Rawalpindi	Bridge	97.00	6	15.50	IV	07/07/2018		87.050	0.000	Ep		2,423,310	Evaluation	
P-NSN-1293+800 (TEAM-02)	Saima Nullah Plaf	N-5	Punjab North	Wazirabad	Bridge	69.40	6	15.50	IV	17/07/2018		86.008	0.000	Ep	Es	2,805,004	Evaluation	
P-NSN-1323 (TEAM-02)	Khayali Fly Over Gujranwala	N-5	Punjab North	Wazirabad	Bridge	629.00	11	10.60	IV	05/10/2018		85.690	0.000	Ep		2,645,065	Evaluation	
PNSN-1362 (TEAM-02)	Gujrat	N-5	Punjab North	Wazirabad	Bridge	48.00	3	9.80	IV	13/08/2018		83.578	0.000	Es		924,338	Evaluation	
P-NSS-1606+950 (TEAM-03)	CNG Station Bridge	N-5	Punjab North	Rawalpindi	Bridge	20.30	4	10.88	IV	31/05/2018		83.232	0.000	Ep		350,624	Evaluation	
PNSN-1464+100 (TEAM-03)	PNSN-1464+100 MISSA KASSOWAL	N-5	Punjab North	Wazirabad	Bridge	226.37	8	8.20	III	07/07/2018		67.492	0.000	Es		3,944,606	Evaluation	
P-NS-1581 (TEAM-01)	Wah Garden Bridge	N-5	Punjab North	Rawalpindi	Bridge	98.00	12	15.60	III	04/05/2018		65.400	0.000			2,553,559	Evaluation	
P-NSS-1608+500 (TEAM-02)	Wah College of Account Bridge	N-5	Punjab North	Rawalpindi	Bridge	57.40	8	10.10	III	28/06/2018		64.441	0.000			693,264	Evaluation	
P-NSN-1310+500 (TEAM-02)	Unique Dhaba BBQ	N-5	Punjab North	Wazirabad	Bridge	59.00	15	14.25	III	29/09/2018		62.336	0.000			100,760	Evaluation	
P-NSN-1321 (TEAM-02)	Gujranwala	N-5	Punjab North	Wazirabad	Bridge	99.00	4	8.65	III	20/07/2018		61.846	0.000			2,084,532	Evaluation	
P-NSN-1592+200 (TEAM-01)	Punjab Floor Mill Bridge	N-5	Punjab North	Rawalpindi	Bridge	379.95	10	19.41	II	29/06/2018		47.471	0.000	Ep		5,729,960	Evaluation	
P-NS-1630+700 (TEAM-03)	Sawan Jor Bridge	N-5	Punjab North	Rawalpindi	Bridge	37.00	1	10.15	II	31/07/2018		44.474	0.000			518,020	Evaluation	
P-NSS-1351	Oila Kalan	N-5	Punjab North	Wazirabad	Bridge	14.00	3	12.80	II	15/08/2018		44.325	0.000			21,652	Evaluation	

Ver. 1.0.0.6

- Draft Annual Maintenance Plan (AMP) has been prepared on the basis of priority list by having inspection of 36 bridges & 5 culverts in the Model Area

Bridge Management Unit, NHA Islamabad

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2. CURRENT ACTIVITIES & ACHIEVEMENTS

TRAININGS

- **Inventory Survey (Feb 2018):**
BMU along with JICA Experts conducted 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 (April 2018):**
BMU along with JICA Experts conducted for training for trainees and officers of all Maintenance Units from Punjab (North) and Punjab (South) at NHA- HQ, HRTC and on Site.
- **Structural Mechanics (Sep 2018):**
JICA Experts conducted Structural Mechanics training for BMU and Trainees.
- **BIDB and BMS Software Operation (Aug 2018):**
JICA Expert Team for BMU.
- **BMS Software Prioritization (Nov 2018):**
JICA Expert Team for BMU.
- **System Administration (Nov 2018):**
JICA Expert Team for IT Engineer (BMU)

Bridge Management Unit, NHA Islamabad

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3. SHORT TERM, MEDIUM TERM & LONG TERM PLANS

ASSUMPTIONS

Based on current performance of TE's during conducting Inventory survey of 608 structures, inspection of 36 bridges with 5 culverts and accordingly data entry for both inventory and inspection in the BIDB Software, timelines for each activity were assumed as;

TASKS	CAPACITY/TEAM
• Inventory Survey:	5 bridges or 10 culverts/day
• Inspection:	3 spans of a bridge or 3 culverts/day
• Data entry (Invt):	On site-one day/week
• Data entry (Insp):	On site-one day/week + Time reserved at the end of inspection
• Trainee Engineers:	12 Nos. (4 Teams)
• Outsourcing:	Timely procurement of consultants
• Others:	Readily available transportation facilities for TE's

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Bridge Management Unit, NHA Islamabad

3. SHORT TERM, MEDIUM TERM & LONG TERM PLANS

ESTIMATED WORKING DAYS REQUIRED/TEAM

Regional Office	Inventory Survey Days			Inspection Days		
	Bridge	Culvert	Total	Bridge	Culvert	Total
Punjab North	67	50	117	825	9	834
Muzaffarabad	20	24	43	45	23	68
Punjab South	89	214	303	474	82	556
Sindh North (Sukkur)	34	154	188	134	27	161
Sindh South (Karachi)	61	100	161	338	40	378
Kyber Pakhtunkhwa	104	157	261	418	96	514
Northern Areas	30	87	117	93	17	110
Gilgit - Baltistan	21	112	133	48	9	57
Balochistan North (Quetta)	155	245	400	927	174	1101
Balochistan South (Khuzdar)	90	99	189	306	99	405
Balochistan West (Makran)	103	167	270	478	127	605
Motorways (Kalar Kahar)	107	94	201	366	22	388

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Bridge Management Unit, NHA Islamabad

3. SHORT TERM, MEDIUM TERM & LONG TERM PLANS

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 [Lahore MU only]	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
TOTAL		1,615	6,724

Bridge Management Unit, NHA Islamabad

3. SHORT TERM, MEDIUM TERM & LONG TERM PLANS

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 of 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							■

Bridge Management Unit, NHA Islamabad

3. SHORT TERM, MEDIUM TERM & LONG TERM PLANS

MEDIUM TERM PLAN

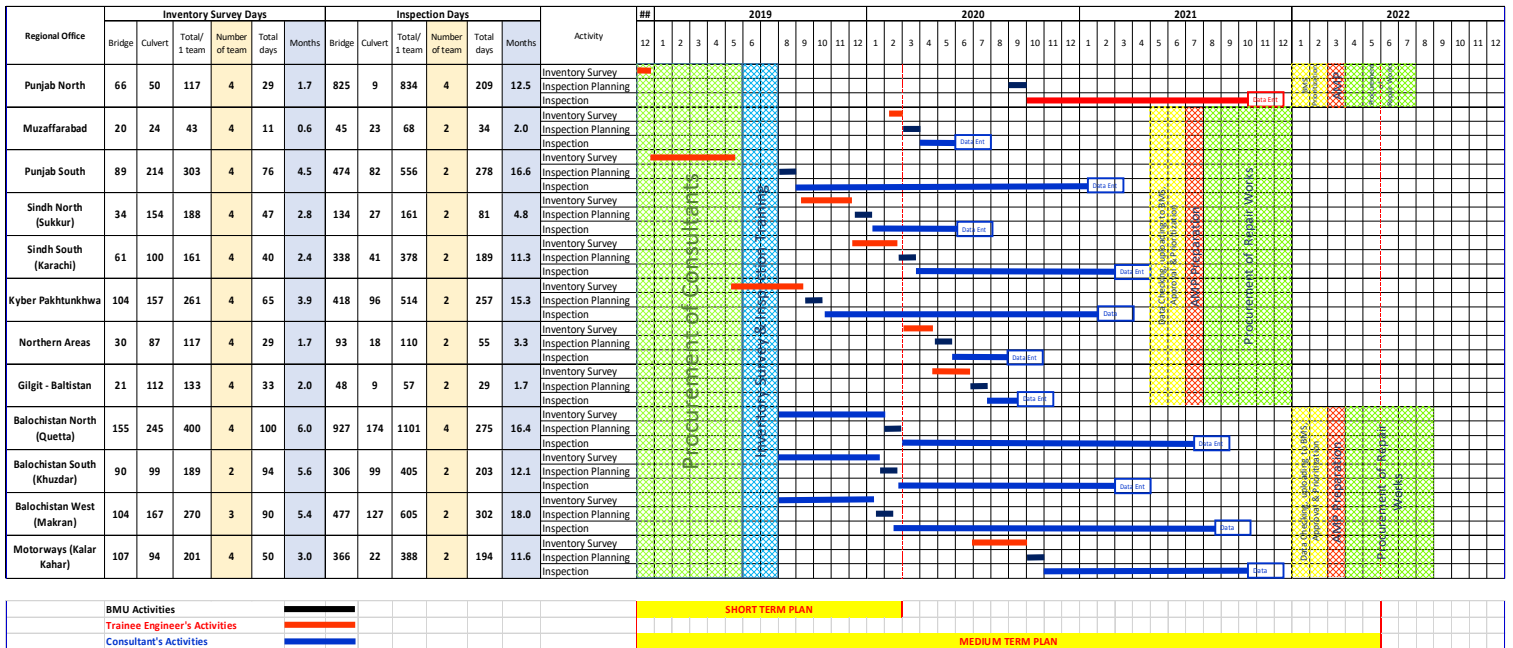
- Resources: **12X Trainee Engineers + Consultants**
- Time Period: **TE's [Mar-2020 to Dec-2021], Conslt [Aug-2019 to Dec 2021]**

Sr. No	Regional Office	Inventory Survey		Inspection	
		Bridges	Culverts	Bridges	Culverts
1	Punjab North	Conducted already by TE's in Short-Term Plan		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
Trainee Engineers		792	2928	332	27
Consultants		1,743	5,104	4,073	2,153
Grand Total		2,535	8,032	4,405	2180

Bridge Management Unit, NHA Islamabad

3. SHORT TERM, MEDIUM TERM & LONG TERM PLANS

SHORT & MEDIUM TERM PLAN IMPLEMENTATION SCHEDULE



3. SHORT TERM, MEDIUM TERM & LONG TERM PLANS

LONG TERM PLAN

- ❖ Annual Inspection of 20% bridges and culverts in all regional offices
 - ❑ Procurement for outsourcing Inspections
 - 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
- ❖ Re-Inspection after execution of repair works

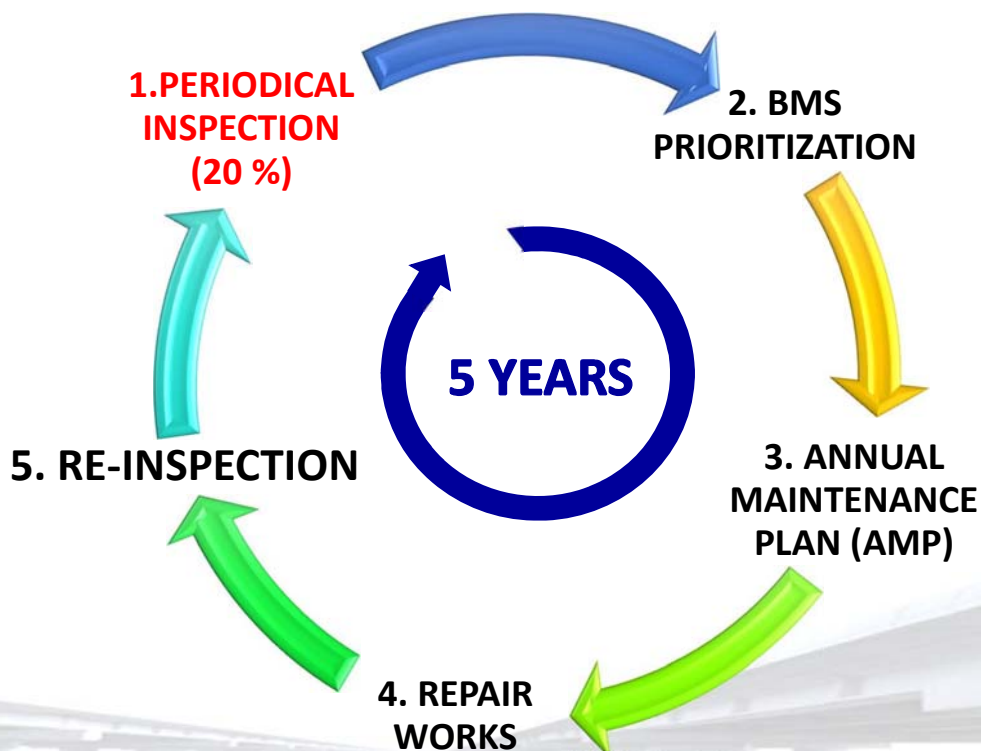
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Bridge Management Unit, NHA Islamabad

3. SHORT TERM, MEDIUM TERM & LONG TERM PLANS

LONG TERM PLAN

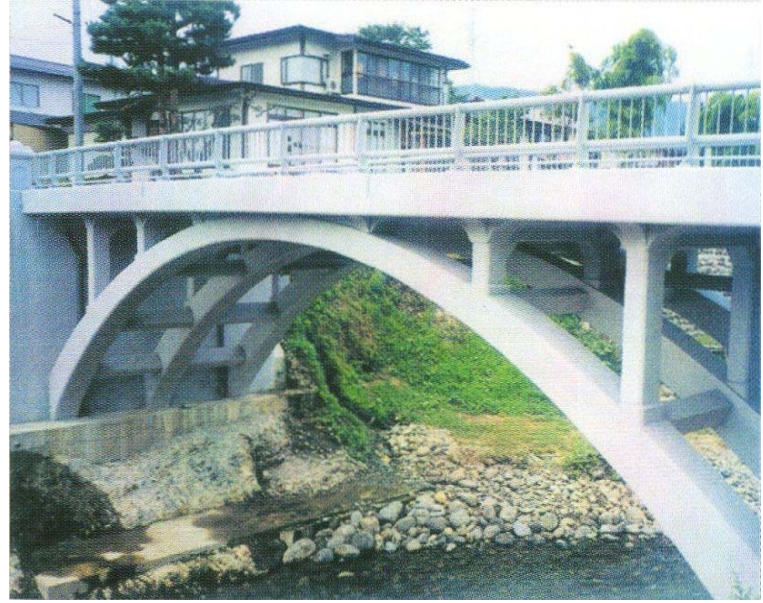
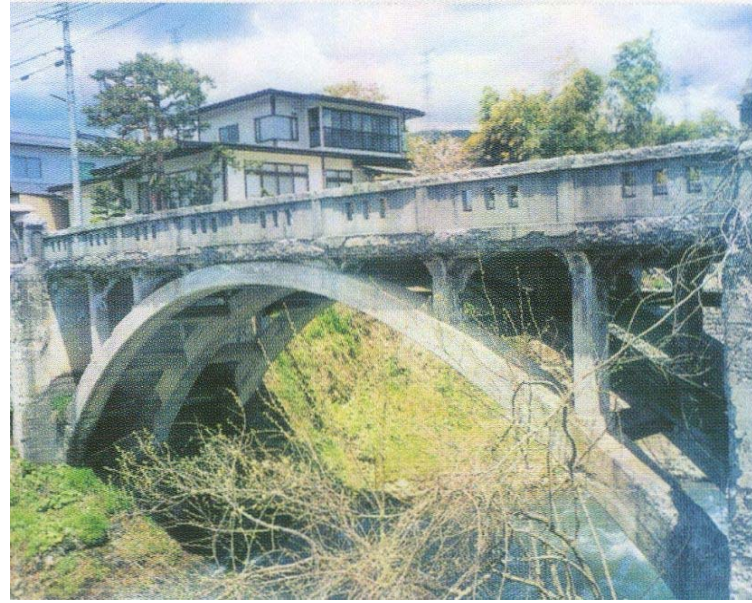
BRIDGE MANAGEMENT CYCLE



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Bridge Management Unit, NHA Islamabad

THAT'S WHAT WE EXPECT



THANKS FOR LISTENING



Presentation
on

PRIORITIZATION , BUDGET ALLOCATION

by

Bridge Management Unit (BMU)
RAMD, NHA Islamabad

BRIDGE MANAGEMENT SYSTEM (BMS)

December 10, 2018

Contents

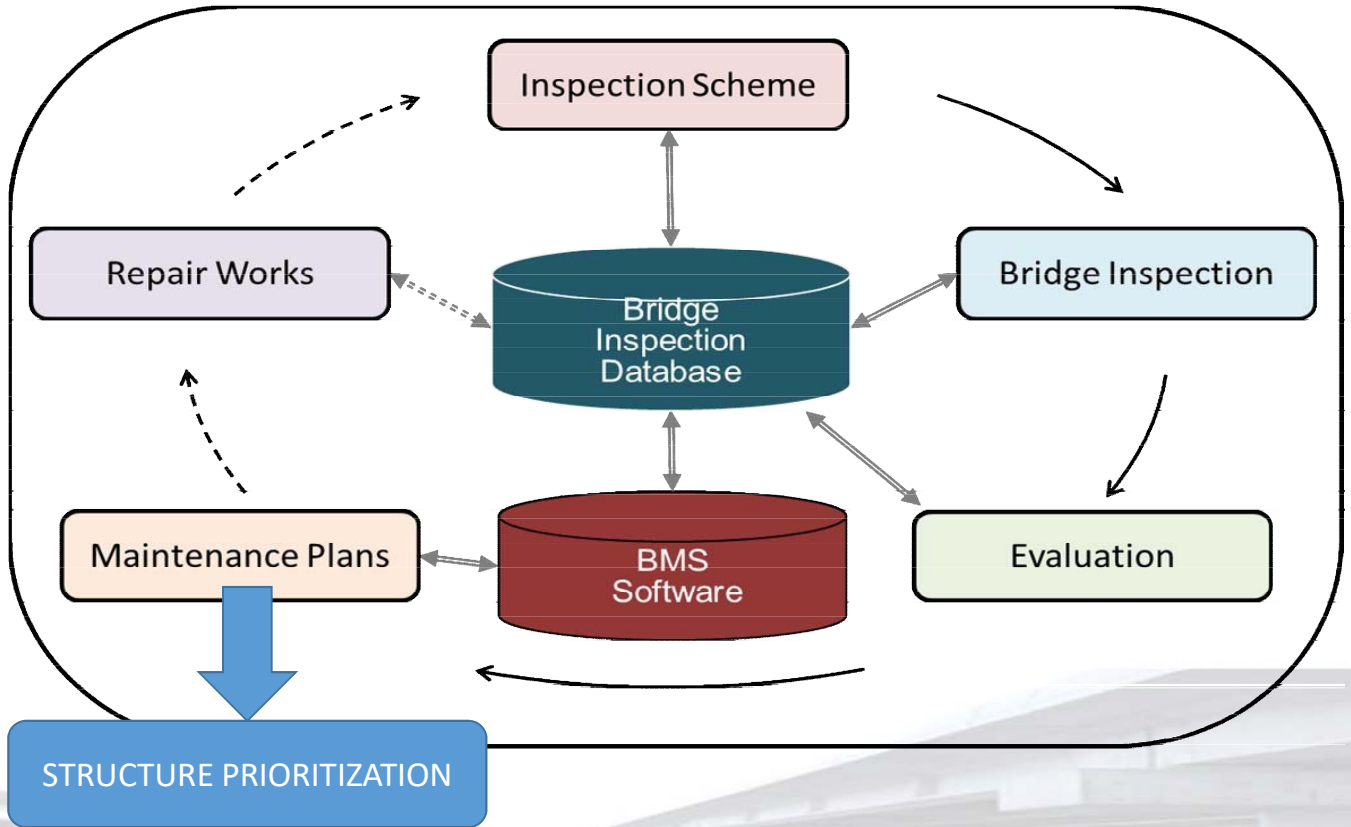
1. BMS CYCLE

2. CONCEPT OF STRUCTURE PRIORITIZATION

3. BUDGET REQUIREMENTS FOR MODEL AREA

1. BMS CYCLE

The Concept



Bridge Management Unit, NHA Islamabad

3

2. CONCEPT OF STRUCTURE PRIORITIZATION

PRIORITIZATION BASIS AND RELATED WEIGHTS AND SCORES

Priority Parameters:

The priority of bridge repairs are calculated on the basis of the certain parameters and they will be discussed here individually, collectively they make up the priority score. They are shown below along with their individual scores. It is also pertinent to mention here that all such scores can be modified and are based on experience.

Priority Indexes		
Model Area Calculations	Load	Add New Sett
Loaded Setting: Model Area Calculations		Edit
Weight total is 100		
Index	Weight	Detail Settings
1 Soundness of Bridge	80	settings
2 Evaluation of Members	10	settings
3 Passage Type	2	settings
4 Maximum Span Length	1	settings
5 Years of Construction	1	settings
6 Cause of Damage	2	settings
7 Structure Type	2	settings
8 Road Type	2	settings

Bridge Management Unit, NHA Islamabad

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2. CONCEPT OF STRUCTURE PRIORITIZATION

PRIORITIZATION BASIS AND RELATED WEIGHTS AND SCORES

1. Soundness of a Bridge:

The soundness of the bridge is actionable assessment of its over all condition based on evaluation of all its damages after its complete inspection. After assessing all its damages the soundness diagnosis is done based on the highest damage degree. It accounts for 80% of all the score

CLASS		REPAIR METHOD
I	Good	No damages and no functional problems 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 remedial measure should be implemented in an 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.

Score Settings are 0 to 100

Soundness of Bridge	Score
1 I	25
2 II	50
3 III	75
4 IV	100

2. CONCEPT OF STRUCTURE PRIORITIZATION

PRIORITIZATION BASIS AND RELATED WEIGHTS AND SCORES

2. Evaluation of Members:

The evaluation of members is done after assessing all the damages and based on such evaluation score is calculated. The concept is to give higher weightage to damages of main elements in comparison to secondary elements and tertiary elements. It carries 10 % score.

Evaluation of Members	Score	Member Group	Weight	Selected Members	Detail Settings
1 A	0				
2 B	30				
3 Cd	60				
4 Cs	80				
5 Ep	100				
6 Ee	100				
		1 Main element	30	superstructure-main girder-main girder superstructure-truss-chord superstructure-truss-bracing-vertical member superstructure-truss-portal bracing	settings
		2 Secondary element	10	superstructure-gerber girder-gerber girder superstructure-crossbeam-crossbeam superstructure-stringer-stringer superstructure-sway bracing-sway bracing	settings
		3 Deck slab	20	superstructure-deck slab-deck slab	settings
		4 Abutment	5	abutment-abutment-approach beam abutment-abutment-wall abutment-abutment-wing wall abutment-abutment-abutment foundation	settings
		5 Pier	10	substructure-pier-column substructure-pier-transom substructure-pier-rigid zone substructure-pier-pier foundation	settings
		6 Bearing	5	bearing-bearing-bearing bearing-anchor bolt-anchor bolt bearing-seismic device-seismic device bearing-base mortar-base mortar	settings
		7 Expansion joint	5	surface-expansion joint-expansion joint	settings
		8 Guard fence	3	surface-railling-railling surface-parapet-parapet surface-curb-curb surface-median-median	settings
		9 Pavement	3	surface-curb stone-curb stone surface-pavement-pavement	settings
		10 Drainage	3	drainage-drain basin-drain basin drainage-drain pipe-drain pipe drainage-others-others	settings
		11 River training	3	related structure-river training-guide banks related structure-river training-gabion spurs related structure-river training-cumetes related structure-river training-erosion protection slab	settings
				surface-lighting device-lighting device surface-sinn facility-sinn facility	

2. CONCEPT OF STRUCTURE PRIORITIZATION

PRIORITIZATION BASIS AND RELATED WEIGHTS AND SCORES

3. Passage Type Importance:

This parameter takes into account the importance of passage type, i.e: whether it carries traffic over a river, nullah, waterway, railway, or pedestrian way. Different situations carry different scores, which are shown below, the over all weightage is 2 % of over all priority calculation score.

Score Settings are 0 to 100

Passage Type	Score
1 Not Defined	0
2 A / River	100
3 B / Nullah	0
4 C / Flood Relief Channel	0
5 D / Irrigation Channel	0
6 E / Railway	0
7 F / Roadway	50
8 G / Pedestrian Way	50
9 X / None	0
10 Y / Other	0
11 V / Several	0

2. CONCEPT OF STRUCTURE PRIORITIZATION

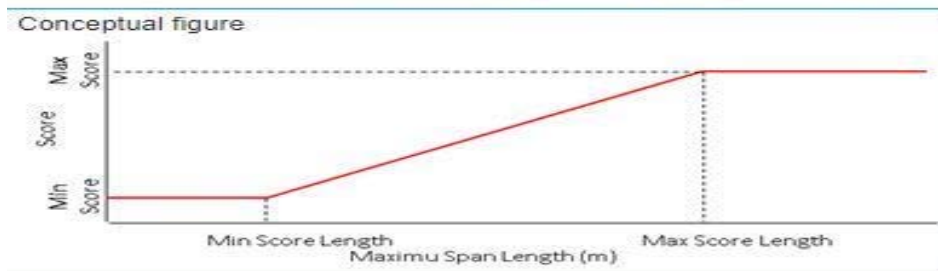
PRIORITIZATION BASIS AND RELATED WEIGHTS AND SCORES

4. Maximum Span Length:

This parameter takes into account the length of spans. It is based on the concept that large span bridges should have higher priority in comparison to small span bridges. The over all weightage is 1 % of over all priority calculation score.

Score Settings are 0 to 100

Maximum Span Length	Length(m)	Score
1 Minimum Score Length	0	0
2 Maximum Score Length	100	100



2. CONCEPT OF STRUCTURE PRIORITIZATION

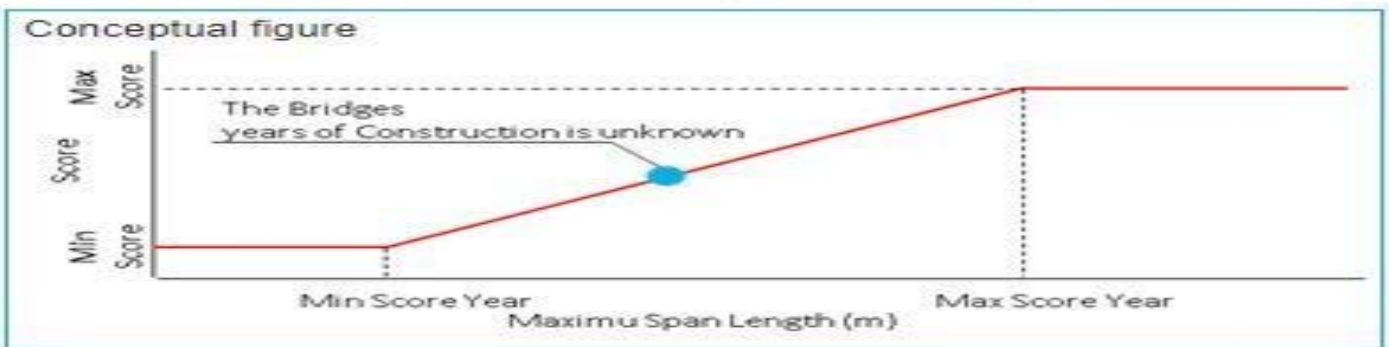
PRIORITIZATION BASIS AND RELATED WEIGHTS AND SCORES

5. Year of Construction:

This parameter takes into account the age of the bridge. If the damages occur in newly constructed bridges it represents a problem and such situation has higher priority over for older bridges. The over all score of this parameter is 1 % in over all priority calculation.

Score Settings are 0 to 100

Years of Construction	Year	Score
1 Minimum Score Year	1950	0
2 Maximum Score Year	2000	100
3 Years of Construction is unknown		0



2. CONCEPT OF STRUCTURE PRIORITIZATION

PRIORITIZATION BASIS AND RELATED WEIGHTS AND SCORES

6. Cause of Damage:

This parameter takes into account the cause of the damage. Certain damages are more serious than other damages and the details are shown below. The over all score of this parameter is 2 % in over all priority calculation.

Score Settings are 0 to 100

Cause of Damage	Score
1 a) Fatigue	100
2 b) Chloride damage	100
3 c) Freeze and thaw	0
4 d) Alkaline-silica reaction	100
5 e) Carbonation	0
6 f) Deterioration of material	0
7 g) Other	0

2. CONCEPT OF STRUCTURE PRIORITIZATION

PRIORITIZATION BASIS AND RELATED WEIGHTS AND SCORES

7. Structure Type:

This parameter takes into account the type of structure. The concept is that bigger structure should have higher priority over smaller structures and culverts. The over all score of this parameter is 2 % in over all priority calculation.

Score Settings are 0 to 100

Structure Type	Score
1 Not Defined	0
2 Bridge	0
3 Big/Special Bridge	100
4 Culvert	0
5 Small Culvert	0

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Bridge Management Unit, NHA Islamabad

2. CONCEPT OF STRUCTURE PRIORITIZATION

PRIORITIZATION BASIS AND RELATED WEIGHTS AND SCORES

8. Road Type:

This parameter takes into account the type of the road where a particular structure is located. The concept is that structures located on roads carrying more traffic should have a higher priority than structures located on less trafficked roads. The over all score of this parameter is 2% of all calculations.

Score Settings are 0 to 100

Road Type Group	Score	Selected Road	Detail Settings
1 CPEC	100		settings
2 MOTERWAYS	80		settings
3 EXPRESSWAYS	60		settings
4 STARTEGIC ROUTE	40		settings
5 NATIONAL HIGHWA	40		settings
6 NATIONAL HIGHWA	10		settings
7 Not Defined1	0		settings
8 Not Defined2	0		settings

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Bridge Management Unit, NHA Islamabad

2. CURRENT ACTIVITIES & ACHIEVEMENTS

PRIORITY LIST OF PILOT PROJECT AFTER FINAL INSPECTIONS

Bridge Management System User: System Admin [System Admin]

Data Maintenance < back

Inventory Data

Priority Calculation

Re-calculate Priority Export Excel list

19,838 Structures (1 to 100)

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	E-p Rank	E-s Rank	Cost (PKR)	Evaluation	Map
PN5N-1368+300 (TEAM-03)	Chenab River Bridge	N-5	Punjab North	Wazirabad	Bridge	718.00	16	10.30	IV	18/07/2018		89.860	0.000	Ep		760,901	Evaluation	
PN5S-1368+300 (TEAM-03)	Chenab River Bridge	N-5	Punjab North	Wazirabad	Bridge	718.00	16	10.30	IV	19/07/2018		89.530	0.000	Ep		6,979,783	Evaluation	
P-NS-1573+500 (TEAM-01)	Pedestrian Bridge	N-5	Punjab North	Rawalpindi	Big/Special Bridge	25.00	2	2.00	IV	28/07/2018		88.025	0.000	Ep		1,676,556	Evaluation	
P-NSS-1296 (TEAM-02)	Rajpura Bridge	N-5	Punjab North	Wazirabad	Bridge	38.80	3	13.29	IV	25/09/2018		87.287	0.000		Es	146,238	Evaluation	
P-NSN-1581	Wah Garden Bridge	N-5	Punjab North	Rawalpindi	Bridge	97.00	6	15.50	IV	07/07/2018		87.050	0.000	Ep		2,423,310	Evaluation	
P-NSN-1293+800 (TEAM-02)	Saima Nullah Plaf	N-5	Punjab North	Wazirabad	Bridge	69.40	6	15.50	IV	17/07/2018		86.008	0.000	Ep	Es	2,805,004	Evaluation	
P-NSN-1323 (TEAM-02)	Khayali Fly Over Gujranwala	N-5	Punjab North	Wazirabad	Bridge	629.00	11	10.60	IV	05/10/2018		85.690	0.000	Ep		2,645,065	Evaluation	
PN5N-1362 (TEAM-02)	Gujrat	N-5	Punjab North	Wazirabad	Bridge	48.00	3	9.80	IV	13/08/2018		83.578	0.000		Es	924,339	Evaluation	
P-NSS-1606+950 (TEAM-03)	CNG Station Bridge	N-5	Punjab North	Rawalpindi	Bridge	20.30	4	10.88	IV	31/05/2018		83.232	0.000	Ep		356,624	Evaluation	
PN5N-1464+100 (TEAM-03)	PN5N-1464+100 MISSA KASSOWAL	N-5	Punjab North	Wazirabad	Bridge	226.37	8	8.20	III	07/07/2018		67.492	0.000		Es	3,944,606	Evaluation	
P-NS-1581 (TEAM-01)	Wah Garden Bridge	N-5	Punjab North	Rawalpindi	Bridge	98.00	12	15.60	III	04/05/2018		65.400	0.000			2,553,559	Evaluation	
P-NSS-1608+500 (TEAM-02)	Wah College of Account Bridge	N-5	Punjab North	Rawalpindi	Bridge	57.40	8	10.10	III	28/06/2018		64.441	0.000			693,264	Evaluation	
P-NSN-1310+500 (TEAM-02)	Unique Dhaba BBQ	N-5	Punjab North	Wazirabad	Bridge	59.00	15	14.25	III	29/09/2018		62.336	0.000			100,760	Evaluation	
P-NSN-1321 (TEAM-02)	Gujranwala	N-5	Punjab North	Wazirabad	Bridge	99.00	4	8.65	III	20/07/2018		61.846	0.000			2,084,532	Evaluation	
P-NSN-1592+200 (TEAM-01)	Punjab Floor Mill Bridge	N-5	Punjab North	Rawalpindi	Bridge	379.95	10	19.41	II	29/06/2018		47.471	0.000	Ep		15,729,960	Evaluation	
P-NSS-1630+700 (TEAM-03)	Sawan Jor Bridge	N-5	Punjab North	Rawalpindi	Bridge	37.00	1	10.15	II	31/07/2018		44.474	0.000			518,020	Evaluation	
P-NSS-1351	Oila Kalan	N-5	Punjab North	Wazirabad	Bridge	14.00	3	12.80	II	15/08/2018		44.325	0.000			21,659	Evaluation	

Ver. 1.0.0.6

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Bridge Management Unit, NHA Islamabad

3. BUDGET REQUIREMENTS MODEL AREA:

• Calculation 1:

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.

Annual Budgetary Requirements for the Model Area (9 year Phasing)

Case1:ALL Repair Priority	ID		1	2	3	4	5	6	7	8	9
	84.04PN5N-1368+300 (TEAM-03)	760,901									
	83.38PN5S-1368+300 (TEAM-03)	6,979,783									
	78.925P-NS-1573+500 (TEAM-01)	1,676,556									
	78.146P-NSS-1296 (TEAM-02)	146,238									
	77.951P-NSN-1581		2,423,310								
	74.75P-NSN-1323 (TEAM-02)		2,805,004								
	74.588P-NSN-1293+800 (TEAM-02)		2,645,065								
	70.04PN5N-1362 (TEAM-02)		924,339								
	68.841P-NSS-1606+950 (TEAM-03)		356,624								
	63.988PN5N-1464+100 (TEAM-03)			3,944,606							
	58.352P-NSS-1581 (TEAM-01)			2,553,559							
	57.315P-NSS-1608+500 (TEAM-02)			693,264							
	52.031P-NSN-1310+500 (TEAM-02)			100,760							
	51.68P-NSN-1321 (TEAM-02)			2,084,532							
	48.955P-NSN-1592+200 (TEAM-01)				15,729,960						
	43P-NS-1530+700 (TEAM-03)					518,020					
	42.775P-NSS-1587+600 (TEAM-01)					21,659					
	42.309PN5N-1467+900 (TEAM-01)					378,980					
	42.035P-NSS-1351 (TEAM-02)					358,202					
	41.85PN5N-1469+500 (TEAM-01)					228,325					
	41.465P-NSS-1611+020 (TEAM-03)					106,914					
	41.08P-NSN-1561(TEAM-03)						31,486,265				
	38.94P-NSS-1623+300 (TEAM-03)								569,896		
	38.45P-NSN-1552 (TEAM-03)								97,226		
	37.92P-NSN-1587+600 (TEAM-01)								620,854		
	37.775P-NSN-1401+700 (TEAM-01)								91,353		
	37.565P-NSS-1620+700 (TEAM-01)								334,193		
	34.738PN5N-1421+400 (TEAM-01)								23,450		
	34.508PN5N-1420+200 (TEAM-01)								32,818		
	33.741P-NSS-1552 (TEAM-02)								213,748		
	33.7P-NSN-1587+950C (TEAM-03)								5,930		
	32.8P-NSN-1587+850C (TEAM-03)								613,880		
	22.205P-NS-1287+500 (TEAM-03)									3,938,380	
	22.14P-NS-1569+100 (TEAM-03)									13,980	
	21.925PN80-66+300 (TEAM-01)									1,060,320	
	21.795P-N80-107+100 (TEAM-01)									126,660	
	21.18P-NSS-1576C (TEAM-03)									1,228,324	
	19.558PN5N-1419+600 (TEAM-01)									78,910	
	17.85PN5S-1469+500 (TEAM-01)									122,814	
	17.2P-NSN-1625+500 (TEAM-01)									132,425	
	16P-NSN-1623+800 (TEAM-01)									46,100	
	Annual Requirement	9,563,478	9,154,342	9,376,720	15,729,960	1,612,101	31,486,265	-	2,603,347	6,747,913	
	Balance Requirement	76,710,647.75	67,556,306	58,179,586	42,449,626	40,837,525	9,351,260	9,351,260	6,747,913	0	

Bridge Management Unit, NHA Islamabad

3. BUDGET REQUIREMENTS FOR MODEL AREA:

- Calculation 2:**

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.

Annual Budgetary Requirements for the Model Area (5 year Phasing)						
Case1:ALL Repair Priority	ID	1	2	3	4	5
	84.04 P-NSN-1368+300 (TEAM-03)	760,901				
	83.38 P-NSN-1368+300 (TEAM-03)	6,979,783				
	78.925 P-NS-1573+500 (TEAM-01)	1,676,556				
	78.146 P-NS-1296 (TEAM-02)	146,238				
	77.951 P-NSN-1581	2,423,310				
	74.75 P-NSN-1323 (TEAM-02)	2,805,004				
	74.588 P-NSN-1293+800 (TEAM-02)	2,645,065				
	70.04 P-NSN-1362 (TEAM-02)		924,339			
	68.841 P-NS-1606+950 (TEAM-03)		356,624			
	63.988 P-NSN-1464+100 (TEAM-03)		3,944,606			
	58.352 P-NS-1581 (TEAM-01)		2,553,559			
	57.315 P-NS-1608+500 (TEAM-02)		693,264			
	52.031 P-NSN-1310+500 (TEAM-02)		100,760			
	51.68 P-NSN-1321 (TEAM-02)		2,084,532			
	48.955 P-NSN-1592+200 (TEAM-01)		15,729,960			
	43 P-NS-1530+700 (TEAM-03)			518,020		
	42.775 P-NS-1587+600 (TEAM-01)			21,659		
	42.309 P-NS-1467+900 (TEAM-01)			378,980		
	42.035 P-NS-1351 (TEAM-02)			358,202		
	41.85 P-NSN-1469+500 (TEAM-01)			228,325		
	41.465 P-NS-1611+020 (TEAM-03)			106,914		
	41.08 P-NSN-1561 (TEAM-03)				31,486,265	
	38.94 P-NS-1623+300 (TEAM-03)					569,896
	38.45 P-NSN-1552 (TEAM-03)					97,226
	37.92 P-NSN-1587+600 (TEAM-01)					620,854
	37.775 P-NSN-1401+700 (TEAM-01)					91,353
	37.565 P-NS-1620+700 (TEAM-01)					334,193
	34.738 P-NSN-1421+400 (TEAM-01)					23,450
	34.508 P-NSN-1420+200 (TEAM-01)					32,818
	33.741 P-NS-1552 (TEAM-02)					213,748
	33.7 P-NSN-1587+950C (TEAM-03)					5,930
	32.8 P-NSN-1587+850C (TEAM-03)					613,880
	22.205 P-NS-1287+500 (TEAM-03)					3,938,380
	22.14 P-NS-1569+100 (TEAM-03)					13,980
	21.925 P-NS-66+300 (TEAM-01)					1,060,320
	21.795 P-NS-107+100 (TEAM-01)					126,660
	21.18 P-NS-1576C (TEAM-03)					1,228,324
	19.558 P-NSN-1419+600 (TEAM-01)					78,910
	17.85 P-NS-1469+500 (TEAM-01)					122,814
	17.2 P-NSN-1625+500 (TEAM-01)					132,425
	16 P-NSN-1623+800 (TEAM-01)					46,100
	Annual Requirement	17,436,858	26,387,642	1,612,101	31,486,265	9,351,260
	Balance Requirement	68,837,268.37	42,449,626	40,837,525	9,351,260	-

Bridge Management Unit, NHA Islamabad

3. BUDGET REQUIREMENTS FOR MODEL AREA:

- Calculation 3:**

Sample three has been prepared for calculation of budget requirement for repair of most critical elements.

Case2:Only MAIN ELEMENT										
Repair Priority	ID	1	2	3	4	5	6	7	8	9
	84.04 P-NSN-1368+300 (TEAM-03)	193,903								
	83.38 P-NSN-1368+300 (TEAM-03)	5,520,094								
	78.925 P-NS-1573+500 (TEAM-01)	1,065,036								
	78.146 P-NS-1296 (TEAM-02)	80,769								
	77.951 P-NSN-1581		882695							
	74.75 P-NSN-1323 (TEAM-02)		2,439,855							
	74.588 P-NSN-1293+800 (TEAM-02)		2,640,274							
	70.04 P-NSN-1362 (TEAM-02)		918,573							
	68.841 P-NS-1606+950 (TEAM-03)		239,067							
	63.988 P-NSN-1464+100 (TEAM-03)			3,778,275						
	58.352 P-NS-1581 (TEAM-01)			189,345						
	57.315 P-NS-1608+500 (TEAM-02)			331,841						
	52.031 P-NSN-1310+500 (TEAM-02)			98,481						
	51.68 P-NSN-1321 (TEAM-02)			2,003,948						
	48.955 P-NSN-1592+200 (TEAM-01)									
	43 P-NS-1530+700 (TEAM-03)									
	42.775 P-NS-1587+600 (TEAM-01)									
	42.309 P-NS-1467+900 (TEAM-01)									
	42.035 P-NS-1351 (TEAM-02)									
	41.85 P-NSN-1469+500 (TEAM-01)									
	41.465 P-NS-1611+020 (TEAM-03)									
	41.08 P-NSN-1561 (TEAM-03)									
	38.94 P-NS-1623+300 (TEAM-03)									
	38.45 P-NSN-1552 (TEAM-03)									
	37.92 P-NSN-1587+600 (TEAM-01)									
	37.775 P-NSN-1401+700 (TEAM-01)									
	37.565 P-NS-1620+700 (TEAM-01)									
	34.738 P-NSN-1421+400 (TEAM-01)									
	34.508 P-NSN-1420+200 (TEAM-01)									
	33.741 P-NS-1552 (TEAM-02)									
	33.7 P-NSN-1587+950C (TEAM-03)									
	32.8 P-NSN-1587+850C (TEAM-03)									
	22.205 P-NS-1287+500 (TEAM-03)									
	22.14 P-NS-1569+100 (TEAM-03)									
	21.925 P-NS-66+300 (TEAM-01)									
	21.795 P-NS-107+100 (TEAM-01)									
	21.18 P-NS-1576C (TEAM-03)									
	19.558 P-NSN-1419+600 (TEAM-01)									
	17.85 P-NS-1469+500 (TEAM-01)									
	17.2 P-NSN-1625+500 (TEAM-01)									
	16 P-NSN-1623+800 (TEAM-01)									
	Annual Cost	7,742,497	6,237,770	6,401,890						
	Accumulation Cost	7,742,497	13,980,266	20,382,156	20,382,156	20,382,156	20,382,156	20,382,156	20,382,156	20,382,156

3. BUDGET REQUIREMENTS FOR MODEL AREA:

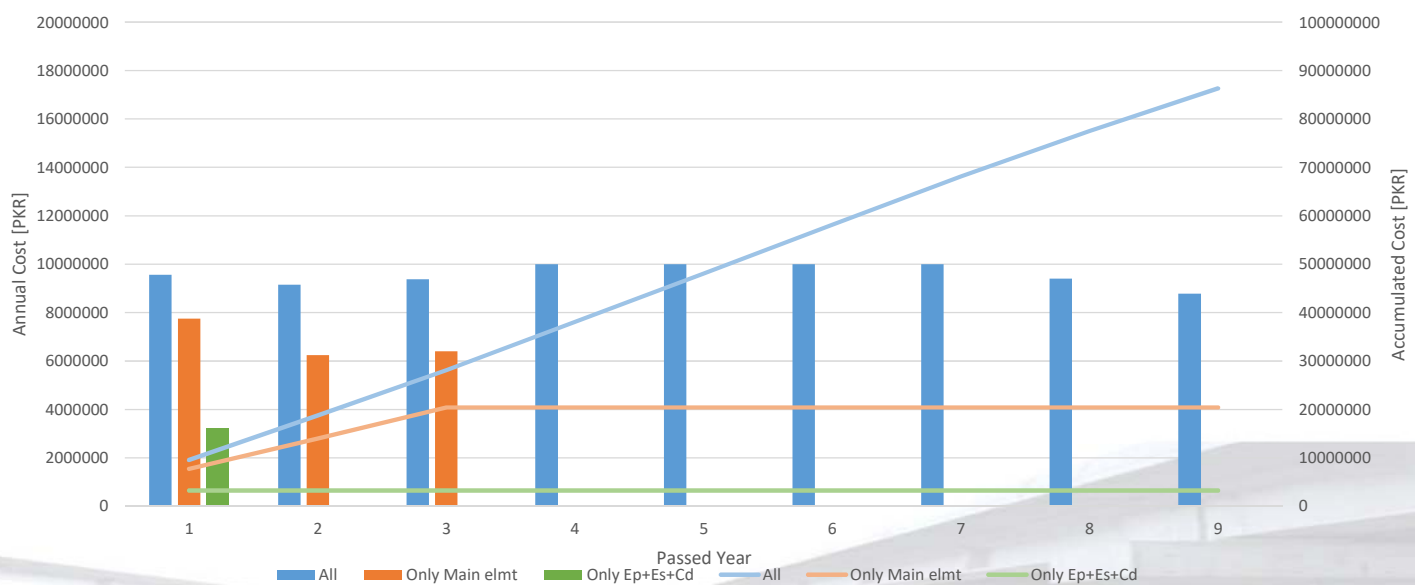
• **Calculation 4:**

Calculation 4 has been prepared for calculation of budget requirement for repair of Ep, Es, & Cs classified evaluations respectively.

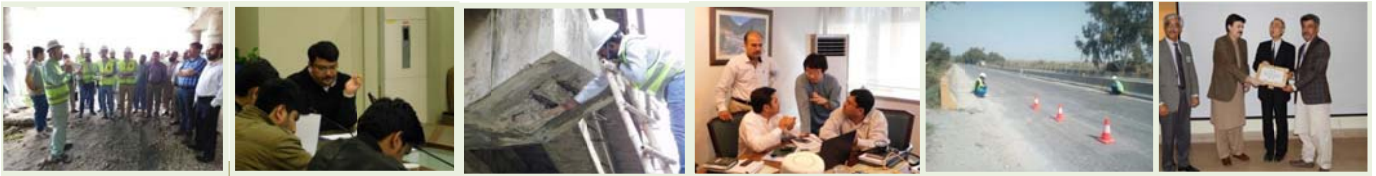
Repair Priority	ID		1	2	3	4	5	6	7	8	9
	84.04 P-N5N-1368+300 (TEAM-03)	52,950									
	83.38 P-N5S-1368+300 (TEAM-03)	167,705									
	78.925 P-N5-1573+500 (TEAM-01)	1,391,040									
	78.146 P-N5S-1296 (TEAM-02)	1,380									
	77.951 P-N5N-1581	156456									
	74.75 P-N5N-1323 (TEAM-02)	2095.92									
	74.588 P-N5N-1293+800 (TEAM-02)	304673.42									
	70.04 P-N5N-1362 (TEAM-02)	447580									
	68.841 P-N5S-1606+950 (TEAM-03)	145133.75									
	63.988 P-N5N-1464+100 (TEAM-03)	67154.6									
	58.352 P-N5S-1581 (TEAM-01)	144231									
	57.315 P-N5S-1608+500 (TEAM-02)	66995.6									
	52.031 P-N5N-1310+500 (TEAM-02)	24390									
	51.68 P-N5N-1321 (TEAM-02)	255760									
	48.955 P-N5N-1592+200 (TEAM-01)										
	43 P-N5S-1530+700 (TEAM-03)										
	42.775 P-N5S-1587+600 (TEAM-01)										
	42.309 P-N5S-1467+900 (TEAM-01)										
	42.035 P-N5S-1351 (TEAM-02)										
	41.85 P-N5N-1469+500 (TEAM-01)										
	41.465 P-N5S-1611+020 (TEAM-03)										
	41.08 P-N5N-1561 (TEAM-03)										
	38.94 P-N5S-1623+300 (TEAM-03)										
	38.45 P-N5N-1552 (TEAM-03)										
	37.92 P-N5N-1587+600 (TEAM-01)										
	37.775 P-N5N-1401+700 (TEAM-01)										
	37.565 P-N5S-1620+700 (TEAM-01)										
	34.738 P-N5N-1421+400 (TEAM-01)										
	34.508 P-N5N-1420+200 (TEAM-01)										
	33.741 P-N5S-1552 (TEAM-02)										
	33.7 P-N5N-1587+950C (TEAM-03)										
	32.8 P-N5N-1587+850C (TEAM-03)										
	22.205 P-N5-1287+500 (TEAM-03)										
	22.14 P-N5-1569+100 (TEAM-03)										
	21.925 P-N80-66+300 (TEAM-01)										
	21.795 P-N80-107+100 (TEAM-01)										
	21.18 P-N5S-1576C (TEAM-03)										
	19.558 P-N5N-1419+600 (TEAM-01)										
	17.85 P-N5S-1469+500 (TEAM-01)										
	17.2 P-N5N-1625+500 (TEAM-01)										
	16 P-N5N-1623+800 (TEAM-01)										
	Annual Cost	3,227,545	-	-	-	-	-	-	-	-	-
	Accumulation Cost	3,227,545	-	-	-	-	-	-	-	-	-

3. BUDGET REQUIREMENTS FOR MODEL AREA:

- 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.



4.4 Presentation on Terminal Evaluation_2019/01/28

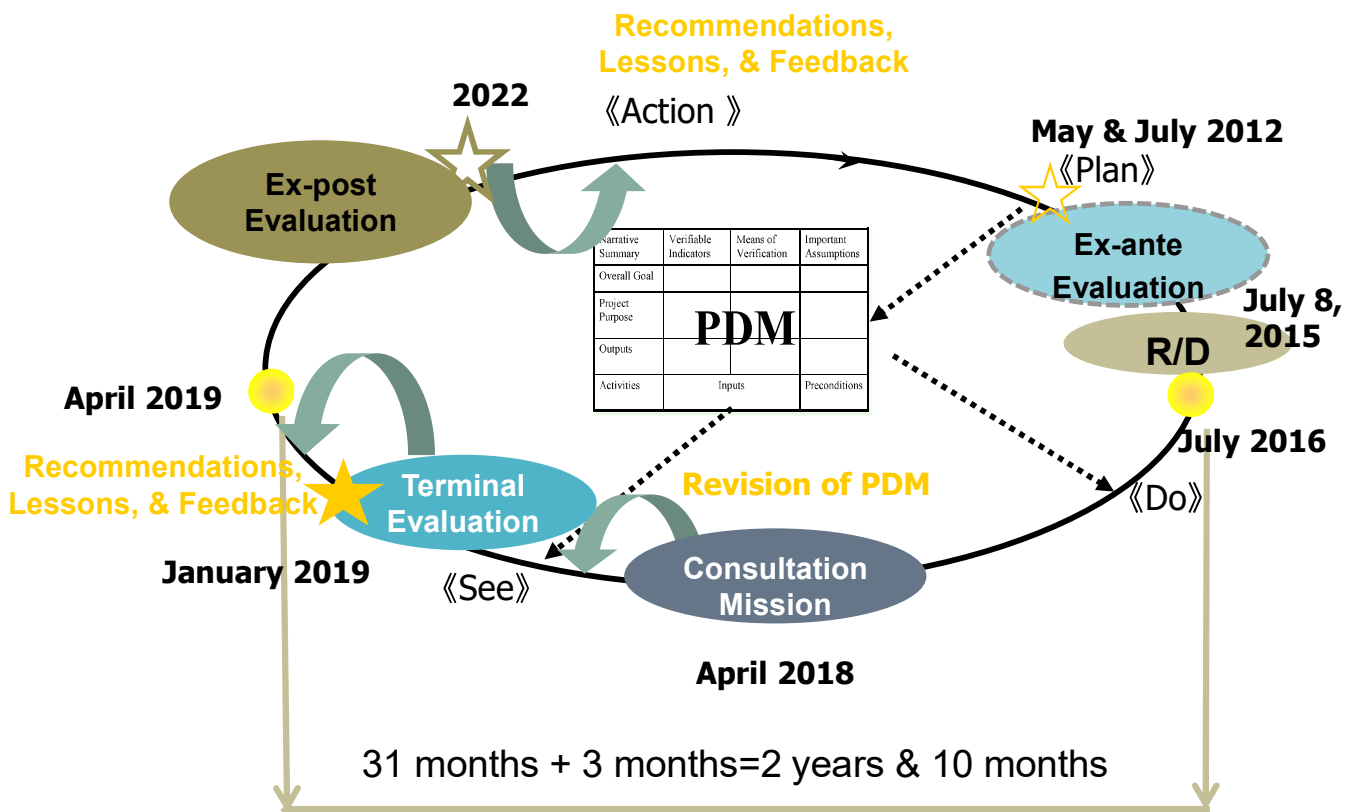


Results of Joint Terminal Evaluation on the Project for Technical Assistance on Implementation of Bridge Management System in NHA

Presented by Task Team
(Toshiko Shimada & Ijaz Ahmed)

Jan 28, 2019₁

Project Cycle and Terminal Evaluation



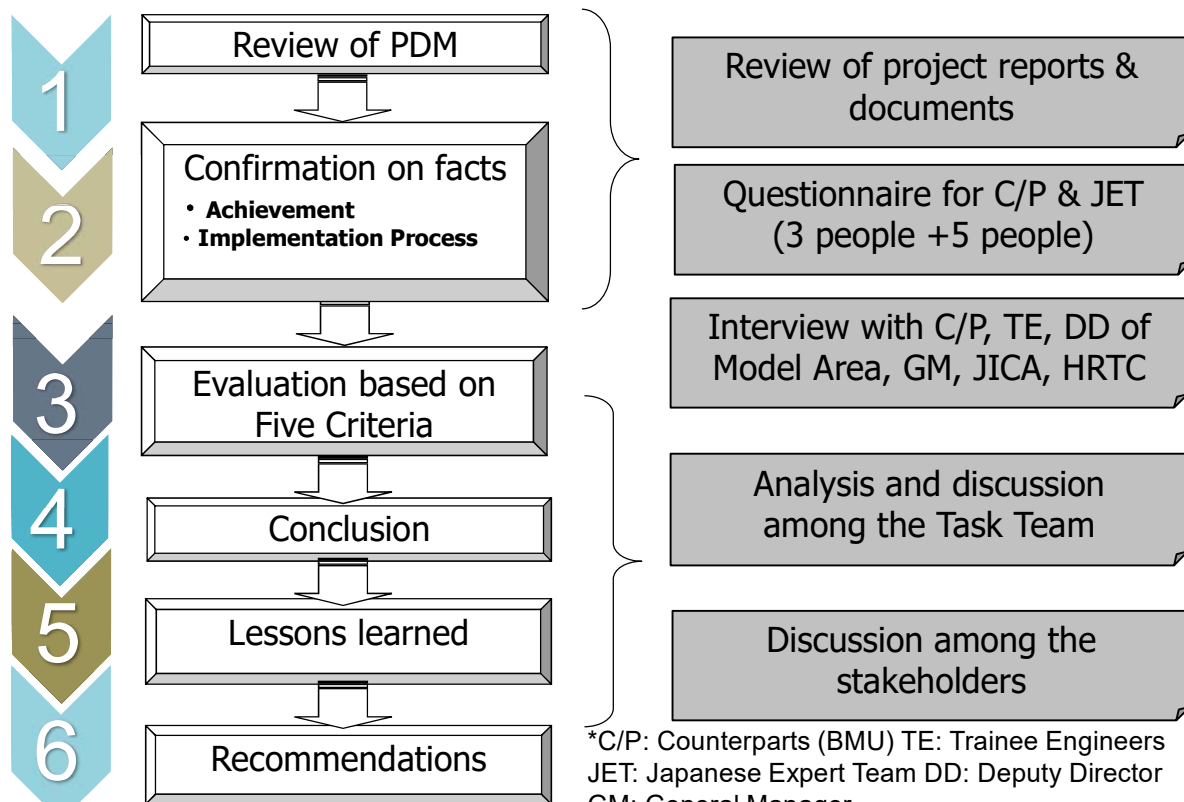
Objectives of Terminal Evaluation

Evaluation is a learning process for all project stakeholders.

1. To assess the extent of achievement of the Project as per the Project Design Matrix (PDM), and the implementation process
2. To assess the Project based on the five criteria such as relevance, effectiveness, efficiency, impact, and sustainability
3. To make recommendations to be implemented by the end of the Project and after the termination of the Project
4. To obtain lessons learned from the Project for better implementation of other projects

3

Procedures & Methods of Terminal Evaluation



*C/P: Counterparts (BMU) TE: Trainee Engineers
 JET: Japanese Expert Team DD: Deputy Director
 GM: General Manager
 HRTC: Highway Research & Training Center

4

1

Assessment of achievement

- To what extent Inputs, Outputs, Project Purpose have been achieved?
- To what extent Overall Goal is likely to be achieved?

Narrative Summary	Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal			
Project Purpose	PDM		
Outputs			
Activities	Inputs		Preconditions

PDM (Project Design Matrix)

Achievement – Input

Pakistani side

	Plan (R/D)	Achievement
Counterparts (C/Ps) deployed:	4 people <ul style="list-style-type: none"> • Member (Planning) • GM (RAMS) • DD (BMS) } 2 people • AD (BMS) } 	6 people at present (Up to now 9 people in total involved) <ul style="list-style-type: none"> • Member (Engg.& Coord.) • GM (RAMD) • DD (BMU-I) • DD (BMU-II) • DD (BMU-III) } 4 people • IT engineer }
Budget allocated:	Travel expenses & allowance for participants of master TOT (Training of Trainers) and training at all Maintenance Units (MUs).	PKR 9.15 million <ul style="list-style-type: none"> -Salary, TA&DA for TEs -Transportation -Furniture for JET's room -Survey equipment
Office & facilities provided:	Office space with furniture, internet and telephone	Office space with furniture and internet

Achievement – Input

Note: *Others include costs of equipment, training in Japan, subcontract in Japan, report printing and public relation
 **JICA procurement rate (PKR 1=0.799750) in January 2019

Japanese side		
	Plan	Achievement
Experts:	7 people (46.34 MM)	9 people (53.85MM)
Program Budget and others*:	27.51 million yen	27.67 million yen (**PKR 34.6 million)
Equipment:	15.45 million yen -Carbonation Test -Crack Scale -Test Hammer -Helmet -Reinforcement detector -Half cell -Shimidt Hammer -Client PCs -Server for clients -MS Excel &-MS Access	2.56 million yen (**PKR 3.2 million) -Carbonation Test -Crack Scale -Test Hammer -Helmet
Training in Japan:	2 times	1 time (2 people)

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Achievement – Output 1

Output 1:Manuals, Database and BMS developed for bridge inspection and bridge repair.	
Indicators	Achievement
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.	Developed. Except for Indicator 1, BMS software operation manual and BMS software administration manual were developed in August and in November 2018.
2. Draft bridge/culvert inspection formats developed by December 2016.	Developed in December 2016.
3. Prototype Database developed by July 2017, and prototype BMS by December 2017.	Developed. The Project developed the BMS with the prioritization function which the ex-BMS did not have.

8

Achievement – Output 1

Output 1: Manuals, Database and BMS developed for bridge inspection and bridge repair.	
Indicators	Achievement
4. 2 types of draft training materials for (1)bridge/culvert inspection and (2) bridge repair developed by December 2016.	Developed in February 2017.
5. Manuals, formats, Database & BMS, and training materials finalized by September 2018.	Finalized in October 2018.
<p><Summary></p> <ul style="list-style-type: none"> The Output 1 has been already achieved because all 5 Indicators have been achieved. 	

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Achievement – Output 2

Output 2: Bridge/culvert inspection in the model area is implemented after BMS training.	
Indicators	Achievement
1. On-the-job-training (OJT) by JICA Expert Team which enables BMU to implement BMS in NHA by December 2018.	The Indicator 2-1 and the Indicator 2-2 are not relevant to measure the Output 2 directly. They are one of the means for enhancing the capacity of the BMU to implement BMS. They were undertaken as Activity 2-1 and 2-2.
2. Inventory Survey, Bridge Inspection and Data Input Training for NHA engineers.	
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.	Completed in September 2018. The Project selected 36 bridges and 5 culverts for periodic inspection preferentially in the model area because they can cover almost all other categories and patterns. Accordingly, the Project set them as the target value of the Indicator 3.

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Achievement – Output 2

Output 2: Bridge/culvert inspection in the model area is implemented after BMS training.	
Indicators	Achievement
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.	Confirmed in November 2018.
<p><Summary></p> <ul style="list-style-type: none"> The Output 2 has been already achieved because the Indicator 3 and the Indicator 4 have been achieved. 	

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Achievement – Output 3

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.	
Indicators	Achievement
1. BMS Software Training for BMU by December 2018.	Conducted in August 2018. The BIDP and BMS training and the follow-up training programs have helped BMU manage the bridge data of the model area.
2. Analysis of Bridge Inspection Data of the model area included in Bridge Inspection Database (BIDB) using BMS Software.	Analyzed in October 2018. The BMU prepared and finalized the priority repair list.
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.	This Indicator is the same as that of the Project Purpose.
<p><Summary></p> <ul style="list-style-type: none"> There is an overlap between the Output 3 and the Project Purpose, and the Indicator 3 is the same as that of the Project Purpose. The Output 3 should have been set as "bridge data of the model area is available with BMU at NHA HQ." Because the Indicator 1 and 2 have been achieved, the Output 3 has been achieved. 	

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Achievement – Project Purpose

Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of the model area	
Indicators	Achievement
1. Bridge maintenance plan with breakdowns for the model area prepared by November 2018.	<p>The Project has intended to prepare the bridge maintenance plan of 36 bridges and 5 culverts in the model area. This should have been clearly described in the Indicator 1.</p> <p>Prepared in November 2018 by calculating the budget requirement for three cases. They included: 1) All the repairs are to take place in the cycle of five years; 2) Most critical elements are to take place; and 3) Repairs of Ep, Es, and Cs classified are to take place.</p>
<p><Summary> The Indicator 1 has been achieved. Thus, the Project Purpose has been achieved.</p>	

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Achievement (Prospect) – Overall Goal

Bridge inspection & maintenance status improved on the bridges of National Highways in the model area.	
Indicators	Achievement
1. The bridges identified in the maintenance plan prepared under the Project are maintained and repaired according to the plan.	<p>Some of the inspected bridges and culverts are likely to be integrated into the Annual Maintenance Plan with the budget request within 3 years after the completion of the Project. If the activities identified in the Short- and Medium- Term Plans are to be undertaken as planned, the Indicator 1 is likely to be achieved.</p>
2. In the model area, more than 65 bridges are annually inspected and the bridge maintenance plan is annually revised.	<p>NHA decided to inspect all bridges once every 5 years. Based on this policy, the Project set "more than 65 bridges" out of 325 in the model area as the target value of the Indicator 2. Considering the BMU has already started the bridge inspection as its regular activities in the model area, the Indicator 2 is likely to be achieved.</p>
<p><Summary> The Overall Goal is likely to be achieved if the activities identified in the Short- and Medium Term Plans are to be undertaken. It is important for BMU to follow the policy of bridge inspection once every 5 years.</p>	

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Summary of assessment of achievement based on the indicators of PDM

Output 1	Achieved.
Output 2	Achieved.
Output 3	Achieved.
Project Purpose	Achieved.
Overall Goal (prospect)	Likely to be achieved if the activities identified in the Short- and Medium-Term Plans are to be undertaken as planned.

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2

Assessment of Implementation Process

-whether activities are conducted as originally planned and what is happening in the process of project implementation? -



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Implementation Process

<Management & Monitoring>

- ◆ **The Project had not been smoothly implemented for the initial 1.5 years because of several factors** such as the shortage of C/Ps, the shortage of the trained manpower in MUs & ROs, less feasible original PDM and time-consuming for reaching mutual understanding between C/Ps and JET. **After the establishment of the BMU and the change in target areas** from the whole country to the model area, **the Project has made significant progress in its management.**
- ◆ Overall, Joint Coordinate Committee (JCC) meeting has worked in terms of sharing the progress of Project activities and discussing the issues and countermeasures.
- ◆ Monitoring has been regularly undertaken through 1) JCC, 2) monitoring sheets developed every 6 months and 3) weekly meeting using "To Do List".

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Implementation Process

<Coordination & Communication>

- ◆ For the initial 1.5 years, both the C/Ps and the JET sometimes found it difficult to adjust their schedule because the C/Ps were too busy with their routine tasks to find the time to work with the JET during the latter's limited assignment duration. After the establishment of BMU, both coordination and communication have been much improved.
- ◆ It took time for the C/Ps and the JET to build a common understanding of the Project because it was the first time for the parties to work together in a JICA technical cooperation project.

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Implementation Process

<Technical transfer, Commitment & Ownership>

- ◆ The C/Ps have enhanced their capacity of BMS by participating in Project activities including a series of training programs and OJT.
- ◆ Also, the Trainee Engineers (TEs) have much improved their capacity by participating in Project activities such as training, OJT and inventory survey & bridge inspection.
- ◆ Some of the C/Ps and the TEs felt that JET should have been dispatched for much longer time to transfer their knowledge and skills of BMS to them.
- ◆ After the establishment of BMU, the C/Ps have been more actively involved in Project activities with a sense of ownership.

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3

Evaluation with Five Evaluation Criteria

Evaluate the Project based on five evaluation criteria



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Five Evaluation Criteria

1. Relevance

refers to the validity of the Project Purpose and the Overall Goal in accordance with the policy direction of the Government of Pakistan and the Japanese Official Development Assistance as well as the needs of beneficiaries and target groups.

2. Effectiveness

refers to the extent to which the expected benefits of the Project have been achieved as planned, and examines if the benefit was generated as a result of the Project.

3. Efficiency

refers to the productivity of the implementation process, examining if the input of the Project was efficiently converted into the Output.

4. Impact

refers to direct and indirect, positive and negative impacts caused by the Project, including the extent to which the Overall Goal has been attained.

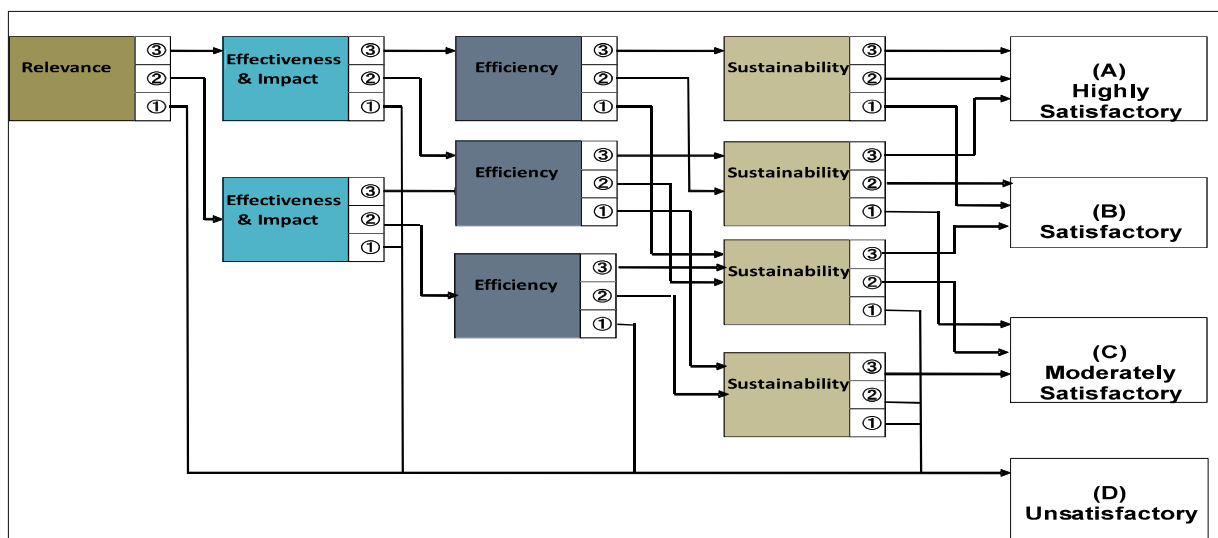
5. Sustainability

refers to the extent to which the NHA side can further strengthen and sustain the Project's effects in the policy, organizational, institutional, financial and technical aspects

Rating Scale



FYI: Rating flow of Ex-post Evaluation



Relevance --- Moderately High

1. **Consistent with the Vision 2025**
2. **Matched the needs of NHA** to improve its capacity of implementation of appropriate BMS
3. **Consistent with the Japanese aid policies** from the viewpoint of strengthening transportation infrastructure sector
4. **Appropriate approaches such as selection of model area and OJT of C/Ps and the TEs**
5. **Less feasible approach of training & mobilization of Master Trainers of BMS** through the cascade model considering the shortage of manpower and required expertise in MUs and ROs of NHA
6. **Less relevant Project Purpose of the original PDM** which intends to implement inventory survey & bridge inspection of 5,000 bridges and 16,000 culverts of the entire country for 2.5 years, and to prepare an Annual Maintenance Plan considering the shortage of C/Ps and technically trained manpower of MUs and ROs in the area of BMS

23

Effectiveness --- High

1. **The Project has newly developed the BMS at NHA Headquarters. More specific effects include:**
 - 1) development of BMS and related manuals;
 - 2) development of training manuals related to BMS;
 - 3) development of Bridge Inspection Database (BIDB) & BMS Software;
 - 4) enhancement of capacity of BMU staff and TEs; and
 - 5) development of bridge maintenance plan of model area (36 bridges + 5 culverts).
2. **The Project Purpose and the three Outputs have been already achieved.**

24

Efficiency --- Medium

1. Inputs from the NHA side:

- ◆ **The number of C/Ps has increased from 1 to 4** during the implementation since January 2018
(2 C/Ps were supposed to be assigned in the beginning of the Project).
- ◆ **Around PKR 10 million including the salary of TEs borne by the NHA has been allocated** exclusively to undertake the training and the inventory survey & bridge inspection efficiently.

25

Efficiency --- Medium

2. Inputs from the JICA side:

- ◆ **The number of experts has increased from 7 to 9** mainly because BMS software needs to be newly developed. The total person-months were 58.85 which increased by 19 %, as compared with the Plan.
- ◆ **The program budget borne by JICA was 27.67 million yen which slightly exceeds the plan** (more than 0.6% of the planned budget). Although the cost for the subcontract for software programming in Japan was additionally borne, the costs of some equipment such as the NDT and training in Japan were decreased because of the cancellation of provision of these inputs based on a series of discussions.

3. Project period:

The entire duration of the Project was 34 months. It was extended by 3 months because of less progress of the Project for the initial 1.5 years since the commencement of the Project.

26

Efficiency --- Medium

4. Several factors affected the efficiency of the Project for the initial 1.5 years since its beginning as follows:

- 1) shortage of C/Ps;
- 2) limited involvement of C/Ps for Project activities;
- 3) limited coordination and communication;
- 4) time-consuming process to reach a mutual understanding; and
- 5) lack of trained manpower of BMS in MUs and ROs.

<Countermeasures>

- The entire duration of the Project was extended by 3 months.
- The Project Purpose and the target area were changed.
- The approach was shifted from training & mobilizing master trainers in the whole country to establishing BMU at HQs & mobilizing TEs in the model area.

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Efficiency --- Medium

5. The following factors considerably helped to increase the efficiency of the Project from January to December 2018 :

- 1) establishment of BMU;
- 2) deployment of C/Ps in BMU;
- 3) change in the target area from the whole country to the model area;
- 4) employment and involvement of TEs in the Inventory Survey and Bridge Inspection; and
- 5) extension of the entire duration of the Project by 3 months

28

Impact (Prospect) --- High

1. **The Overall Goal is likely to be achieved** if the activities in the Short- and Medium-Term Plans are to be undertaken as planned.
2. **Some positive signs towards the achievement of the Overall Goal have already emerged as follows:**
 - 1) establishment of BMU based on the recommendation by the Project;
 - 2) approval of 3 manuals* and Standard Operating Procedures (SOP)** from the NHA Executive Board
 - 3) Development of the Short-, Medium-, and Long-Term Plans of BMS implementation by BMU

*Manuals of Bridge Inspection, Bridge Repair & BIDB were developed by the Project.

**SOP was developed by the BMU.

29

Sustainability (Prospect) - Medium to Moderately high

■ Policy aspect – High

1. The NHA/BMU plans to take the lead in conducting inventory survey & bridge inspection by mobilizing TEs and outsourcing these activities to consultants based on their Short-, Medium- and Long-Term Plans.
2. The above policy is likely to be sustained because the BMU initiated to undertake the activities such as conducting inventory survey and bridge inspection in model area and a few non-model areas and preparing a draft TOR for consultants at present.

30



Sustainability (Prospect) - Medium to Moderately high

■ Organizational aspect – Medium to Moderately high

1. BMU with 3 C/Ps was established to keep implementing the BMS, which is expected to play a key role in ensuring the sustainability of the Project.
2. NHA renewed the contract of 8 TEs up to February 2020 and completed the interview of 4 new TEs at present.
3. **One IT engineer** who was involved in the Project **has yet to be deployed officially as a member of BMU.**



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Sustainability (Prospect) - Medium to Moderately high

■ Organizational aspect – Medium to Moderately high

4. **Insufficient number of trained manpower at BMU/NHA is still a big concern.** It may be difficult for the trained TEs to keep working for BMU because of the one-year contract without any insurance, and their title of TE which undermines their performance and trust. The adequate number of trained manpower at BMU is imperative to provide training for consultants, supervise their work and ensure the quality of work although NHA is less likely to be able to recruit the new permanent staff based on the government's decision.
5. **Inadequate equipment & transportation for bridge inspection is another issue of concern.**



32

Sustainability (Prospect) - Medium to Moderately high

■ Institutional aspect – Medium to Moderately high

1. Approval of 3 manuals and SOP by the NHA Executive Board is a positive step of institutionalizing the effects of the Project.
2. Development of Short-, Medium- and Long-Term Plans of implementation of BMS and planning to integrate BMS training into the training program of HRTC are also good initiative of BMU.
3. It will **take more time for BMU to institutionalize and sustain the BMS.**
4. **The practice for BMS was undertaken for limited structures in the model area for just 1 year. Bridge repair was not implemented** by the Project that is beyond its scope, though its manual was developed. It is **uncertain how BMU will be able to take countermeasures for issues of bridge repair which will emerge.**

33

Sustainability (Prospect) - Medium to Moderately high

■ Financial aspect – Medium to Moderately high

1. The effects of the Project is likely to be sustained within 3 years after its end from the financial aspect if all goes smoothly based on the Medium Term Plan (Dec 2018-May 2022) mainly focusing on the implementation of inventory survey and bridge inspection in the entire country.
2. Bridge maintenance budget was 2% to 4% of the total maintenance budget of NHA during the Implementation of the Project. The source of bridge maintenance budget is the NHA's revenue such as road maintenance funds mainly collected from road tolls. The change in the government in 2018 is less likely to affect their budget immediately.
3. It is **uncertain how to ensure the financial sustainability in a long run** because **the BMU has yet to develop the Annual Bridge/Culvert Maintenance Plan for the entire country based on priority analysis of the data in BIDD and budget estimation.**

34

Sustainability (Prospect) - Medium to Moderately high

■ Technical aspect – Medium to moderately high

1. All C/Ps who acquired knowledge, skills and know-how related to BMS will keep applying what they learned from the Project while they work in BMU.
2. The TEs are likely to put what they learned into practice on sites for a while. However, there is a risk for the NHA/BMU to lose some of these trained TEs considering their unstable status.
3. Both the C/Ps and the TEs have felt **the needs to enhance their capacity, particularly the practical knowledge and experiences of bridge repair and bridge design.**
4. BMU/NHA has felt **the needs of further support if technical problems of BIDB and BMS software that could not be solved by themselves will occur. There is room for improvement of capacity in these areas.**

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Summary of Evaluation based on 5 criteria

1.Relevance	Moderately High	
2.Effectiveness	High	
3.Efficiency	Medium	
4.Impact	High	
5.Sustainability	Medium to Moderately High	
	■ Policy:	High
	■ Organizational:	Medium-Moderately High
	■ Institutional:	Medium-Moderately High
	■ Financial:	Medium-Moderately High
■ Technical:	Medium-Moderately High	

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4

Recommendation and Lessons



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Recommendations

- 1. Strengthening the BMS by implementing, monitoring the activities in the Short-, Medium- and Long-Term Plans, and revising these plans whenever necessary**
- 2. Reporting and sharing the progress and issues of above activities with JICA by submitting monitoring sheets on a quarterly basis**
- 3. Taking countermeasures* to retain the trained and dedicated TEs in BMU (*change in the title of TEs, provision of insurance, employment as contracted assistants for BMU etc.)**
- 4. Promoting information dissemination of BMS and strengthening coordination to be further institutionalized in NHA HQs, MUs and ROs (e.g. Sharing & Feedback workshop for GM Maintenance of ROs)**
- 5. Allocating financial resources for bridge maintenance countermeasures in the Annual Maintenance Plan**

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Lessons Learned from the Project

- 1. In promoting to ensure the sustainability of a project, it is effective for its stakeholders to discuss and take concrete measures towards institutionalization of project effects during a project period.**
- 2. The scope of a project and its required arrangements from JICA and the recipient country such as dispatching JET, assigning C/Ps, provision of equipment and allocating budget should have been fully discussed and appropriately examined by ex-ante evaluation prior to the commencement of a project.**

=END=

5. Evaluation Grid (評価グリッド)

5.1 Evaluation Grid (English)

Appendix 5.1 : Evaluation Grid

1. Achievement of the Project

Evaluation Item	S/N	Narrative Summary	Indicators	Data Needed	Data Sources	Data Collection Methods
Achievement/ Prospect of achievement (Overall Goal)	1	The extent of achievement or the prospect of achievement of Overall Goal "Bridge inspection & 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.	<ul style="list-style-type: none"> • Bridge maintenance plan • Inspection and maintenance record in the BMS 	<ul style="list-style-type: none"> • Project documents and reports • Counterpart Personnel (C/P) and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
	2		2. In the model area, more than 65 bridges are annually inspected and the bridge maintenance plan is annually revised.	<ul style="list-style-type: none"> • Bridge maintenance plan • Inspection and maintenance record in the BMS • Justification of the target value, i.e., 65 bridges of the Indicator 2 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
Achievement (Project Purpose)	3	The extent and the prospect of achievement of Project Purpose "Annual bridge maintenance plan prepared on the basis of the latest bridge inspection data of the model area."	1. Bridge maintenance plan with breakdowns for the model area prepared by November, 2018.	<ul style="list-style-type: none"> • 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"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
	4		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.	<ul style="list-style-type: none"> • 3 types of draft manuals 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
Achievement (Outputs)	5	The extent of achievement of Output 1 "Manuals, Database and BMS developed for bridge inspection and bridge repair."	1-2. Draft bridge/culvert inspection formats developed by December, 2016.	<ul style="list-style-type: none"> • Draft bridge/culvert inspection formats 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
	6		1-3. Prototype Database developed by July, 2017, and prototype BMS by December, 2017.	<ul style="list-style-type: none"> • Prototype Database & BMS 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
	7		1-4: 2 types of draft training materials for 1 bridge/culvert inspection and 2 bridge repair developed by December, 2016.	<ul style="list-style-type: none"> • 2 types of draft training materials 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
	8		1-5. Manuals 1-1), formats (1-2), Database & BMS (1-3), and training materials (1-4) finalized by September, 2018.	<ul style="list-style-type: none"> • 3 types of manuals, bridge/culvert inspection formats, Database & BMS, and 2 types of training materials 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders

Appendix 5.1 : Evaluation Grid

Achievement (Outputs)	9	2-1. On-the-job-training (OJT) by JICA Expert Team which enables BMU to implement BMS in NHA by December 2018.	• Training records and reports	• Project documents and reports • C/P and Japanese experts	• Review of documents and reports • Questionnaire • Interview with stakeholders
	10	2-2. Inventory Survey, Bridge Inspection and Data Input Training for NHA engineers.	• Training records and reports	• Project documents and reports • C/P and Japanese experts	• Review of documents and reports • Questionnaire • Interview with stakeholders
	11	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.	• Inspection data of the model area including the representative 36 bridges and 5 culverts in Bridge Inspection Database.	• Project documents and reports • C/P and Japanese experts	• Review of documents and reports • Questionnaire • Interview with stakeholders
Achievement (Outputs)	12	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.	• Input data to Database and its evaluation	• Project documents and reports • C/P and Japanese experts	• Review of documents and reports • Questionnaire • Interview with stakeholders
	13	3-1. BMS Software Training for BMU by December 2018.	• Record of BMS Training	• Project documents and reports • C/P and Japanese experts	• Review of documents and reports • Questionnaire • Interview with stakeholders
	14	3-2. Analysis of Bridge Inspection Data of the model area included in Bridge Inspection Database (BIDB) using BMS Software.	• Output data of BMS (Prioritization)	• Project documents and reports • C/P and Japanese experts	• Review of documents and reports • Questionnaire • Interview with stakeholders
	15	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 management Plan • Difference from the Indicator 1 of the Project Purpose	• Project documents and reports • C/P and Japanese experts	• Review of documents and reports • Questionnaire • Interview with stakeholders
Achievement (Inputs from the Pakistani side)	16	Actual inputs including comparison with the description of Record of Discussion (R/D)	• List of counterpart personnel • Program costs borne by the Pakistani side • Office space and facilities provided by the Pakistani side	• Project documents and reports • Japanese experts	• Review of documents and reports • Interview with stakeholders
Achievement (Inputs from the Japanese side)	17	Actual inputs (including comparison with the description of R/D)	• Number of dispatched Experts and professional field • List of equipment • List of training participants • Program costs borne by the Japanese side	• Project documents and reports • Japanese experts	• Review of documents and reports • Interview with stakeholders

Appendix 5.1 : Evaluation Grid

2. Process of Project Implementation

Evaluation Item	Evaluation Question (Main Question)	Evaluation Question (Sub Question)	Data Needed	Data Sources	Data Collection Methods
Project management and progress of activities	1	<ul style="list-style-type: none"> • Have the project management and the technical transfer been conducted smoothly? • If they have been smoothly conducted, what are contributing factors? If not smoothly conducted, what are hindering factors? 	<ul style="list-style-type: none"> • Project management system (internal factors) • Divergence between original PDM and current activities • Changes of important assumptions and other external factors that might influence the Project 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
	2	<ul style="list-style-type: none"> • Progress of activities • Contributing and hindering factors for implementation of activities • Any challenges arisen during implementation of activities 	<ul style="list-style-type: none"> • Divergence between original Plan of Operation and current activities • Changes of inputs and important assumptions • Other internal factors such as contributing and hindering factors and countermeasures • Process of modifying activities and relevant documents describing such modification 	<ul style="list-style-type: none"> • Project documents and reports including meeting of minutes • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Interview with stakeholders
Monitoring of progress of activities	3	<ul style="list-style-type: none"> • How have the monitoring activities been conducted? (including methods, frequency,) • How have the PDM indicators been monitored? • How were the results of monitoring fed back to the Project? • Is there any room for improving monitoring methods? 	<ul style="list-style-type: none"> • Whether or not any monitoring tools • Methods of monitoring, and of utilization and feedback of monitoring results 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
	4	<ul style="list-style-type: none"> • Response to changes of Important Assumptions 	<ul style="list-style-type: none"> • Changes of Important Assumptions and countermeasures • Whether or not there are any records, and methods of recording/reporting 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Interview with stakeholders
	5	<ul style="list-style-type: none"> • Pre-conditions 	<ul style="list-style-type: none"> • Views of Project Manager and Chief Advisor about preconditions of the Project 	<ul style="list-style-type: none"> • Project documents and reports • Project Manager and Chief Advisor 	<ul style="list-style-type: none"> • Review of documents and reports • Interview with stakeholders

Appendix 5.1 : Evaluation Grid

<p>Communication among project stakeholders</p>	<ul style="list-style-type: none"> • Communication and common understanding about problems/concerns related to the Project 	<ul style="list-style-type: none"> • Have the Experts and the C/P communicated sufficiently? • Have the Experts and the C/P had common understanding about problems/concerns related to the Project? • Have the Experts and the C/P communicated sufficiently during the non-assignment period of the Experts? • Have the C/P organizations communicated sufficiently? • Have the C/P organizations had common understanding about problems/concerns related to the Project? • Have the Project, JICA Headquarters and JICA Pakistan Office communicated sufficiently? • Have the Project, JICA Headquarters and JICA Pakistan Office had common understanding about problems/concerns related to the Project? 	<ul style="list-style-type: none"> • Whether or not there are any communication tools • Frequency of various meetings for project management and methods of recording/reporting • Views of the JICA Headquarters and the JICA Pakistan Office, Experts and C/P 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts • JICA Headquarters and JICA Pakistan Office 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
<p>Knowledge & expertise exchange</p>	<ul style="list-style-type: none"> • Progress of knowledge & expertise exchange 	<ul style="list-style-type: none"> • What type of knowledge and skills that should be transferred to which level of C/P? • Have knowledge and skills that should be transferred to C/P been changed compared to the beginning of the Project? • Have such knowledge and skills been transferred to C/P in an appropriate manner? • How did the Experts work out to transfer knowledge and skills mentioned above? 	<ul style="list-style-type: none"> • Target groups of knowledge and skills transfer, detailed information on knowledge and skills that should be transferred to C/P • Whether or not there are any changes in knowledge and skills that should be transferred to C/P by comparison with the original plan • Methods of transfer of knowledge and skills 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
<p>Ownership of implementing organizations</p>	<ul style="list-style-type: none"> • Progress of nurturing a sense of ownership among the implementing organization and the responsible organization 	<ul style="list-style-type: none"> • Extent of recognition of the Project by NHA • Extent of participation of the Project by NHA • Appropriateness of assignment of C/P • Operational costs borne by the Pakistani side 	<ul style="list-style-type: none"> • Frequency of each meeting, participants of each meeting, and issues discussed • Whether or not there are any case examples that might indicate the ownership of implementing agencies has been enhanced. • Number and duty position of C/P • Project operational costs borne by the Pakistani side 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders

Appendix 5.1 : Evaluation Grid Evaluation by Five Criteria

Evaluation Item	S. N.	Evaluation Question (Main Question)	Evaluation Question (Sub Question)	Data Needed	Data Sources	Data Collection Methods
Relevance (Are the Project Purpose and the Overall Goal valid for the Project?)	1	Necessity of the Project	Does the Project, focusing on development of manual and formats for bridge inspection and bridge repair, development of prototype database and prototype BMS, development of training materials, capacity development of NHA staff members through OJT, and bridge maintenance plan with cost estimate, meet the needs of the NHA?	<ul style="list-style-type: none"> Perceptions and views of NHA, Bridge Management Unit about the Project 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders
	2	Priority of the Project	Are the Project Purpose and the Overall Goal consistent with the upper-level plans and other related policies of the Government of Pakistan?	<ul style="list-style-type: none"> Vision 2025 Other related policies 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts Relevant policies and strategies 	<ul style="list-style-type: none"> Review of documents and reports Interview with stakeholders
	3		Are the Project Purpose and the Overall Goal consistent with Japanese Government's aid policies for the Islamic Republic of Pakistan?	<ul style="list-style-type: none"> Country Assistance Policy for the Islamic Republic of Pakistan(2018) Rolling plan for Pakistan(2017) 	<ul style="list-style-type: none"> Website of Ministry of Foreign Affairs 	<ul style="list-style-type: none"> Review of documents and reports
Effectiveness	4	Appropriateness of strategies and approaches of the Project	Are the approaches* adopted by the Project relevant as means for formulating and improving the NHA's bridge maintenance plan? Do the approaches meet the needs of the Pakistani side? (*Project implementation structure including formation of joint working group, selection of model areas, capacity development through OJT and related training programs)	<ul style="list-style-type: none"> Views of C/P, Japanese experts and other stakeholders 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts Other stakeholders 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders
	5		Does Japan have the adequate experiences and know-how of bridge inspection and maintenance?	<ul style="list-style-type: none"> Japan's similar cooperation C/P's perceptions and views about the Japanese support for bridge inspection and maintenance 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders
	6	Achievement of the Project Purpose	Is there a good chance that the Project Purpose would be achieved?	<ul style="list-style-type: none"> Achievement Grid 	<ul style="list-style-type: none"> Achievement Grid 	<ul style="list-style-type: none"> Achievement Grid
	7	Contribution of Outputs	Has the Project Purpose been achieved due to the effect of achievement of each Output?	<ul style="list-style-type: none"> Achievement of Outputs Stakeholders' views 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders Achievement Grid

Appendix 5.1 : Evaluation Grid

<p>Effectiveness (Has the target group received benefits from implementation of the Project? Has the Project Purpose been achieved or going to be achieved? Did or does the achievement of the Project Purpose result from Outputs?)</p>	<p>8 Contribution of Outputs</p>	<p>In order to achieve the Project Purpose, are there any Outputs that were not described in PDM but should be added in PDM?</p>	<p>• Comparison between original Plan of Operation and actual performance of activities • Views expressed by the stakeholders</p>	<p>• Project documents and reports • C/P and Japanese experts</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>
<p>9</p>	<p>Did the Important Assumptions, i.e., "NHA arranges adequate human resources for BMS implementation" and "NHA allocates enough budget to maintain and repair prioritized bridges in the annual maintenance plan" influence implementation of activities?</p>	<p>• Transfer and retirement of C/Ps • Influences of the new Law on Environmental Protection on the MOC's roles and responsibilities regarding ISWM</p>	<p>• Project documents and reports • C/P and Japanese experts</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>
<p>10</p>	<p>Influence of Important Assumptions from the Outputs to the Project Purpose</p>	<p>Except for the Important Assumptions, were there any external factors that have influenced the Project positively or negatively?</p>	<p>• Identification of external factors that contribute to and impede the achievement of the Project Purpose</p>	<p>• Project documents and reports • C/P and Japanese experts</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>
<p>11</p>	<p>What are the contributing and hindering factors that have influenced effectiveness of the Project?</p>	<p>• Identification of internal factors that contribute to and impede the achievement of the Project Purpose</p>	<p>• Project documents and reports • C/P and Japanese experts</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>
<p>12</p>	<p>Achievement of Outputs</p>	<p>Is there a good chance that three Outputs would be achieved?</p>	<p>• Achievement Grid</p>	<p>• Achievement Grid</p>	<p>• Achievement Grid</p>
<p>13</p>	<p>Were the number of experts dispatched, their special fields of expertise, and timing of dispatch appropriate?</p>	<p>• List of dispatch of experts • Stakeholders' views about the experts</p>	<p>• Project documents and reports • C/P and Japanese experts</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>
<p>14</p>	<p>Were the type, quantity and timing of the procurement of equipment appropriate?</p>	<p>• List of equipment provided • Usage and condition of equipment • Stakeholders' views about equipment</p>	<p>• Project documents and reports • C/P and Japanese experts</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>
<p>15</p>	<p>Efficiency of the inputs from the Japanese side in terms of quality, quantity and timing, judging from the achieved outputs</p>	<p>Were the number of trainees of counterpart training in Japan, the training content and the training period appropriate?</p>	<p>• List of C/P training in Japan • Stakeholders' views about the C/P training</p>	<p>• Project documents and reports • C/P and Japanese experts</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>
<p>16</p>	<p>Was the project operational cost borne by the Japanese side appropriate?</p>	<p>• List of project operational costs borne by the Japanese side • Stakeholders' views about project operational costs</p>	<p>• Project documents and reports • C/P and Japanese experts</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>	<p>• Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid</p>

Appendix 5.1 : Evaluation Grid

	17	Were the number of counterparts, their assignment and their capabilities appropriate?	<ul style="list-style-type: none"> List of C/P Stakeholders' views about assignment of the C/P 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders Achievement Grid
	18	Efficiency of the inputs from the Pakistani side in terms of quality, quantity and timing, judging from the achieved outputs	<ul style="list-style-type: none"> Current state of buildings and facilities provided by the Pakistani side Stakeholders' views about the buildings and facilities provided by the Pakistani side 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders Achievement Grid
	19	Was the project operational cost borne by the Pakistani side appropriate?	<ul style="list-style-type: none"> List of project operational cost borne by the Pakistani side Stakeholders' views about project operational costs 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders Achievement Grid
	20	Were sufficient activities planned to produce the Outputs? Were these activities carried out in a timely manner?	<ul style="list-style-type: none"> Comparison between the Plan of Operation and the actual performance Stakeholders' views 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders Achievement Grid
Efficiency (Was input converted to efficient activities? Was the Project carried out efficiently?)	21	Were there any activities that were not described in PDM but contributed to the achievement of Outputs? If there were, should such activities have been additionally described in PDM?	<ul style="list-style-type: none"> Comparison between the Plan of Operation and the actual performance Stakeholders' views 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders Achievement Grid
	22	Were there any activities that have not been carried out but need to be added in PDM in order to achieve the Outputs?	<ul style="list-style-type: none"> Comparison between the Plan of Operation and the actual performance Stakeholders' views 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders Achievement Grid
	23	Did Important Assumptions such as " BMS is continuously in use by NHA for preparation of bridge maintenance plan", "BMU (Bridge Management Unit) is established in NHA headquarters" and "BMS organization is gradually established in NHA, who will implement BMS in a sustainable manner" influence implementation of activities?	<ul style="list-style-type: none"> Influences of Important Assumptions 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders Achievement Grid
	24	Was the Pre-Condition "Pakistan, especially Islamabad and Lahore, is continuously safe enough for JICA Expert Team to implement the activities" met?	<ul style="list-style-type: none"> Status of Pre-condition 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders Achievement Grid
	25	What are the contributing and hindering factors that have influenced efficiency of the Project?	<ul style="list-style-type: none"> Identification of external factors that contribute to and impede efficiency of the Project 	<ul style="list-style-type: none"> Project documents and reports C/P and Japanese experts 	<ul style="list-style-type: none"> Review of documents and reports Questionnaire Interview with stakeholders Achievement Grid

Appendix 5.1 : Evaluation Grid

<p>Impacts (Has the Project generated the long-term, indirect and ripple effects? Is there a good chance that the Project would generate these impacts?)</p>	26	Prospect of achievement of the Overall Goal	Is there a good chance that Overall Goal "Bridge inspection & maintenance status improved on the bridges of National Highways in the model area." would be achieved?	<ul style="list-style-type: none"> • Achievement of the Overall Goal Indicators • Stakeholders' views 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid
	27	Influence of Important Assumptions	Are the Important Assumption i.e., "Availability of optimum maintenance budget", "Continuous update of bridge data" and other external factors that were not described in PDM likely to influence the achievement of the Overall Goal? .	<ul style="list-style-type: none"> • Confirmation of Important Assumptions and prospects of their influence 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
	28	Ripple effects	Except for the Overall Goal, were there any positive effects brought about by the Project?	<ul style="list-style-type: none"> • Identification of other impacts and prospects for their influence 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
	29		Were there any unexpected and negative effects brought about by the Project?	<ul style="list-style-type: none"> • Identification of negative impacts and prospects of their influence 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
	30	What are the contributing and hindering factors that have influenced or will influence the achievement of the Overall Goal?		<ul style="list-style-type: none"> • Identification of internal contributing and hindering factors 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders • Achievement Grid

Appendix 5.1 : Evaluation Grid

31	Policies	Are there any policies on bridge maintenance can ensure sustainability and expansion of the effects generated by the Project?	<ul style="list-style-type: none"> • Stakeholders' views • Case examples of sustainability in the policy aspect <ul style="list-style-type: none"> • NHA Annual Maintenance Plan • Short-, Medium-, Long-Term Maintenance Plans 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
32	Institution	Will the various Project's activities and products including the manuals and formats for bridge inspection and repair, training materials, and BMS software and BIDD on bridge inspection be institutionalized in BMU/NHA?	<ul style="list-style-type: none"> • Stakeholders' views • Case examples of sustainability in the institutional aspect <ul style="list-style-type: none"> • NHA Annual Maintenance Plan • Short-, Medium-, Long-Term Maintenance Plans 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
33	Organization	Will BMU/NHA be able to manage bridge inspection and related activities supported by the Project?	<ul style="list-style-type: none"> • Stakeholders' views • Case examples of sustainability in the organizational aspect <ul style="list-style-type: none"> • NHA Annual Maintenance Plan • Short-, Medium-, Long-Term Maintenance Plans 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
34	Finance	<p>Have NHA and BMU allocated the sufficient budget to sustain the effects of the Project?</p> <p>Will NHA and BMU be able to allocate the sufficient budget to inspect and repair bridges?</p>	<ul style="list-style-type: none"> • Stakeholders' views • Case examples of sustainability in the financial aspect <ul style="list-style-type: none"> • NHA Annual Maintenance Plan • Short-, Medium-, Long-Term Maintenance Plans 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
35	Knowledge/Skills	<p>To what extent, will C/Ps of BMU and trainee engineers be able to utilize and sustain the knowledge and skills transferred after the completion of the Project?</p> <p>Are there any areas for improvement of capacity development related to bridge management/maintenance?</p>	<ul style="list-style-type: none"> • Stakeholders' views • Case examples of sustainability in the technical aspect 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders
36	What are the contributing and hindering factors that have influenced or will influence sustainability of the Project?		<ul style="list-style-type: none"> • Identification of internal and external factors, and contributing and hindering factors for sustainability of the Project 	<ul style="list-style-type: none"> • Project documents and reports • C/P and Japanese experts 	<ul style="list-style-type: none"> • Review of documents and reports • Questionnaire • Interview with stakeholders

5.2 Evaluation Grid (Japanese 評価グリッド)

付属資料5.2:評価グリッド

実績の確認

評価項目	プロジェクトの要約	実績を確認するための指標	必要な情報・データ	情報源	調査方法	
実績と目標達成の見込み(上位目標)	1. 【上位目標】モデルエリアの国道における橋梁点検・維持管理状況が改善する」の達成度の現況と達成見込み	1. プロジェクトで作成した維持管理計画に基づき、選定した橋梁を計画に沿って維持管理し補修している。 2. モデルエリアで毎年65橋以上を点検し、橋梁維持管理計画を毎年改訂している。	橋梁維持管理計画、橋梁維持管理に関する記録、報告書 橋梁維持管理計画、モデルエリアに関する維持管理に関する記録、報告書 目録値65橋の設置理由要確認	プロジェクト報告書 C/Pと日本人専門家 プロジェクト報告書 C/Pと日本人専門家	報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュー 報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュー	
	3	【プロジェクト目標】「モデルエリアの国道における最新の橋梁点検の結果に基づき、橋梁維持管理の年度計画が準備される」の達成度の現況と達成見込み	1. モデルエリアでの橋梁維持管理計画(内訳書を含む)が2018年11月までに作成される。	モデルエリアでの橋梁維持管理計画(BMS)に入力されたモデルエリアのデータの分析、橋梁維持管理予算資料)	プロジェクト報告書 C/Pと日本人専門家	報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュー
実績(成果)	4		1-1. (1)橋梁点検マニュアル案が2016年12月までに、(2)橋梁補修マニュアル案が2016年12月までに、(3)橋梁点検データ入力マニュアル案が2017年12月までに作成される。 1-2. 橋梁・カルバート点検フォーマット案作成される。	橋梁点検マニュアル案、橋梁補修マニュアル案、橋梁点検データ入力マニュアル案 橋梁・カルバート点検フォーマット案	プロジェクト報告書 C/Pと日本人専門家 プロジェクト報告書 C/Pと日本人専門家	報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュー
	5		1-3. データベースのプロトタイプが2017年12月までに作成される。	データベースとBMSのプロトタイプ	プロジェクト報告書 C/Pと日本人専門家	報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュー
	6		【成果1】「橋梁の点検や補修に必要なマニュアル、データベース及び橋梁維持管理システム(BMS)が整備される」の達成度	橋梁・カルバート点検と橋梁補修に関する研修教材案	プロジェクト報告書 C/Pと日本人専門家	報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュー
	7		1-4. (1)橋梁・カルバート点検と(2)橋梁補修の研修教材案が2016年12月までに作成される。	橋梁・カルバート点検と橋梁補修に関する研修教材案	プロジェクト報告書 C/Pと日本人専門家	報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュー
	8		1-5. マニュアル(活動1-1)、フォーマット(同1-2)、データベースとBMS(同1-3)、研修教材(同1-4)を2018年9月までに最終化する。	マニュアル3種、橋梁・カルバート点検フォーマット、データベースとBMS、研修教材2種	プロジェクト報告書 C/Pと日本人専門家	報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュー
	9		2-1. 2018年12月までにBMUがNHAのBMS研修を実施できるよう、専門家チームによるOJT研修。	研修記録、報告書	プロジェクト報告書 C/Pと日本人専門家	報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュー
	10		2-2. NHA技術者向けインベントリー調査、橋梁点検、データ入力研修。	研修記録、報告書	プロジェクト報告書 C/Pと日本人専門家	報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュー
	11		2-3. 2018年10月までに完了した代表的な36橋と5カ所のカルバートを含むモデルエリアの橋梁・カルバート点検、補修工法選定、データベースへのデータ入力完了している。	橋梁点検データベースに登録されたモデルエリアの点検データ	プロジェクト報告書 C/Pと日本人専門家	報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュー
	12		2-4. BMUと専門家チームは2018年10月までにモデルエリアの補修工法選定と橋梁点検入力データベース入力が正確であることを確認。	データベース入力データとその評価	プロジェクト報告書 C/Pと日本人専門家	報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュー

付属資料5.2:評価グリッド

実績 (成果)	13 14 15 【成果3】「モデルエリアの橋梁データが本部のBMUで活用が可能となり、データに基づき橋梁維持管理計画が立案される」の達成度	3-1. 2018年12月までにBMU対象のBMSソフトウェア研修 3-2. BMSソフトウェアを用いて橋梁点検データベースに含まれるモデルエリアの橋梁点検データ分析 3-3. 代表的36橋と5カルバートを含むモデルエリアの構造物の補修工法と概算予算を含む年間維持管理計画の一部となる橋梁維持管理計画が立案される。	・BMS研修記録 ・BMS(優先順位)の出力データ ・橋梁維持管理計画 ・プロジェクト目標指標1との違い要確認	・プロジェクト報告書 ・C/Pと日本人専門家 ・プロジェクト報告書 ・C/Pと日本人専門家 ・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ
実績 (パキスタン側 投入)	16	投入内容 可能限り金額で示す(R/D記載内容との比較)	・C/Pの配置 ・運営経費(手当等も含む) ・プロジェクト専門家執務室、施設等の提供	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・関係者へのインタビュ
実績 (日本側 投入)	17	投入内容 可能な限り金額で示す(R/D記載内容との比較)	・専門家の数・専門分野 ・機材 ・受入れ研修員の数 ・運営経費等	・プロジェクト報告書 ・日本人専門家	・報告書のレビュー ・関係者へのインタビュ

付属資料5.2:評価グリッド

実施プロセスの把握

評価項目	評価設問(大項目)	評価設問(小項目)	必要な情報・データ	情報源	調査方法
プロジェクト運営、活動の進捗状況	1 プロジェクト全体の実施状況 ・運営面、技術面の促進要因と阻害要因	・プロジェクトの運営、技術移転は円滑になされてきたか ・円滑になされてきた要因は何か、なされていないとすれば原因は何か	・プロジェクトマネジメント体制(内部要因) ・PDMとの乖離 ・外部条件の変化、その他プロジェクトを取り巻く外部要因	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ
	2 活動の進捗状況 ・活動の促進要因と阻害要因 ・活動実施にかかる問題点	・各成果の活動は順調に進んでいるか ・活動を促進している要因と阻害している要因は何か ・十分に実施されていない活動はあるか、あるとしたらその原因は何か	・POとの乖離 ・投入や外部条件の変化 ・その他の内部的な促進・阻害要因と対処法 ・活動修正の際のプロセスや文書記録	・プロジェクト報告書・ミニッツ ・C/Pと日本人専門家	・報告書のレビュー ・関係者へのインタビュ
モニタリングの実施状況	3 モニタリングの仕組み	・モニタリング(プロジェクトの進捗状況、PDMの指標の達成の確認)はどのように行われていたか(形態・頻度) ・進捗状況確認の結果はどのようにフィードバックされていたか ・モニタリング方法の改善の余地はあったか	・モニタリングツール(記録方法等含む)の有無 ・モニタリング実施方法、活用・フィードバック方法	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ
	4 外部条件の変化とその対応	・外部条件に関して変化はあったか、変化があった場合、誰がどのように対応したか ・外部条件に記載していない外部要因による変化はあったか、変化があった場合、誰がどのように対応したか	・外部条件の変化と対処策 ・記録の有無、記録方法	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・関係者へのインタビュ
関係者間のコミュニケーション	5 前提条件の変化とその対応	・前提条件は満たされていたか ・前提条件として設定すべき事柄が他にあったか	・前提条件に関するプロジェクトマネージャー(PM)と総括の意見	・プロジェクト報告書 ・パキスタン側PM、日本側総括	・報告書のレビュー ・関係者へのインタビュ
	6 コミュニケーションと問題認識の共有状況	・専門家とC/Pの間で十分なコミュニケーションが図られていたか ・専門家とC/Pの間で問題に対する認識は共有されていたか ・専門家不在時も、C/Pとコミュニケーションが十分図られていたか ・C/P同士で十分なコミュニケーションが図られていたか ・C/P同士で問題に対する認識は共有されていたか ・JICA本部、JICAパキスタン事務所、プロジェクトとの間で十分なコミュニケーションが図られていたか ・JICA本部、JICAパキスタン事務所、プロジェクトとの間で問題に対する認識は共有されていたか	・コミュニケーションツールの有無 ・各種会議の頻度や記録方法、記録内容 ・JICA本部、JICAパキスタン事務所、専門家、C/Pの意見、見解	・プロジェクト報告書 ・C/Pと日本人専門家 ・JICA本部/パキスタン事務所	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ

付属資料5.2:評価グリッド

<p>技術・知見・ノウハウの共有の手法</p>	<p>7</p> <ul style="list-style-type: none"> ・技術、知識、ノウハウの共有の進捗状況 	<ul style="list-style-type: none"> ・C/P/Pに伝えるべき技術、知識、ノウハウの内容は何で対象は誰か ・移転すべき上記内容はプロジェクト開始時に比べ変化してきているか ・的確に上記が移転されているか、技術移転の際、どのような工夫がなされているか 	<ul style="list-style-type: none"> ・移転すべき技術、知識、ノウハウの内容と対象者 ・移転すべき技術、知識、ノウハウの内容の変化の有無 ・技術移転の方法 	<ul style="list-style-type: none"> ・プロジェクト報告書 ・日本人専門家 	<ul style="list-style-type: none"> ・報告書のレビュー ・専門家に対する質問票 ・関係者へのインタビュアー
<p>相手国実施機関のオーナシップ</p>	<p>8</p> <ul style="list-style-type: none"> ・実施機関のプロジェクトに対する主体性の醸成状況 	<ul style="list-style-type: none"> ・NHAのプロジェクト(技術プロジェクトスキームの理解を含む)に対する認識の度合い ・NHAのプロジェクトへの参加の度合い ・C/P/Pの配置の適性度 ・プロジェクト予算の負担状況(開始後の予算額の推移) 	<ul style="list-style-type: none"> ・各種会議の開催頻度、参加者、協議内容 ・その他、実施機関の主体性の醸成が確認できる事例の有無 ・C/P/Pの配置人数、職位 ・プロジェクト開始後の予算額の推移 	<ul style="list-style-type: none"> ・プロジェクト報告書 ・C/Pと日本人専門家 	<ul style="list-style-type: none"> ・報告書のレビュー ・専門家に対する質問票 ・関係者へのインタビュアー

評価5項目による分析

評価項目	評価設問(大項目)	評価設問(小項目)	必要な情報・データ	情報源	調査方法	
妥当性 (プロジェクトの実施の正当性、必要性を問う)	1	プロジェクトの必要性	協力内容(橋梁点検や補修・補強検討に必要なマニュアル・ソフトウェアの整備、橋梁点検データベースと新設BMSソフトウェアの構築、研修教材作成、研修を通じた職員能力強化、橋梁維持管理費積算、橋梁維持管理計画作成)はNHAのニーズに合致しているか	<ul style="list-style-type: none"> ・C/Pのプロジェクトに対する認識、見解 ・日本人専門家のプロジェクトの必要性に対する見解 	<ul style="list-style-type: none"> ・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュー 	
	2	プロジェクトの優先度	プロジェクト目標、上位目標はパキスタンの上位計画、その他関連政策との整合性はあるか	<ul style="list-style-type: none"> ・Vision 2015(2014年) 	<ul style="list-style-type: none"> ・プロジェクト報告書 ・C/Pと日本人専門家 ・上位の国家開発計画 	
	3		プロジェクト目標、上位目標は日本の対パキスタン援助政策との整合性はあるか	<ul style="list-style-type: none"> ・対パキスタン・イスラム共和国別援助方針(2018年) ・事業展開計画(2017年) 	<ul style="list-style-type: none"> ・関連文書のレビュー 	
	4	計画、戦略・アプローチの適切性	プロジェクトの当初計画やプロジェクトがとった実施体制(合同作業グループ)やアプローチ(モデルエリアの選定、OJTや研修を通じた職員の能力強化)は現場のニーズに即したもので、またNHAの橋梁維持管理計画の作成・強化手段として適切だったか	<ul style="list-style-type: none"> ・関係者のプロジェクトに対する認識、見解 	<ul style="list-style-type: none"> ・プロジェクト報告書 ・C/Pと日本人専門家 	
	5		日本の技術の優位性はあるか	<ul style="list-style-type: none"> ・日本の類似分野での協力実績 ・日本の技術に対する関係者の認識 	<ul style="list-style-type: none"> ・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュー 	
	有効性 (プロジェクト実施によりターゲットグループに便益がもたらされているか、プロジェクト目標が達成される見込みはあるか、それは成果の結果によりもたらされているのか)	6	プロジェクト目標の達成	プロジェクト目標が達成される見込みはあるか	<ul style="list-style-type: none"> ・実績表 	<ul style="list-style-type: none"> ・実績表
		7	成果(アウトプット)の貢献	プロジェクト目標の指標の変化は、プロジェクトのそれぞれの「成果が達成されつつある変化」によって引き起こされた結果と言えるか	<ul style="list-style-type: none"> ・成果の指標の実績 ・関係者の意見 	<ul style="list-style-type: none"> ・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュー ・実績
		8		プロジェクト目標の達成のために、PDMIには記載されていないが相当量の投入・活動を行い成果と呼べるようなものがあったか、それはPDMIに成果として記載すべきか	<ul style="list-style-type: none"> ・活動実施計画(Plan of Operation)と活動実績の対応表 ・関係者の意見 	<ul style="list-style-type: none"> ・プロジェクト報告書 ・C/Pと日本人専門家

付属資料5.2: 評価グリッド

有効性 (投入された資源量に見合った活動が実施されたか、プロジェクトは効率的であると言えるか)	9	「NHAがBMS実施のために十分な人員を配置する」と「NHAが年間維持管理計画で優先橋梁の維持管理や補修に十分な予算を措置する」の外部条件の影響はあるか	・カウンターパートの配置・異動 ・橋梁の維持管理費の推移	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ・実績表
	10	プロジェクト目標に至るまでの外部条件の影響	・PDMIに記載されていないが影響を与えた外部要因(促進・阻害要因)があるか	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ・実績表
	11	プロジェクトの有効性に影響を与えた貢献・阻害要因は何か	・プロジェクト内部の貢献・阻害要因の特定と根拠	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ・実績表
	12	成果(アウトプット)の達成	3つの成果(アウトプット)は達成されるか	・実績表	・実績表
	13	専門家派遣人数、専門分野、派遣時期は適切だったか	・派遣実績 ・関係者の意見	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ・実績表
	14	供与機材の種類、量、調達は適切だったか	・機材実績 ・機材利用状況 ・関係者の意見	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ・実績表
	15	(成果を達成する上での)日本側の投入の質、量、タイムングの観点からの効率性	・研修員の受け入れ人数、分野、研修内容、研修期間、受け入れ時期は適切だったか	・研修員受け入れ実績 ・関係者の意見	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ・実績表
	16	プロジェクトの予算、日本側のコスト負担は適正規模だったか	プロジェクトの予算、日本側のコスト負担は適正規模だったか	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ・実績表
	17	カウンターパートの人数、配置、能力は適切だったか	・C/P配置状況 ・関係者の意見	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ・実績表
	18	(活動を行う上での)パキスタン側の投入の質、量、タイムングの観点からの効率性	・執務室の規模、質、利便性に問題はなかったか	・執務室の現状 ・備品の配置 ・関係者の意見	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ・実績表
	19	プロジェクトの予算、パキスタン側のコスト負担は適切規模だったか	プロジェクトの予算、パキスタン側のコスト負担は適切規模だったか	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ・実績表

付属資料5.2: 評価グリッド

効率性 (投入された 資源量に 合わせた活動が 実施された か、プロジェク トは効率的で あると言える か)	20	成果(アウトプット)を達成するために十分な活動が計画され、タ イミングよく実施されているか	・活動実施計画(Plan of Operation)と 活動実績の対応表 ・関係者の意見	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ー ・実績表
	21	活動の貢献	・活動実施計画(Plan of Operation)と 活動実績の対応表 ・関係者の意見	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ー ・実績表
	22	成果(アウトプット)の達成のために、PDMIには記載されていないが 記載すべきだったか	・活動実施計画(Plan of Operation)と 活動実績の対応表 ・関係者の意見	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ー ・実績表
インパクト (プロジェクト の実施により 長期的・間接 的・波及効果 を生み出した か、波及効果 があるか、あ つあるか、あ つないは戻 りがあるか)	23	活動から成果に至るまでの外部条件「NHAが橋梁維持管理計 画の立案にあたりBMSの活用を継続する」、「NHAが橋梁管理 ユニット(BMU)を本部に設立する」、「NHAは段階的にBMSに関 する組織を構築し、継続的にBMSを実施する」は、影響を与え たか	・活動から成果に至るまでの外部条 件	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ー ・実績表
	24	活動から成果に至るまでの外 部条件の影響	・前提条件	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ー ・実績表
インパクト (プロジェクト の実施により 長期的・間接 的・波及効果 を生み出した か、波及効果 があるか、あ つあるか、あ つないは戻 りがあるか)	25	プロジェクトの効率性に影響を与えた貢献・阻害要因は何か	・プロジェクト内部の貢献・阻害要因 の特定と根拠	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ー ・実績表
	26	上位目標達成の見込み	・上位目標の指標の実績 ・関係者の意見	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ー ・実績表
	27	上位目標に至るまでの外部条 件の影響	・外部条件の特定と影響度予測	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ー ・実績表
	28	波及効果	・そのほかのインパクトの特定と影 響予測	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ー ・実績表
	29	予期しなかったマイナスの効果・影響はあったか	・負のインパクトの特定と影響予測	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ー ・実績表
30	上位目標の達成に影響を与えている貢献・阻害要因は何か、また今後予想される貢献・阻害 要因は何か	・プロジェクト内部の貢献・阻害要因 の特定と根拠	・プロジェクト報告書 ・C/Pと日本人専門家	・報告書のレビュー ・C/Pと専門家に対する質問票 ・関係者へのインタビュ ー ・実績表	

付属資料5.2:評価グリッド

<p>31</p> <p>持続性 (プロジェクトの 効果は協力 終了後も持続 していく見込 みはあるか)</p>	政策	プロジェクトの効果を持続あるいは拡大する取り組みが政策で担保されているか	<ul style="list-style-type: none"> 関係者の意見 政策面の持続が見込める根拠 	<ul style="list-style-type: none"> プロジェクト報告書 C/Pと日本人専門家 	<ul style="list-style-type: none"> 報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュ
	制度	プロジェクトで作成支援した橋梁点検・補強マニュアル類やフォーマット、研修教材、整備したBMSソフトウェアと橋梁点検データベースなどが活用される橋梁維持管理制度が十分整備されているか	<ul style="list-style-type: none"> 関係者の意見 制度面の持続が見込める根拠 	<ul style="list-style-type: none"> プロジェクト報告書 C/Pと日本人専門家 	<ul style="list-style-type: none"> 報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュ
	組織	BMUが引き続き業務を行う体制がNHA内で整っているか、プロジェクト終了後も見込まれるか	<ul style="list-style-type: none"> 関係者の意見 組織面の持続が見込める根拠 	<ul style="list-style-type: none"> プロジェクト報告書 C/Pと日本人専門家 	<ul style="list-style-type: none"> 報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュ
	財政	上記プロジェクトが支援した活動実施・継続に必要な予算がNHAで十分確保されているか 橋梁維持管理に必要な予算がNHAで見込まれるか	<ul style="list-style-type: none"> 関係者の意見 予算面の持続が見込める根拠 	<ul style="list-style-type: none"> プロジェクト報告書 C/Pと日本人専門家 	<ul style="list-style-type: none"> 報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュ
	技術	プロジェクトを通じて移転された橋梁維持管理に関する知見やノウハウは今後も持続する見込みがあるか、プロジェクトの協力範囲で引き続き技術移転が必要な事柄があるか	<ul style="list-style-type: none"> 関係者の意見 技術面の持続が見込める根拠 	<ul style="list-style-type: none"> プロジェクト報告書 C/Pと日本人専門家 	<ul style="list-style-type: none"> 報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュ
	持続性に影響を与えている貢献・阻害要因は何か 貢献・阻害要因は何か	持続性に影響を与えている貢献・阻害要因は何か、また今後、持続性に影響を与えるであろう貢献・阻害要因は何か	<ul style="list-style-type: none"> プロジェクト内部、外部の貢献・阻害要因の特定と根拠 	<ul style="list-style-type: none"> プロジェクト報告書 C/Pと日本人専門家 	<ul style="list-style-type: none"> 報告書のレビュー C/Pと専門家に対する質問票 関係者へのインタビュ
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