Subject: Minutes of WS1 to WS8.

Presentation on the following workshops under Bridge Management Capacity Development Project (BMCDP) had been held as per schedule stated below chaired by the Additional Chief Engineer, Bridge Management Wing, RHD, and Project Director, BMCDP.

WS1 (A1-WS1)	Date: November 11, 2015	Time : 10:00am – 12:50pm
WS2 (A2-WS1)	Date: December 13, 2015	Time : 10:30am – 12:00pm
WS3 (A2-WS2)	Date: December 13, 2015	Time : 12:30pm – 14:00pm
WS4 (A1-WS2)	Date: January 10, 2016	Time : 10:00am – 11:30am
WS5 (A2-WS3)	Date: January 10, 2016	Time : 11:45am – 13:15pm
WS6 (A1-WS3)	Date: January 17, 2016	Time : 10:15am – 13:15pm
WS7 (A1-WS4)	Date: January 17, 2016	Time : 13:45pm – 15:10pm
WS8 (A3-WS1)	Date: February 04, 2016	Time : 10:10am – 12:00pm

Discussion is opened in every session; Many points and suggestions had been pointed out by the core members in the meeting. Consultants explained some issues and agreed to incorporate the issues discussed in the workshops. Considering the discussions held in the workshops, the minutes had been prepared by the consultants and informed to all core members.

Now, to maintain the time schedule of the project it is required to prepare the "Draft Manuals" and the minutes of the workshops need to be approved as a reference to guide the preparation of "Draft Manuals".

After preparing "Draft Manuals" there is even scope to change/update any points in the "Draft Manuals" after its wide circulation to RHD officers.

So the minutes of the above workshops may be approved in order to prepare "Draft Manuals" for consideration of any change/updating after taking views and opinions of RHD officers.

Team Leader
BMCDP

12/04/16
(Md. Sohel Rana)
Sub-divisional Engineer, RHD
BMMS Sub-division
and
Core Member, BMCDP.

12/04/16
(Md. Shafiqul Islam)
Executive Engineer, RHD
BMMS Division
and
Core Member, BMCDP.

12.04.16
(A.K.M Manir Hossain Pathan)
Superintending Engineer, RHD
Planning & Data Circle
and
Core Member, BMCDP.

12/04/16
(Mohammed Shamim Al Mamun)
Executive Engineer, RHD
Habigonj Road Division
and
Core Member, BMCDP.

12.04.16
(Mohammad Saifuddin)
Executive Engineer, RHD
Comilla Road Division
and
Core Member, BMCDP.

22/8/16
(Najmul Hasan)
Executive Engineer, RHD
Rajshahi Road Division
and
Core Member, BMCDP.

22/8/16
(Md. Khaled Shaheed)
Executive Engineer, RHD
Barisal Road Division
and
Core Member, BMCDP.

12.04.16
(Md. Shafiul Azam)
Executive Engineer, RHD
Database Division
Sarak Bhaban Tejgaon, Dhaka.
and
Core Member, BMCDP.

12/5/16
(Parimal Bikash Sutradhar)
Additional Chief Engineer, RHD
Bridge Management Wing
and
Project Director, BMCDP.

তত্ত্বাবধায়ক প্রকৌশলী, সওজ
প্লানিং এন্ড ডাটা সার্কেল
সড়ক ভবন, ঢাকা।

17/05/16

Minutes of the Workshop 1 (A1-WS1)

-Bridge Management Capacity Development Project-

Date	November11, 2015 10:00-12:50
Venue	Chief Engineer Conference Room, RHD, Tejgaon, Dhaka.
Participants	List attached

1. **Opening Address** : Chairperson
   Self-introduction by the attended officials

2. **Welcome Address including Background of the Project**
   The background of the Project including project history up to now had been introduced by the Project Director and the JICA Program Advisor.

3. **Explanation of attached document REFERENCE: WS1 (A1-WS1) (REF:A1-WS1) "Towards the Establishment of Bridge Maintenance Cycle (BMC)".**

(1) Team Leader of the Consultant presented and explained the followings.

1) Significance of the Establishment of BMC.
2) Factors to be considered to establish BMC.
3) Current Status of the Bridges under RHD Jurisdiction as per present Documentation.
4) Categorization of Damage Conditions.
5) Basic concepts of BMC.
6) Bridge Inspection Methods.
7) Bridge soundness evaluation.
8) Setup of Short-Term Maintenance Plan.
9) Basic Concepts of Repair Works.
10) Economic calculation trial on Preventive Maintenance.
11) Establishment of Medium-Term & Long-Term Maintenance Plan.

(2) Elaboration by JICA Team Leader and discussions on above mentioned Topics of REF: A1-WS1:

1) Significance of the Establishment of BMC (REF:A1-WS1, Article: 1)
   - O-P-D-C-A (Observe-Plan-Do-Check-Act) is sometimes used instead of P-D-C-A (Plan-Do-Check-Act).

2) Factors to be considered to establish BMC (REF:A1-WS1, Article: 1)
   - 4 factors are fundamental

i . Inspection

ii. Setup of Bridge Maintenance System (BMS)

iii. Human Development to run BMS

iv. Secure required budget for BMS

- This project will cover first 3.

3) Current Status of the Bridges under RHD Jurisdiction as per present Documentation (REF:A1-WS1, Article: 2-2, Article: 2-4)

[Comments on the existing Bridge Maintenance Management System (BMMS)]

[Technical terminology]

- "Culvert" is not clearly defined; Additional Project Director proposed that it should be defined clearly in the new Inspection Manual.
- "RCC" means Reinforced Cement Concrete, however Reinforced Concrete "RC" is more common internationally.
- "Steel Beam" is same as "Steel Girder".
- "Bailey" is characteristic steel truss bridge type and already commonly used.

[Types of Defective Bridges]

- Types of Bridges of damage level 'D' (Table 2-6 of attached REF:A1-WS1, page-7) on Zilla Roads are both RC and Steel bridges, separate table for RC and Steel bridges will be more helpful.

4) Categorization of Damage Conditions

[Classification of Defects]

- RHD follows only 8 types of defects where Japan follows 26 types (REF:A1-WS1, Appendix-1); defect types are in need of revision. More types of defects may be seen in reality.
- The Classification of Defects will be discussed in the next Workshop for Bridge Inspection Manual.

[Condition Category]

- Criteria for damage classes (Table 3-2 of attached REF:A1-WS1, page-15) are not clear in existing RHD Bridge Condition Survey Manual. Criteria for damage score are in need to be revised and clearly defined.
- The Condition Category after Evaluation should be discussed in the next Workshop for Bridge Evaluation Manual.

5) Basic concepts of Bridge Management Cycle (BMC) (REF:A1-WS1, Article: 3-1)

- RHD needs to follow a certain standard for the best Output of the BMC.
- Providing all the inputs of the BMC in the right time is very important for a well practiced BMC.

6) Bridge Inspection Methods (REF:A1-WS1, Article: 3-2)

- No specific time cycle for Bridge Inspection is followed by RHD.
- Culverts are often excluded from the inspection.
- Current inspection method of RHD is not able to get the exact data of the damages due to lack of modern equipments and technology.
- Installation of modern equipments is desirable but shortage of fund prevents to import inspection vehicle or any other modern sophisticated instruments.
- RHD need more skilled human resource for bridge inspection.

7) Bridge soundness evaluation (REF:A1-WS1, Article: 3-3)

- Authentic Bridge condition evaluation is very important to get the required budget.
- Bridge Deterioration Curves are in use to evaluate the bridge condition in many countries of the world; but not in RHD.
- Database of RHD is in need to be updated for the purpose of developing a Bridge Deterioration Curve.
- The Assumption of Deterioration Curve depends on different factors. The Problem will be discussed in the Bridge Evaluation Workshop.

8) Setup of Short-Term Maintenance Plan (REF:A1-WS1, Article: 3-4)

- Short-Term maintenance plan is the maintenance plan for 5 years.
- It helps to decrease the deterioration rate of the bridges and keeps the bridges usable for a longer period before major repair or replacement.

9) Basic Concepts of Repair Works (REF:A1-WS1, Article: 3-5)

[Technical terminology]

- "Stop Hole" is the hole created at the end of the crack of a steel structure to stop its further propagation; it will be discussed in detail on the Repair Workshop.
- "Electric Protection" which is actually "Cathodic Protection" is a

protection system to the reinforcement of concrete to save it from corrosion; it will be discussed in detail on the Repair Workshop too.

10) Economic calculation trial on Preventive Maintenance

- Data presented on Article 4-2 of REF:A1-WS1(page-20) about the costing of bridge repair are very old.

[Finance Problem]

- Budget allocation against demand is only 16% in Bangladesh at present; proper funding is a requisite for the proper maintenance.
- More funding is in need to run the system in a better way.

11) Establishment of Medium-Term & Long-Term Maintenance Plan (REF:A1-WS1, Article: 4)

- Medium-Term maintenance plan is the maintenance plan for 20 years.
- Long-Term maintenance plan is the maintenance plan for 50 years.

[Development of up to date Database]

- For Medium-Term and Long-Term maintenance plan, an up to date database is the most important element.

[Specialist Trainee]

- To Skill-up Specialists for Bridge Maintenance is very important.
- Skill up process will be done through many workshops and training programs.
- RHD personnel will be trained up for the proper use of new BMS.

[Execution of Bridge Maintenance Cycle]

- Proper execution of the Bridge Maintenance Cycle (BMC) is required to be followed strictly.

4. Next WS Schedule

Next Workshops for the Bridge Inspection Manual WS2 (A2-WS1) and Bridge Evaluation Manual WS3 (A2-WS2) are scheduled to be on **December 13th 2015.**

The Chairperson ended the meeting with thanks to all for their fruitful discussions and wished the success of the project within the scheduled time.

Work Shop-1-1 Attendance Sheet

Nov,11,2015

	Name	Belongings	Signature
1		Executive Engineer, RHD, Mymensingh Road Division	
2		Executive Engineer, RHD Road Division, Rajshahi	
3		Executive Engineer. RHD. Road Division, Comilla	
4		Executive Engineer RHD. Barisal Road Divisn	
5		Executive Engineer, BMMS, Division	
6		Executive Engineer. Database Div, RHD	
7		Sub-divisional Engineer. BMMS sub-division, RHD	
8		Addl. Chief Engineer, RHD Bridge Management Wing	
9		SE. RHD. PIU cell	
10		Advisor (Transport), JICA Bangladesh Office	
11		JICA Expert in RHD	
12		JICA Consultant, IBS	
13		JICA Consultant, OCG	
14		JICA Consultant, IBSI	
15		INTERPRETER AND COORDINATOR OF JICA.	
16			
17			
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Minutes of the Workshop2 (A2-WS1)

-Bridge Management Capacity Development Project-

Date	December 13, 2015 10:30-12:00
Venue	RHD Training Center, Paikpara, Darussalam Road, Mirpur-1, Dhaka.
Participants	List attached

1. **Opening Address** : Chairperson

2. **Welcome Address**

   The background and goals of the Project including the importance for upgrading the Bridge Inspection Manual and the necessity of developing Bridge Maintenance Management System in RHD with the help of new technologies, techniques, procedures, machineries and instruments had been addressed in welcoming speech by the Project Director.

3. **Approval of Minutes of Workshop 1 (A1-WS1)**

   Minutes of WS1 (A1-WS1) held on 11 November 2015 is approved.

4. **Explanation of Reference: Workshop 2 (A2-WS1) [REF: A2-WS1] "Development of Bridge Inspection Manual".**

A. JICA Consultant presented and explained the followings.

   a) Present status of Bridge Inspection in RHD
   b) Major Contents of Bridge Inspection Manual
      - Significance of Bridge Inspection
      - Frequency of Bridge Inspection
      - Types of defects
   c) Periodic Inspection Procedure
      - Inspection Planning and Preparation of Inspection
      - Performing the Inspection
   d) Qualification of Bridge Inspector
   e) Record of Inspection
   f) Safety measures during Inspection
   g) Training of the Bridge Inspectors

   As the first step, fundamental elements of the Bridge Inspection Manual had been introduced based on the experiences of Bridge Inspection in Japan. Necessary upgradations/modifications for these information presented would be accommodated based on the experiences of Bridge Inspection in RHD.

B. Discussions on above mentioned Topics

a) Present status of Bridge Inspection in RHD

- Lack of in-house trained skilled staff, modern equipment, technologies, instruments, standardized methods and systems are the major problems.
- After reviewing and analyzing the contents of existing manuals of RHD, updated Bridge Inspection Manual will be prepared and established.

b) Major Contents of Bridge Inspection Manual

- A new feature in the upcoming manual-

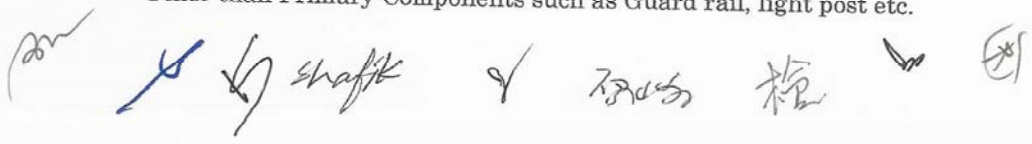
  "Element Level Inspection" is required for remedial action of bridge defects and effective Bridge Management System (BMS). This issue will be presented more elaborately in the next workshop for Bridge Inspection Manual. To identify each location of elements "Element Numbering System" for Element Level Inspection is necessary by which a unique identity (such as numbering Girder-1 between Abutment-1 and Pier-1) is given to every element of the bridge before execution of inspection. And defects are recorded against each element.
- Significance of Bridge Inspection
  - Bridge Inspection is the most important step of Bridge Management Cycle.
  - Efficiency of the Bridge Maintenance Management Cycle (BMMC) depends on the quality of the Inspection.
- Frequency of Bridge Inspection
  - This issue will be discussed later.
- Types of defects
  - ✧ 26 types of defects and rating condition state ("a" to "e")
    - Types of 26 defects are attached in the appendix-1 of Reference: A1-WS1.More detailed discussions will be done later.
    - Defects of concrete include cracking, spalling/exposed rebar, delamination, water leakage/efflorescence, falling out and cracking of deck slab etc.
    - Cracks are more dangerous in PC structures than RC structures.
    - Ratings of severity are classified from "a" to "e". Some defects rated with only 'a' & 'e' mean 'yes/no' defects.
  - ✧ Even if the feature of defects are same, its location/component (primary or secondary), and future progress of the defect defines the severity of the condition. Causes and future progress will be discussed in evaluation part.

Primary Components

– Components related to structural safety such as Girder, Pier etc.

Secondary Components

– Other than Primary Components such as Guard rail, light post etc.



- RHD proposed to include all kinds of possible defects in PC, RC and Steel Bridges in the new Bridge Inspection Manual.
- The followings are the mostly encountered issues in RHD

[Culverts]

- RC Culverts are numerous in Bangladesh; defects of culverts like cracking, spalling, exposed rebar etc. should be described adequately. Defects category applied to box culvert is same as RC structures described in the manual.
- 20+ years old culverts that wing wall and abutment were not monolithic cast and the gap between those structures is increased. Tilting and sliding of wing wall and abutment are visible in different region of Bangladesh. Discussion on this type of defect is necessary.
- The type of this defect is "settlement/tilt/movement at side wall" (REF: A2-WS1, Table: Types of Defects, page-25) and the additional note in the inspection report is "separation between abutment and side wall is identified". Inspector should record the defect element by element, evaluator will decide if the defects affect the whole structure and the damage condition of the whole structure. Remedial measures are to be discussed in Rehabilitation Part.

[Weathering Steel Structure]

- The components and elements to be inspected and types of defects of weathering steel structures are the same as those of "Steel Girder Bridges".
- Specific points like defect types, features etc. are to be noted in the manual.

[Scouring]

- Scouring should be more emphasized and described in the new Inspection Manual.
- If scouring is seen in visual inspection, it must be recorded with the rating. In case of Perennial River, measuring the depth of river bed can indicate the condition of scouring. Use of SONAR (Sound Navigation and Ranging) instruments is also good option in this case.
- Abnormal deflection, side sway or vibration can happen as a result of scouring; if these defects are identified, "Detailed Inspection" must be prescribed.

[Abnormal Noise/Vibration]

- Special attention on abnormal noise/vibration is required.
- Location of generation of these defects shall be noted. Regarding abnormal noise, the criteria in the manual is "Yes/No" with rating of defects judged by qualified inspector. Regarding abnormal vibration, the method of detailed inspection is to be included in the manual.

- If the location of source can't be found "Tried but Source not Found" should be commented and "Detail Inspection" should be prescribed if evaluation demands.

[Expansion Joints and Bearings]

- RHD is facing most of the problems with the expansion joints, bearings and pre-stressing anchorage system. Practical demonstration during inspection of expansion joints, bearings and pre-stressing anchorage system are required very much.

c) Periodic Inspection Procedures

- Close Up visual Inspection is very important.
- A systematic standard procedure should be established prior to visit the site.
- Inspection planning and preparation of inspection
  - Review of the Bridge Inspection and Rehabilitation history before inspection.
  - Take necessary arrangements such as manage required instruments to reach the bridge for close up visual inspection.
  - To make sure if the required tools and safety measures are taken.
- Performing the Inspection
  - Bring a copy of last inspection report from Bridge Database to site.
  - No portion should be overlooked.
  - Numbering of Bridge Elements.
  - Photographs of the defects should be taken from different angles.
  - Defects should be marked by chalk for better identification.
- Standard inspection methods should be developed for best management of bridge assets along with suggestions for the requirement of RHD's manpower and equipment to establish that standard. All the instruments required for a standard bridge inspection should be described in the Manual.
- Example photographs of all types of defects prevailing in Bangladesh are preferable to be included in the manual. Example photographs should represent the defects clearly.
- Core members are requested to bring forward the photographs of defects they have encountered earlier or at present.

d) Qualification of Bridge Inspector

- Should have proper knowledge, training and experience on Bridge Inspection.
- Should have the mental and physical strength to inspect potentially hazardous spots of the bridge.
- The role of Inspector is to identify all defects correctly. Evaluator requires high engineering judgment for the remedial actions to be taken for identified defects and their extent by considering the location, future progress and importance for

remedial action. For this reason Japan employs separate teams for inspection and evaluation, RHD is appreciated to follow the same practice with study cases.

- Even if the defects are of same type and extent (inspection i.e. identifying the defects), the seriousness (evaluation category for remedial action) depends on the location/component, defected feature and future progress.

e) Record of Inspection

- Photograph of the whole bridge shall be taken from side and approach road.
- Close up as well as wide angle photos of every defect must be taken with the identification board.
- Inspection data should be recorded in specified form with necessary photos and field sketches regarding cracking, delamination, spalling of concrete, cracks and deformation in steel, water leakage; and detailed description in case of abnormal noise/vibration which cannot be covered in photographs.
- Detail procedure will be described in the Manual.

f) Safety measures during Inspection

- A bridge inspection always involves safety risk.
- Lack of safety measures can be resulted into major injuries, even death.
- All the required safety measures will be described in detail in the Manual.

g) Training of Bridge Inspectors

- Proper training on bridge inspection is essential to increase the expertise of Bridge Inspectors.
- Number of Bridge Inspectors can be increased by providing training on regular basis.

4. Next Workshop Schedule

Next Workshop for the Bridge Evaluation Manual is scheduled to beat **12:30 PM** on **December 13th 2015.**

The Chairperson ended the meeting with thanks to all for their fruitful discussions and wished the success of the project within the scheduled time.

Date : Dec 13,2015

Peoples Republic of Bangladesh / Japan International Cooperation Agency (JICA)

Bridge Management Capacity Development Project

Workshop 2 (A2-WS1)

ATTENDANCE SHEET

	Name	Belongings	Signature
1		ADDL. CHIEF ENGINEER, RHD BRIDGE MANAGEMENT WING	
2		JICA expert	
3		JICA Project Team	
4		〃	
5		〃	
6		〃	
7		EE, RHD, BMMS Div.	
8		EE, RHD Training Center	
9		EE, RHD, RAJSHAH ROAD DIVISION	
10		EE, RHD, Database Division	
11		EE, RHD, Road Division, Mymensing.	
12		EE, RHD, comilla Road Divisi Comilla	
13		EE, RHD. Barisal Road Div.	
14		SE. RHD	
15		SDE, RHD, BMMS Sub-division	
16		JICA Project Team	
17		Bridge Engr., JICA Team, BMCDP	
18		JICA Project Team.	
19			
20			

Minutes of the Workshop3 (A2-WS2)

-Bridge Management Capacity Development Project-

Date	December 13, 2015 12:30-14:00
Venue	RHD Training Center, Paikpara, Darussalam Road, Mirpur-1, Dhaka.
Participants	List attached

1. **Opening Address** : Chairperson
   Self-introduction by the attended officials

2. **Welcome Address**
   The goals of the Project including the importance for upgrading the Bridge Evaluation Manual had been addressed in welcoming speech by the Project Director.

3. **Explanation of Reference: Workshop3 (A2-WS2) [REF: WS3 (A2-WS2) "Development of Bridge Evaluation Manual".**

A. JICA Consultants presented and explained the followings.
   a) Purpose of Bridge Evaluation.
   b) Brief review of Bridge Evaluation Method in practice by RHD.
   c) Cases of emergency damage.
   d) Detailed survey of Bridges.
   e) Detail survey methods of concrete and reinforcement deterioration.
      (i) Electromagnetic Radar Method.
      (ii) Rebound Hammer Method.
      (iii) Carbonation Depth Method.
      (iv) Chloride Content Method.
   f) Evaluation for Load Carrying Capacity.
   g) Monitoring of Vibration.

B. Discussions on above mentioned Topics

   a) The purpose of Bridge Evaluation
      - The main purpose of Bridge Evaluation is to determine the soundness/health condition of a bridge and priority order of rehabilitation.

   b) Brief review of Bridge Evaluation Method in practice by RHD
      - Damage score range of 0~500 is very wide and used seldom internationally.
      - Only the description of deterioration is available but no explanation with photo and inspection sheet.

- No provision for indicating cause, extent or severity of the defects.
- No option is available to indicate the emergency situation.
- Do not indicate the time to take necessary rehabilitation measures.
- Therefore, the present Bridge Evaluation Method needs to be updated.
- Adoption of new classification system (I,II,III,IV) may create confusion, because A,B,C,D system is already well known in Bangladesh.
- It is better to keep the current classification system (A,B,C,D) and revise the scoring criteria and weightage of the defects.
- Total score 100 instead of 500 is recommended for the planned BMS.

c) Cases of emergency damage situation

- Emergency situation is such situation when severe structural damage occurs due to catastrophic disaster or failure of any structural element of the bridge.
- Safety of vehicles and pedestrians are at such risk that accident could occur at any time.
- Abnormal sound at bridge end zone is such emergency situation that detailed inspection should be done as soon as possible.
- If emergency situation prevails the bridge should be kept out of service until adequate safety is ensured. Examples will be described in the Evaluation Manual.

d) Detailed survey of Bridge

[Technical terminology]

- "**Delamination**" is a symptom of steel corrosion in reinforced concrete. If steel is corroded, concrete cover is spalling due to the growth of steel rust volume. As the result, delamination (separation) is occur around (above and below)the reinforcing steel.

- "**Delamination Survey**" is a method of survey where infrared instruments are used to identify the intensity and extent of the delaminated area under the top cover of concrete. Finding the delamination at the early ages is important for the preventive maintenance.

e) Detail survey methods of concrete and reinforcement deterioration

- Different methods are being followed worldwide for detailed survey of bridges. Most commonly practiced methods are described as follows-

(i) Electromagnetic Radar Method (Covermeter Method)

- Electromagnetic Radar is used to identify the location of the rebar in the

concrete which is preliminary to some tests like extraction of cores, ultrasonic pulse velocity measurement etc.

- Identify the location of buried ferromagnetic objects e.g. water pipes, steel joists, lighting conduits etc.

(ii) Rebound Hammer Method

- Rebound Hammer is used to measure the compressive strength of concrete as non-destructive Measuring Method.
- It is essential to maintain the perpendicularity of the hammer during the test.

(iii) Carbonation Depth Method

- Depth of Carbonation indicates the vulnerability of concrete.
- It is measured by Core Extraction and Drill Powder Method. This type of instrument will be bought for this project.
- Drill Powder Method is preferable at present days as it is easier to perform than Core Extraction.
- High Carbonation Depth means deterioration is high and the concrete is more vulnerable than earlier stage.

(iv) Chloride Content Method

- Chloride ion analysis determines the chloride ion distribution in the concrete.
- Cracks with rust stain are the primary symptoms of Chloride damage.
- Chloride damage is similar to cancer, when rebar exposure happens, the structure is beyond cure for a long term; so such rehabilitation measures are taken which keep the bridge in service until a new bridge is built.
- In case of Chloride Damage, the widely used rehabilitation method is use of Fiber Reinforced Polymer (FRP) sheets. The durability, cost and advantages etc. will be discussed in detail in the workshops for Rehabilitation and Cost Estimation.

f) Evaluation for Physical Deterioration and Load Carrying Capacity

- Most of problems of RHD bridges are Physical Deterioration. The problems will be discussed more elaborately in the next Workshop for Evaluation.
- Which classes of vehicles (load classes) should be permitted and which should be prohibited from using the bridge under the current damage situation is very important.

- If overloaded vehicles pass over the bridge in large numbers then the bridge will collapse more rapidly and catastrophically.

g) Monitoring of Vibration

- Steel bridges are more prone to vibration than concrete bridges.
- In case of concrete bridges, if the concrete is so damaged that usual frequency of bridge has been changed then it shows abnormal vibration.
- If the measured E-moduli of the bridge is reduced, it is assumed the serious damage in the structure, so we need the detailed inspection of bridge as soon as possible. To identify the change, we must know the normal E-moduli, measured in the early age of the bridge or the proposed E-moduli in the bridge design.
- There are many other reasons of vibration. So it needs serious attention.
- If abnormal vibration is identified then "Need of Detailed Inspection" should be prescribed. Detail discussion on this topic will be held on next workshop.

4. Next WS Schedule

Next Workshop for the Problems/Issues on Bridge Maintenance Cycle {WS4 (A1-WS2)} is scheduled to be on **January 10th 2016**.

The Chairperson ended the meeting with thanks to all for their fruitful discussions and wished the success of the project within the scheduled time.

Date : Dec 13,2015

Peoples Republic of Bangladesh / Japan International Cooperation Agency (JICA)

Bridge Management Capacity Development Project

Workshop 3 (A2-WS2)

ATTENDANCE SHEET

	Name	Belongings	Signature
1		Addl. chief Engineer, RHD Bridge Management Wing.	
2		JICA expert	
3		SE. RHD.	
4		EE, RHD, BMMS Div.	
5		EE, RHD Training Centre	
6		EE, RHD, RAJSHAHI ROAD DIV	
7		EE, RHD, Data base	
8		EE, RHD, Mymensingh Road Division.	
9		EE, RHD, Comilla Road Division, Comilla	
10		EE, RHD, Barisal Road Div.	
11		SDE, RHD, BMMS Sub-division	
12		JICA project team	
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Minutes of the Workshop4 (A1-WS2)

-Bridge Management Capacity Development Project-

Date	January 10, 2016 10:00-11:30
Venue	Chief Engineer's Conference Room, RHD, Sarak Bhaban, Tejgaon.
Chaired by	Mr. Parimal Bikash Sutradhar Additional Chief Engineer, Bridge Management Wing, RHD Project Director, Bridge Management Capacity Development Project.
Participants	Attendance Sheet attached.

1. **Opening Address:** The goals of the Project including the importance for developing a standard institutional framework for bridge maintenance management, bridge inspection/evaluation and rehabilitation manuals had been addressed in the opening speech by the Chairperson.

2. **Explanation of REF: WS4 (A1-WS2) - "Maintenance Work Implementation, Estimate of Annual Work Volume, Necessity & Securing Human Resources".**

A. Team Leader of the Consultants Mr. Yoshimitsu HIYAMA presented and explained the followings.

a) Bridge Inspection Work Volume
   i. Bridge Inspection Frequency
   ii. Composition of Inspection Team
   iii. Estimated Work Volume and Cost of Inspection Work

b) Rehabilitation Work Volume
   i. Present Condition of the Bridges and Culverts under RHD
   ii. Estimated Rehabilitation Work Volume
   iii. Estimated Cost of Rehabilitation Work

c) Concept of Preventive Maintenance

d) Necessity for Introduction of Maintenance Control Level

B. Summary of discussions on above mentioned topics

a) Bridge Inspection Work Volume

- Work volume varies according to number of bridges, frequency of inspection, type of inspection and composition of inspection team.

i. Bridge Inspection Frequency

- According to BCS Manual 2014, frequency of BCS-1&2 (Annual Bridge Condition Survey) is 1(One) year for all category (A,B,C,D) of bridges; frequency of BCS-3 (Preliminary Rehabilitation Assessment Survey) is 2/3

years for category-A, 2 (two) years for category-B and 1(one) years for category-C&D; frequency of Principal Bridge Inspection (PBI) is 5 years for category-A&B, 2 years for category-C and 1(One) year for category-D bridges.

- Frequency of Inspection must be prescribed in such a way that the quality and schedule of the inspection can be maintained and the bridges are getting inspected at regular interval so that timely remedial action can be taken.

ii. Composition of Inspection Team

- Composition of Inspection Team is very important issue. Consultant's proposals are as follows.
- The chief of the Inspection Team is the Senior Evaluator. An Executive Engineer should hold the post. S/He doesn't have to go to field Inspection unless it is very critical.
- 3 Evaluators (Sub Divisional Engineer) under Senior Evaluator will lead 3 field inspection teams. S/He should join the field inspection work.
- Assistant Engineers can be deployed as Senior Field Inspector and Sub Assistant Engineer should be Field Inspector.
- Every Field Inspection team will have 1 Assistant Inspector (SAE), 2 skilled Workers, 1 Driver and required no. of traffic security guards as supporting staff.
- Core Members had different opinions about the composition of Inspection Team. It will be discussed elaborately in the next workshop for development of standard institutional framework for bridge maintenance management.

iii. Estimated Work Volume and Cost of Inspection Work

- On an average 1(One) Field Inspection Team can inspect 3 bridges a day.
- Considering the number of bridges and culverts under RHD's jurisdiction, it is almost impossible to conduct such huge load of inspection work by existing in-house human resource every year.
- If outsourced, RHD has to spend around 3.08 crore Taka per year with a total cost of 15.40 crore Taka in the next 5(five) years in order to inspect all bridges and culverts. (Reference: REF:WS4(A1-WS2) Table 1-5).

b) Rehabilitation Work Volume

i. Present Condition Of Bridges and Culverts under RHD

- At present the condition of RHD's bridges and culverts are-
  - Category A: 12331Nos (67.5%)
  - Category B: 2341Nos (12.8%)
  - Category C: 2821Nos (15.5%)

- Category D: 765Nos (4.2%)

(Source: Culverts & Arch Masonry: 2004 Survey Data, Bridges: 2013 Survey Data by EBBIP)

- According to BMMS, 82 bridges have been selected for replacement.

ii. Estimated Rehabilitation Work Volume

- 2341Nos (721 bridges + 1560 culverts, total length-24721m) of category B bridges and culverts need minor repair. [Reference: REF: WS4(A1-WS2), Table2-4]
- 2821Nos (1198 bridges + 1623 culverts, total length-52604m) of category C and 606Nos (312 bridges + 294 culverts, total length-9302m) of category D (total-3427Nos, 63906m) need major repair.
- 159Nos (82 bridges + 77 culverts, total length-2441m) of category D need replacement.
- These data presented here are from existing BMMS. After the update of BMMS data, these numbers could be changed.

iii. Estimated Cost of Rehabilitation Work

- Total 3222.2 crore taka is needed to do all the repair and replacement works mentioned above.(Reference: REF:WS4(A1-WS2) Table 2-3, Table 2-4)
- This 3222.2 crore taka is the initial cost of shifting from symptomatic maintenance approach to preventive maintenance approach; after the establishment of preventive maintenance approach, the cost for routine and periodic maintenance in every year will be lower than the present symptomatic maintenance cost.
- Considering a 5-year plan for establishing preventive maintenance approach, over 640 crore taka is required per year for repair and replacement, which is more than 5 times of current PMP (Bridge) budget.

c) Concept of Preventive Maintenance

- Preventive maintenance is very important and effective system for reducing the life cycle cost of a bridge. It costs much less than currently practiced Symptomatic Maintenance system.
- This system maintains the desired level of soundness through preventive measures in right time before the damage crosses a certain level.
- Preventive Maintenance system has four control levels, described as follows.

  - Control Level–A always maintains highest level of soundness through frequent repair works at low cost just after the minor damage occurs.
  - Control Level–B maintains relatively high level of soundness through

repeating repair works at low cost after the damage occurs; in this case both the interval between two consecutive repair works and damage level are higher than control Level–A.

- Control Level–C maintains medium level of soundness through preventive measures at slightly higher cost when the damage reaches more serious level than Level–B.

- Control Level–D maintains the minimum level of soundness with minimum effort through leaving bridges unattended until it reaches renewal threshold.

d) Necessity of Introduction of Maintenance Control level

- Maintenance control level helps to get the optimum output from Bridge Maintenance Management Cycle.
- It helps to keep the most important bridges at most sound condition which is very important for countrywide communication and national economy.
- Control Level–A can be assigned to the most important roads of the country (as example: N1~N8); and so on according to the importance of the road.

3. **Next WS Schedule**

Next Workshop on some Case Studies of Detailed Inspection is scheduled to be at **12:30 PM** on **January 10, 2016**.

The Chairperson ended the workshop with thanks to all for their fruitful discussions and wished the success of the project within the scheduled time.

Bridge Management Capacity Development Project
Workshop 4 (A1 - WS2)

10/01/2016

Name	Belonging	Signature
	ACE, BMW, RHD & PD, BMCDP	
	SE. PD circle APD BMCDP	
	JICA Expert in RHD	
	JICA Team Member	
	JICA Team Member	
	EE, BMMS, RHD	
	EE, RHD, Barisal Road Division	
	EE, RHD, Comilla Road Division	
	EE, RHD, RAJSHAHI Road Division	
	EE, RHD, Database Div	
	Consultant Team Leader	
	Consultant * Team	
	Consultant team	
	Consultant Team	
	EE, RHD	

Minutes of the Workshop5 (A2-WS3)

-Bridge Management Capacity Development Project-

Date	January 10, 2016 11:45-13:15
Venue	Chief Engineer's Conference Room, RHD, Sarak Bhaban, Tejgaon.
Chairperson	Mr. Parimal Bikash Sutradhar Additional Chief Engineer, Bridge Management Wing, RHD Project Director, Bridge Management Capacity Development Project.
Participants	Attendance sheet attached.

1. **Opening Address:** The goals of the Project including the importance for developing standard bridge inspection/evaluation and rehabilitation manuals, detailed investigation methods of defected bridges to find out the actual cause of defect and to select appropriate rehabilitation method had been addressed by the Project Director.

2. **Explanation of Reference: WS5 (A2-WS3) "Case Study of Detailed Investigation of Load Capacity"**

A. JICA Consultant Mr. Kenichi HIDA presented and explained the followings.

a) Case study 1: Soundness estimation of steel bridge by vibration measurement and stress frequency measurement.

b) Case study 2: Load carrying capacity investigation of Pre-stressed Concrete (PC) Bridge due to chloride attack in coastal environment.

c) Case study 3: Existing stress measurement of the PC bridges by slit stress relief technique using the optical full-field measurement method.

B. Discussions on above mentioned topics

a) Case study 1: Soundness investigation of steel bridge by vibration measurement and stress frequency measurement

- In this Case, a crack in steel was found at the gusset plate weld by visual inspection and confirmed by Magnetic Particle Inspection.
- Dynamic load test was done by allowing a 25 ton rough terrain crane to pass. In this test, the strain of the lower flange and gusset plate was measured; from which stress state of main girder was determined.
- Stress Frequency measurement confirmed the amplitude of the stress by the traffic load; which helped to presume the fatigue life.
- The mode of vibration was measured by accelerometer and Eigen-frequency value analysis was performed to determine the cause of vibration.
- All the analysis showed that the crack occurred due to stress concentration at the gusset plate and the cause of abnormal vibration was lack of stiffness.

- RC and PC bridges can be analyzed by this method too.
- Stress-Endurance Diagram (S-N curve) for steel was established by Japan Steel Structure Society. S-N curve for RC and PC structures was established later by JSCE (Japan Society of Civil Engineers).
- Selection criteria of the Method of Measurement for Investigation of Load carrying capacity will be answered by the consultant later.
- RHD can do Vibration measurement and Eigen-frequency value analysis whenever they have the required equipments or by Outsourcing. FEM analysis can be done with the help of any Finite Element Analysis Software.

b) Case study 2: Load carrying capacity investigation of Pre-stressed Concrete (PC) Bridge due to chloride attack in coastal environment.

- In this Case, the defects of the bridge were spalling of concrete, corroded rebar, broken PC tendon etc.
- Slot stress method was used to measure the stress on concrete and rebar cutting was used to measure the stress of the lower flange.
- The maximum loss of pre-stressing force was found about 30%.
- The bridge was strengthened by additional support pier method.

c) Case study 3: Existing stress measurement of the PC bridges by slit stress relief technique using the optical full-field measurement method.

- In this Case, Two images have been taken from the testing point of the girder by the scanner before and after the cutting of slit.
- After the slit is cut, liberating strain occurs and distribution of the liberating strain is obtained by comparing the two images (before and after the slit cut) taken by the scanner. Digital Image Correlation Method (DICM) was used for the comparison.
- Existing stress condition was presumed by analyzing the measured values with a two dimensional FEM analysis model. Stress-Strain relationship was used to calculate the stress.
- Slit Stress Relief technique is a minute destructive method.
- Consultant will answer unresolved questions from Core Members in workshop 6.

3. **Next WS Schedule**

Next Workshop on the Pending Issues of Previous Workshops is scheduled to be on **January 17, 2016.**

The Chairperson ended the workshop with thanks to all for their fruitful discussions and wished the success of the project within the scheduled time.

Bridge Management Capacity Development Project
Workshop 5 (A2-WS3)

10/01/2016

Name	Belonging	Signature
	ACE, BMW, RHD & PD, BMCDP	
	SE. PD circle, TPD BMCDP	
	JICA Expert in RHD	
	JICA Team Member	
	JICA Team Member	
	EE, BMMS, RHD	
	EE, RHD, Barisal Road Division	
	EE, RHD. Comilla Road Division	
	EE, RHD, RAJSHAHI Road Division.	
	EE, RHD, Database Div	
	Consultant Team Leader	
	Consultant & team	
	Consultant team	
	Consultant Team	

Minutes of the Workshop6 (A1-WS3)

-Bridge Management Capacity Development Project-

Date	January 17, 2016 10:15-13:15
Venue	Chief Engineer's Conference Room, RHD, Sarak Bhaban, Tejgaon.
Chaired by	Mr. Parimal Bikash Sutradhar Additional Chief Engineer, Bridge Management Wing, RHD Project Director, Bridge Management Capacity Development Project.
Participants	Attendance sheet attached

1. **Opening Address:** The goals of the Project including the necessity of clarification and explanation of unresolved issues of previous workshops for the desired progress of the project had been addressed in welcoming speech by the Project Director.

2. **Explanation of Reference: WS6 (A1-WS3)-1 "Consideration Regarding Pending Items"**

A. Team Leader of the Consultants Mr. Yoshimitsu HIYAMA presented and explained the followings.

a) Necessity of renewal of the Bridge Condition Survey Manual (2014)
   i. Limitations of Bridge Condition Survey Manual (2014).
   ii. Equipments required for Detailed Survey of the Bridge.

b) Classification of defects into 26 types
   i. Reasons of classifying into 26 types.
   ii. Detailed description of 26 types of defects.

c) Revision of damage scores

d) Necessity of developing new BMS
   i. Limitations of existing BMMS.
   iii. Features to be added in the new BMS.

B. Summary of discussions on above mentioned topics

a) Necessity of renewal of the Bridge Condition Survey Manual (2014)
   i. Limitations of Bridge Condition Survey Manual (2014)
      - Only 8 types of defect are listed, which did not cover all types of defect found in reality on the bridges and culverts under the jurisdiction of RHD.
      - Rating of defect is only 'major' or 'minor' which is not enough to identify the condition of the defect.
      - Numbering of element is not available; so it is impossible to point out the exact location of defect among the several similar elements.

- No demonstration is available about how to conduct the inspection work.
- No instruction is available about the use of specific instruments as required.
- New manual will be free of these limitations and will work as up-to-date guidelines for working in Bridge Maintenance Management System (BMMS).

ii. Equipments required for the Detailed Investigation of the Bridge

- The equipments required for Detailed Investigation are listed in Table-3 of the reference document (Reference: WS6 (A1-WS3)) of the workshop.
- 2(two) RC radars (Rebar Detectors), 2(two) Concrete Core Cutters, 2(two) Concrete Drills and Salinity Measuring instruments along with reagent for chemical tests will be provided in this project to RHD by Consultants Team.
- Consultants will make lists of the required instruments and vehicles for bridge inspection which will be included in the upcoming manual.

b) Classification of defects into 26 types

i. Reasons of classifying into 26 types

- Earlier in Japan more than 32 types of defects were in practice which created confusion to the field inspectors many times, so Japan introduced 26 types of defects to reduce the confusion of the field inspectors. Number of types of defects could be revised depending on the status of bridges and culverts in Bangladesh.
- The understanding of all the defect categories depend on the knowledge level and experiences of an individual; if there exist so many types of defects then there is possibility of putting a defect into wrong category by an inadequately educated or inexperienced inspector.

ii. Detailed Description of 26 types of defects

- Mr. HIYAMA gave the floor to Mr. HARAZAKI. He described the defect types in detail. Explanation and discussions of that part is covered in Article-4.

c) Revision of damage scores

- Currently practiced total damage score of 500 will be revised to 100 in the new BMS which will be named as "Damage Degree" (DD).
- "DD=0" means the bridge is in 'completely sound condition'; "DD=100" means the bridge is in the 'worst condition' and collapse is about to happen at any moment.
- Bridge condition is classified into 4(four) categories – A~D.
- Elemental damage degree (a~e) given by the inspector is evaluated by the evaluator and resulted into A~D.

d) Necessity of Developing new BMS

i. Limitations of existing BMMS

- Bridges at the site are different from the data of BMMS. Bridge name and LRP name can't be confirmed at the site.
- Input of any bridge data is impossible without LRP, but for most of the bridge cases LRP was not found at site.
- Input of photos or drawings/sketches is impossible.
- Many of the bridges have dual data (2004 and 2013 survey data); it is impossible to screen out the duplicated data.
- Data can't be sorted in the BMMS; to sort any data, it is required to copy the data from BMMS to any other data sorting software like Microsoft Excel.
- No option is available for the modification (edit/erase) of current data.
- Bridges are listed according to road name such as N1, N2 etc. but not according to condition class (A~D); it is impossible to sort all the bridges of the country according to class (A~D) in the BMMS.
- Bridge history of construction, earlier inspection record or any rehabilitation record is not kept in BMMS Database.
- MIS department of RHD don't have any documents about the development procedure, program, data input software or other relevant issues of BMMS.
- No user's manual is available.
- It is impossible to expand or modify BMMS according to user's demand.

ii. Features to be added in the new BMS

- New BMS will be free of the limitations stated above.
- It will be able to calculate bridge importance.
- It will be able to calculate rehabilitation project priority.
- It will suggest the rehabilitation method and probable cost.
- It will calculate the cost-benefit ratio of any rehabilitation project.
- It will prepare the Annual Bridge Maintenance Needs Report.
- It will also make the list for next 5 year rehabilitation works.
- Scope of expanding BMS will be available, so users (administrators of BMS) can modify the system at any time according to their requirement.
- There will be a user's manual containing detail instruction about BMS.

3. Explanation of Reference: WS6 (A1-WS3)-2 "Types of Defects and Rating"

A. JICA Consultant Mr. Ikuo HARAZAKI presented and explained the followings.

a) Detailed description of 26 types of defects.

[The reference document containing "Types of Defects and Rating" (Reference: WS6

(A1-WS3)-2) will be a part of the main body of "Bridge Inspection Manual - 2016"]

B. Summary of discussions on above mentioned topic

a) Detail description of 26 types of defects

- Defect no. (6) Crack, (7) Spalling/Exposed Rebar, (8) Water Leakage/ Efflorescence, (9) Fallen out of Deck Slab, (10) Crack at Deck Slab, (11) Delamination, (17) Defects of Reinforcing Materials for Rehabilitation/ Strengthening, (19) Discoloration/Deterioration, (20) Water Leakage/Puddle, (22) Abnormal Deflection, (23) Deformation/Break are equally applicable for RC elements and Culverts.
- Generally Cracks are always more dangerous in PC elements than RC elements; whenever a crack is visible in PC structure, it must be treated more seriously.
- The main cause of Fallen out of Deck Slab is basically repeated excessive loading; deficiencies in construction work/materials could be another reason.
- Defect no. (6) Crack and (10) Crack at Deck Slab are different category because Causes and Effects of the two categories are totally different. Defect no. (6) covers cracks at all the bridge components except deck slab.
- Defects of Concrete girders are applicable for RC, PC girders and Culverts. Application procedure of these types of defects to culverts was showed in the workshop2 (A2-WS1), and will be included in the manual. These types of defects are applicable for PC Box girders too.
- The elements related to the Defect no. (12) Abnormal Spacing and (13) Difference in Level are as follows-

  (12) Abnormal Spacing — applicable for i. Main Girders, ii. Bearings and iii. Expansion joints.

  (13) Difference in Level – applicable for i. Expansion Joint, ii. Pavement Surface.
- Regarding Abnormal Noise/Vibration, Inspector must try to find out the source of the defect. If the source is not found, "source not found" should be reported and "Detailed Investigation" should be prescribed after the Periodic Inspection. No instrument is used to measure Noise/Vibration in Periodic Inspection in Japan, USA, Malaysia, The Philippines and Vietnam.
- Types and Methods of Detailed Investigation will be included in the manual (in the Evaluation part).
- No defect should be considered unimportant; consultant has a real life experience of serious accident in Japan resulted from loosen bolts of expansion joint.

- Consultant will present the limitations of the existing Bridge Condition Survey Manual – 2014 in the next workshop on Output-1 {WS9 (A1-WS5)}.

4. **Explanation of Reference: WS6 (A1-WS3)-3 "Answer to the Questions by Core Members at WS5 (A2-WS3) about Detailed Investigation of Load Carrying Capacity".**

A. JICA Consultant Mr. Kenichi HIDA answered the unresolved questions from WS5 (A2-WS3) about "Detailed Investigation of Load Carrying Capacity"

Q1- What are the differences between "Slot Stress Method" and "Slit Stress Relief Technique"?

A1- Both methods are being used for the measurement of existing action stress of a component of the bridge. But there are some differences. The differences are as follows-

- "Slot Stress Method" was developed by a French Company about 20 years ago; "Slit Stress Relief Technique" was developed by The Consultant (Mr. K. HIDA) and his fellow Researchers in Japan recently. The name "Slot Stress" is patented to the French Company, so the Japanese team named it "Slit Stress".
- Stress is measured directly in "Slot Stress Method" but in "Slit Stress Method" stress is not measured directly, it is determined from measured strain. Strain is measured by comparing two images using Digital Image Correlation Method (DICM). Two images are taken by the scanner before and after the slit cut.
- Though both "Slot" and "Slit" are long narrow cut, "Slot' is a bit wider than "Slit". Cutting depth of "Slot" and "Slit" are 8 cm and 3 cm respectively.
- Possible measurement point of "Slot Stress" method is very limited because Rebar or PC tendon could be cut during the cutting of 8 cm deep Slot. But "Slit Stress" method can be applied anywhere only if 40cmX40cm space on the surface of the structural component is available for the scanner; there is least possibility of rebar or PC tendon cut as the depth of rebar or PC tendon is normally 3 cm or more from the concrete surface.
- "Slit Stress" method is less destructive than "Slot Stress" method.
- Costs are 850,000 yen/point for "Slot Stress Method" and 450,000 yen/point for "Slit Stress Method" in Japan.

Q2- What are the Criteria for selecting a particular Method of Load Carrying Capacity Investigation?

A2- Selection of an Investigation Method depends on the condition of Individual Component; it is very difficult to prescribe any particular method for any particular type of component before the evaluation of the defect seriousness condition. So the Consultant will list many types of Detail Investigation Method

with respective inputs and outputs in the upcoming Manual. The inspection team will have to choose the appropriate method by applying engineering judgment to the defect condition of the component.

Q3- Is it possible to apply "Slit Stress Relief Technique" in Bangladesh?

A3- To apply the method, at first Bangladesh have to import the instrument as it is not available in Bangladesh now. FEM analysis can be done with any available FEM Analysis software. This is a specialized job to be conducted by a specialist engineer in this particular field.

Q4- Can vibration measurement and Eigen value analysis be done in Bangladesh?

A4- Vibration measurement and Eigen value analysis requires extreme technical knowledge and experience. Identifying the target point and execution of measurement is very critical and important. So it is suggested to outsource the job to highly experienced experts in this field until RHD can develop their own in-house experts.

5. Next WS Schedule

Next Workshop for the Development of Institutional Framework for Bridge Maintenance is scheduled to be at **13:45** on **January 17, 2016**.

The Chairperson ended the workshop with thanks to all for their fruitful discussions and wished the success of the project within the scheduled time.

Date : Jan 17,2016

Peoples Republic of Bangladesh / Japan International Cooperation Agency (JICA)

Bridge Management Capacity Development Project

Workshop 6 (A1-WS3)

ATTENDANCE SHEET

	Name	Belongings	Signature
1		ACE, RHD, BMW & PD, BMCDP	
2		JICA Expert	
3		SE, RHD, APD - BMCDP	
4		EE, RHD, BMMS	
5		EE, RHD, Barisal Road Div	
6		EE, RHD, Rajshahi Road Div.	
7		SDE, RHD, BMMS	
8		BMCDP Consultant Team.	
9		ditto	
10		ditto	
11		ditto	
12		ditto	
13		ditto	
14		ditto	
15		EE, RHD	
16		EE, Comilla Road Div.	
17		Consultant- team member	
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Minutes of the Workshop7 (A1-WS4)

-Bridge Management Capacity Development Project-

Date	January 17, 2016 13:45-15:10
Venue	Chief Engineer's Conference Room, RHD, Sarak Bhaban, Tejgaon.
Chaired by	Mr. Parimal Bikash Sutradhar Additional Chief Engineer, Bridge Management Wing, RHD Project Director, Bridge Management Capacity Development Project.
Participants	Attendance sheet attached

1. **Opening Address** : The goals of the Project including the importance for developing a standard institutional framework for bridge maintenance and management, bridge inspection/evaluation and rehabilitation manuals had been addressed in welcoming speech by the Project Director.

2. **Explanation of Reference: WS7 (A1-WS4) - "Flow of Bridge Maintenance Activities (Mainly Bridge Inspection)".**

A. JICA Consultant Mr. Rikiya IIZUKA presented and explained the followings.

a) Flow of Bridge Maintenance Activities

i. Roles of Sub-Division Office
ii. Roles of Division Office
iii. Roles of Bridge Maintenance Management System Division

b) Organization for Bridge Inspection Works

i. Organization Chart of Bridge Inspection Works
ii. Members of the Bridge Evaluation Committee
iii. Responsibilities of Chief Inspector (EE)
iv. Responsibilities of Assistant Chief Inspector (AE)
v. Responsibilities of Senior Inspector (SDE)
vi. Responsibilities of Inspector (SAE)
vii. Responsibilities of Assistant inspector (Class III)
viii. Responsibilities of Traffic Security Guard and Driver (Class IV)
ix. Responsibilities of the EE of BMMS Division on Bridge Inspection Works
x. Functions of the Evaluation Committee

B. Discussions on above mentioned Topics

a) Flow of Bridge Maintenance Activities

- Proposed workflow chart is shown in the reference documents of the workshop.
- Category 'A' & 'B' bridges will be added in the workflow chart with necessary

remarks.

i. Roles of Sub-Division Office

- To plan, get approval from EE and to conduct the Field Inspection Work.
- To submit Inspection Report to Division Office, make draft list of candidate bridges for maintenance based on the report from BMS.
- To implement bridge maintenance works and to submit maintenance report to Division Office. Details are discussed in the attached documents.

ii. Roles of Division Office

- To summarize inspection data from all the Sub-Divisions and input into BMS.
- To form Evaluation Committee (EC) for the evaluation of bridge condition and input the evaluation data into BMS.
- To report BMMS Division about the candidate bridges for maintenance based on the report from BMS.
- To monitor progress, quality, safety of maintenance works and input maintenance work data into BMS.

iii. Roles of the Bridge Maintenance Management Division

- To summarize whole country data in BMS.
- Prepare Annual Bridge Maintenance Needs Report and process for approval.
- To allocate the budget among the divisions after approval.
- To monitor the progress of Maintenance Works.

b) Organization for Bridge Inspection Works

i. Organization chart of Bridge Inspection Works

- Described in the attached document.
- The name of the posts are changed as follows based on the comments by PD, APD and other Core Members-

	Proposed Post name (Original)	Requested modification	Remarks
1	Inspector General	Chief Inspector	Inspector General is given to Police Chief.
2	Senior Inspector	Assistant Chief Inspector	Senior is too high for AE (SDE of SDO is higher staff than AE of DO).
3	Chief Inspector	Senior Inspector	Senior is adequate for the Team leader of Field Inspection Team.

ii. Responsibilities of Chief Inspector (EE)

- To chair the Evaluation Committee.

- Details are described in the attached document and will be added in the Manual.

iii. Responsibilities of the Assistant Chief inspector (AE)

- To assist Chief Inspector as required.
- To join in Field Inspection and report to EE about the quality, progress, safety etc. of Inspection works.
- To prepare the Evaluation Committee meeting as a secretary.
- And other kinds of works assigned to him/her by EE.

iv. Responsibilities of Senior Inspector (SDE)

- To lead the Field Inspection Team and conduct Inspection Works.
- Details are described in the attached document and will be added in the Manual.

v. Responsibilities of the Inspector (SAE)

- To arrange necessary equipments, vehicles and manpower.
- To assist SDE as required.
- To carry out every assignment given by the SDE.
- Details are described in the attached document and will be added in the Manual.

vi. Responsibilities of the Assistant Inspector (Class III)

- To assist in daily preparation such as loading, unloading of tools and equipments.
- To reach narrow/high places for taking photo, measurement etc.
- To clean/remove obstructions during inspection
- Any other job assigned to him by the SDE.

vii. Responsibilities of Traffic Security Guard and Driver (Class IV)

- To control traffic during Inspection Work at the site. (Security Guard).
- To confirm movement route by the approval of SDE before Inspection. (Driver).
- To take the team to the Inspection Site and bring back after Inspection.
- To find adequate space for parking during Inspection work near Inspection Site.

viii. Responsibilities of the EE of BMMS Division on Bridge Inspection Works

- Initially this part was assigned to the AE; but according to Core Members' observation, AE is newly recruited inexperienced engineer; it is impossible for him/her to handle such huge load of works. As a result these responsibilities are assigned to the EE of BMMS Division on Bridge Inspection Works.
- Details are in the attached document and will be added in the manual.

ix. Function of the Evaluation Committee

- To evaluate the condition of the bridge from Inspection Report.
- To evaluate the causes and future progress of the defects.
- To calculate the Bridge Condition (A~D) from element condition (a~e).
- To make primary recommendations for Remedial Measures.

3. **Next WS Schedule**

   Next Workshop on Bridge Management System (BMS) is scheduled to be at **10:00 PM** on **February 04, 2016 (Thursday)**.

The Chairperson ended the workshop with thanks to all for their fruitful discussions and wished the success of the project within the scheduled time.

Date : Jan 17,2016

Peoples Republic of Bangladesh / Japan International Cooperation Agency (JICA)

Bridge Management Capacity Development Project

Workshop 7 (A1-WS4)

ATTENDANCE SHEET

	Name	Belongings	Signature
1		ACE, BMW, RHD	
2		SE, PLD, MPD, BMCDP	
3		JICA Expert	
4		BMCDP Consultant Team	
5		ditto	
6		ditto	
7		ditto	
8		ditto	
9		ditto	
10		EE, BMMS	
11		EE, RHD, Barisal Road Div	
12		EE, RHD, Rajshahi	
13		EE, RHD, Comilla	
14		SDE, RHD, BMMS	
15		Consultant Team	
16		Consultant Team Member	
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Minutes of the Workshop8 (A3-WS1)

-Bridge Management Capacity Development Project-

Date	February 04, 2016 10:10-12:00
Venue	Chief Engineer's Conference Room, RHD, Sarak Bhaban, Tejgaon.
Chaired by	Mr. Parimal Bikash Sutradhar Additional Chief Engineer, Bridge Management Wing, RHD Project Director, Bridge Management Capacity Development Project.
Participants	Attendance sheet attached

1. **Opening Address** : The goals of the Project including the importance for developing an intranet based Bridge Management Systems (BMS) for bridge maintenance management and to ensure the good health condition of the bridges and consequent budget for necessary remedial works had been addressed by the Project Director.

2. **Explanation of Reference: WS8 (A3-WS1) - "Program Construction of Bridge Management System".**

A. JICA Consultant Mr. Kengo MAKISHIMA presented and explained the followings.
   a) Outline of Bridge Management System (BMS)
   b) Review of existing BMMS
   c) Functions of new BMS
      i. Bridge Importance Degree
      ii. Bridge Damage Degree
      iii. Checkbox for structural/Public safety
      iv. Calculation of Priority for Rehabilitation/Strengthening
      v. Calculation of Rough Cost
   d) Formation of BMS Construction Team
   e) System Construction Schedule
   f) Topics to be discussed in the next workshop for BMS

B. Discussions on above mentioned Topics
   a) Outline of Bridge Management System (BMS)
      - BMS consists of Database of Inspection Results, Evaluating Function of Priority of Rehabilitation and Calculating Function of Rehabilitation Cost.
      - Input Data of BMS include general Bridge Information, Location and Rating of defect, Evaluated score of the elements, photo and sketches of the defects etc.
      - Output Data of BMS include Digitized Inspection Sheet, Priority of bridges for Remedial Measures, Rough Cost of remedial measures etc.

b) Review of existing BMMS

- Input of bridge data is impossible without LRP, but LRP is not available for every bridge.
- Road data and bridge data are not sufficient, such as traffic volume, type of bearing, type of expansion joint, presence and type of utilities, design standard, design load etc. are absent in the BMMS database.
- Data sorting according to user's requirement is not possible in BMMS.
- Bridge Importance Degree, Remedial priority of bridges, Suggestion of Remedial Measures and Cost Estimate are absent in BMMS.
- User's manual of BMMS is not available in RHD.
- Expansion or modification of BMMS is not possible.

c) Functions of new BMS

- New BMS will be free of the limitations of existing BMMS.
- Bridge data will include all the bridge related information. Details are shown in the attached reference documents.
- Many factors will be used to calculate the remedial priority of a bridge. Those are as follows-

i. Bridge Importance Degree

- Bridge Importance Degree is the summation of the scores for Importance of the Road, Traffic Volume, Existence of Detour and the Crossing under the bridge such as railway, national road etc.
- In the score table for Crossing, Zilla Road must be included.
- In the score table of traffic Volume, the table should begin with "Over 10000" because in N1 (Dhaka-Chittagong Highway) traffic volume is more than 10000.
- The scores presented here are just examples; these must be revised according to the condition of Bangladesh.
- These scores are changeable. If situation demands any change, a committee will be formed headed by the Chief Engineer/Additional Chief Engineer of Bridge Management Wing to make the changes. The committee will decide the new scores by open discussions and meetings with the Responsible Bridge Experts. BMS Administrator will make changes according to the decisions of the committee. BMS will keep record of the change.

ii. Bridge Damage Degree

- Bridge Damage Degree shows accumulation of damage points based on the condition of the defect.
- The values of Coefficients X_{dd} (coefficient of damage degree for superstructure),

Y_{dd} (coefficient of damage degree for substructure), Z_{dd} (coefficient of damage degree for bearing), W_{dd} (weightage coefficient for defect type) and W_{de} (weightage coefficient for element type) presented in the workshop are examples from a project in another country at which the Consultant was involved. There are no standard values of these coefficients. The Bridge Maintenance Management Authority set the values by considering their own situation. And the values may vary from authority to authority in the same country.

- Core Members told that conversion of Damage Category (A~D) to Damage Score (A=0, B=20, C=50, D=100) in BMS is required to be revised. This issue must be discussed thoroughly in the next Workshop for BMS.
- All the Coefficients and Scores presented here are just examples; these should be set according to RHD's requirement. Only the BMS Administrator will be able to change the values according to the decision of the abovementioned committee.

iii. Checkbox for Structural/Public Safety

- If Structural Safety is in danger then "Damage Degree" of the bridge will be 100.
- There will be a checkbox for this issue; the inspector has to put only "yes" in the checkbox. BMS will automatically calculate the damage point to 100.
- PD asked to assign some score for "Public Safety in Danger". That score might come from the damage rating (a~e) of the railing, light post etc. Because Public Safety is important as well as structural safety; and BMS must take it into consideration during the calculation of Rehabilitation Priority of the bridge.
- BMS Administrator will be able to change the scores in future.

iv. Calculation of Priority of Rehabilitation/Strengthening

- BMS will calculate the Priority Order of Bridges for Rehabilitation.
- Prioritization Point is calculated from Bridge Importance Degree and Bridge Damage Degree by multiplying with some coefficients.
- The same values of the coefficients are applied for all the bridges in the country.
- But the values are not fixed. BMS Administrator will be able to change the values in future.

v. Calculation of Rough Cost

- BMS will calculate the Rough Cost for the Rehabilitations measures.
- The rate of the costs will come from the Unit Cost Master Sheet. RHD's rate schedule can be the base of the Unit Cost Master Sheet.
- Core Members asked to include "rating-a" in the "remedial measures sheet" with appropriate remarks (such as "no measures required").
- Core members asked to include "Other Cost" in the Rough Cost (as examples-

Rough Cost for Repair = Σ(unit cost of repair method X quantity of each defect) + Other costs; Rough Cost of Reconstruction= Cost of Superstructure + Cost of Substructure + Other Cost). There might be a separate database for the rate of the items of "Other Costs".

- As the rates change time to time, there will be option for the BMS Administrator will be able to change the rates according to change of RHD's rate schedule.

d) Formation of BMS Construction Team

- BMS Construction Team consists of 2(two) Japanese Specialists (1 Specialist in Bridge Management, 1 Specialist in System Management), 1(one) System Manager (Bangladeshi) and some programmers (Bangladeshi).
- The team will develop BMS by continuous discussion and consultation with RHD.
- During Debugging 1(one) staff from BMMS Division of RHD will join the BMS Team; s/he might continue as BMS Administrator when the System will be handed over to RHD.

e) System Construction Schedule

- BMS Development will be started as soon as possible.
- It will be completed before the commencement of OJT in October, 2016.
- Debugging Process will continue till the end of the project.

f) Topics to be discussed in the next workshop for BMS

- The items to be included in the BMS. This issue is related to the construction procedure of BMS.
- Selection of the values of the coefficients and scores for different criteria of roads, bridges, defect types and ratings in context of Bangladesh. This issue is not related to the construction of BMS but to the operation of BMS. However, this is very important issue for BMS.
- Pending Issues of WS8 (if any).

3. **Next WS Schedule**

Next Workshop on Bridge Maintenance Management Standard is scheduled to be at **12:10 PM** on **February 04, 2016 (Thursday)**.

The Chairperson ended the workshop with thanks to all for their fruitful discussions and wished the success of the project within the scheduled time.

Date : February 04, 2016

Peoples Republic of Bangladesh / Japan International Cooperation Agency (JICA)

Bridge Management Capacity Development Project

Workshop 8 (A3-WS1)

ATTENDANCE SHEET

	Name	Belongings	Signature
1		ACE, BMW, RHD; PD, BMCDP	
2		SE. PLD. RHD. APD, BMC	
3		EE, BMMS Division	
4		EE, RHD, Barisal	
5		EE, RHD, Comilla	
6		EE, RHD, Rajshahi	
7		SDE, RHD, BMMS Division	
8		EE, RHD, RHDTC	
9		JICA expert	
10		JICA Team	
11		JICA Team	
12		JICA Team	
13		JICA team	
14		JICA Teamleader	
15		JICA Team	
16		Jica Team coordinator	
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Minutes of the Workshop9 (A1-WS5)

-Bridge Management Capacity Development Project-

Date	February 04, 2016 12:10-15:25 (lunch break 13:55-14:25)
Venue	Chief Engineer's Conference Room, RHD, Sarak Bhaban, Tejgaon.
Chaired by	Mr. Parimal Bikash Sutradhar Additional Chief Engineer, Bridge Management Wing, RHD Project Director, Bridge Management Capacity Development Project.
Participants	Attendance sheet attached

1. **Opening Address :** The goals of the Project including the necessity of developing a Bridge Maintenance Management Standard for RHD and subsequent activities for the successful application of the standard had been addressed by the Project Director.

2. **Explanation of Reference: WS9 (A1-WS5)-1 "Bridge Maintenance management Standard (Pre-Draft)"**

A. Team Leader of the Consultants Mr. Yoshimitsu HIYAMA presented and explained the followings.
   a) Contents of the Bridge Maintenance Management Standard (draft)
   b) Condition of the bridges under RHD's jurisdiction
   c) Improvement of Bridge Maintenance Institutional Framework

B. Discussion summary on above mentioned Topics
   a) Contents of the Bridge Maintenance Management Standard (draft)
      - The Draft manual consists of 5 chapters including Background, Current Status of Bridge Maintenance in RHD, Establishment of Bridge Maintenance Management Cycle (BMMC), Improvement of Bridge Maintenance Institutional Framework, Recommendations for Building Durable Bridges and Sustainable Maintenance System.
      - Existing "Bridge Maintenance Standard – 2014" was reviewed and some common & important contents from this manual may be added to the "Bridge Maintenance Management Standard – 2016".
      - Headlines and contents of some chapters (presented in earlier workshops) have been revised by the consultant. But all the important issues (such as Preventive Maintenance Plan) are included in the new manual.

   b) Condition of the Bridges under RHD's jurisdiction
      - Most of the available data in BMMS are from 2004; some from EBBIP in 2013. But the time of the collection of data (2004 or 2013) can't be sorted out in BMMS. So there are some duplications and the available data are not reliable enough for

planning or making decisions for an effective Bridge Maintenance Management Standard.

- To get rid of such problem, RHD needs to establish a sustainable Bridge Maintenance Management System which will have regularly updated & upgraded data and clear guidelines for the execution of bridge maintenance activities smoothly.

c) Improvement of Bridge Maintenance Institutional Framework

- Strict execution of Bridge Maintenance Activities in time is mandatory.
- All the responsible personnel in this department should have crystal clear ideas/ guidelines about his/her responsibilities regarding Bridge Maintenance Management Standard from his/her position.
- Intranet based Bridge Management System (BMS) should be in action properly.
- Necessary steps should be taken to ensure fund for bridge maintenance works.
- Regular training should be provided to RHD staff for the enhancement of work efficiency. RHD should produce in-house Trainers for conducting these training through on-field training, seminars, conferences and research opportunities which should be a continuous process.

3. Explanation of Reference: WS9 (A1-WS5)-2 "Capacity Development Training Plan"

A. JICA Consultant Mr. Rikiya IIZUKA presented and explained the followings.

a) Training for RHD Staff by JICA Team
b) Tentative Schedule of Training in Japan
c) Purpose and Contents of On the Job Training (OJT)
d) Basic Conditions of OJT
e) Schedule Plan of OJT
f) Modified version of reference documents of WS7 {Reference: WS7 (A1-WS3)}.

B. Discussion summary on above mentioned topics

a) Training for RHD Staff by JICA Team

- JICA Consultant Team will develop Bridge Maintenance Management Standard, Bridge Inspection and Evaluation Manual, Bridge Rehabilitation/Strengthening Manual, Intranet based BMS and BMS User's Manual through 23(twenty three) workshops, Core Members of RHD are the participants of the workshops.
- JICA team will train 75 Master Trainers through OJT. And several seminars will be arranged for RHD Engineers including Master Trainers for the explanation and demonstrations of the use of the manuals properly.
- JICA Team will also provide training to 12 RHD Engineers in Japan. Number of Trainees may increase with the approval of JICA.

- JICA Team will arrange seminar for explanation of the manuals and about their uses. The seminar will be arranged for the officials related to Bridge Maintenance Activities from different organizations or institutions.

b) Tentative Schedule of training in Japan

- Tentative schedule of Training in Japan is from April 16, 2016 to April 30, 2016.
- Details are shown in the attached document.
- The schedule is in need to be approved by JICA for the execution.

c) Purpose and Contents of On the Job Training (OJT)

- The main purpose of OJT is to transfer the knowledge of Bridge Maintenance to RHD staff which will enhance their capacity of using modern technology and to enable them for spreading the knowledge to their subordinates who will carry out the jobs on field and lead RHD in future.
- The major Contents of OJT are the Explanation of the Manuals to the MTs, Conducting Bridge Inspection and Evaluation on Field, Operation of BMS and Planning Remedial Measures for different types of Defects.
- Explanation of the Manuals and Training on Operation of BMS will be held at RHD's Training Center in Mirpur, Dhaka.
- Inspection/Evaluation and the other field jobs will be held in the selected model Division Manikganj.

d) Basic Conditions of OJT

- 75 Master Trainers (MT); 65 from RHD Road Divisions and 10 from RHD Headquarters will join OJT dividing in three groups in three different times, 25 persons in each group.
- 25 participants will be divided into 6 teams; 4 members in a team which is similar to actual inspection team. Only one team will have 5 members.
- Every member will change position in the Inspection Team by rotation to learn all the activities of bridge inspection. Details are shown in the reference documents.

e) Schedule Plan of OJT

- Tentative schedule of commencement of OJT is 1st week of October 2016. Period of training is 2(two) weeks for Inspection and Evaluation, 1(one) week for BMS Operation and 1(one) week for Rehabilitation for each group of 25 MTs.
- Training by the experts to three groups will be ended in the 2nd week of December.
- After the Training by the Experts, the MTs will go back to respective divisions and train their subordinates. After that, they will carry out the inspection of bridges under their jurisdiction and report to RHD Headquarters.
- Considering the huge regular workload of Engineers in RHD field divisions at dry

season, work efficiency of Bridge Inspection is assumed 60%. So it will be possible for the divisions to complete the inspection job within the specified time besides doing their regular works.

f) Modified version of reference documents of WS7 {Reference: WS7 (A1-WS3)}
   - Name of "Evaluation Committee" has been changed to "Appraisal Committee".
   - Appraisal Committee will crosscheck the condition of "category-D" bridges only.
   - SDE will act as "Evaluator" as well as "Senior Inspector" and he will lead the Inspection Team on field.

4. **Explanation of Reference: WS9 (A1-WS5)-3 "Review of existing Bridge Condition Survey Manual - 2014".**

A. JICA Consultant Mr. Ikuo HARAZAKI presented and explained the followings.
   a) Limitations of Bridge Condition Survey Manual – 2014
   b) Comparison between BCS Manual – 2014 and proposed new Manual – 2016
   c) Draft Contents of new Bridge Inspection Manual – 2016
   d) Work Schedule for Development of Bridge Inspection Manual – 2016

B. Discussion summary on above mentioned topics
   a) Limitations of Bridge Condition Survey Manual – 2014
      - Only "Periodic Inspection" is defined. But in order to implement proper bridge maintenance, other types of inspection such as Routine Inspection, Interim Inspection and Emergency Inspection are also needed.
      - 9 elements of bridge are considered for inspection in this BCS Manual – 2014; but within these 9 elements all the elements are not covered such as Bearings, Expansion Joints, PC Anchorage, Drainage System etc.
      - No provision is available for numbering of elements; only girder/slab/abutment etc. cannot indicate the exact location of the defect.
      - 8 types of defects are listed for the inspection, which do not cover many serious defects. Details are presented in the reference documents.
      - Rating of defect are "major" and "minor"; which is not enough to express the condition of the defects.
      - Inspection personnel are defined as "Responsible Person"; it is very vague term. Organization of Inspection Team and their responsibilities are not defined at all.
      - Inspection Procedure is not elaborately described.
      - No guideline is available for inspectors on how to find defects.
      - Safety precautions for inspectors, traffic and public are not covered.
      - Recording procedure of Inspection Result is not up to the mark. Recording forms do not contain photos or sketches.

b) Comparison between BCS Manual – 2014 and proposed new Manual – 2016

- New manual will be free of the limitations mentioned above.
- In the new manual, different types of Inspection will be described properly.
- 8 main element types with many sub-items will cover all elements of the bridges in the new Bridge Inspection Manual.
- 26 types of defect with rating a~e will cover all the possible defects of bridges.
- Numbering of elements will be established to specify the exact location of defects.
- Organization of Inspection Team will be described with the role of individuals.
- Usable guidelines will be presented for Inspection Procedure, How to Find Defects and Safety Precautions during Inspection.
- Recording form will contain photos and sketches of defects.

c) Draft Contents of new Bridge Inspection Manual – 2016

- The new manual will upgrade and update the contents of old manual with lot of new information.
- The name of the Manual is not decided yet. Tentative name is "Bridge Inspection and Evaluation Manual – 2016".
- The new manual will describe specific Frequency of Routine Inspection; it will include the items to be covered in Routine Inspection and criteria for Interim & Emergency Inspection.
- The new manual will include detailed procedure related to Bridge Inspection and Evaluation so that it can be used as guideline for a new and inexperienced bridge Inspector.

d) Work Schedule for Development of Bridge Inspection Manual – 2016

- In the next workshop for Inspection in mid March 2016, Consultant will present Inspection Procedure, Safety during Inspection and Recording Forms. Contents/ Edition policy of Bridge Inspection will also be discussed.
- In the later workshop in mid April 2016, Consultant will present the Draft Version of "Bridge Inspection and Evaluation Manual – 2016". Requirement of Addition/Removal/Modification of contents will be discussed too. It will be finalized after the workshops and getting feedback from all concerned people.

5. Next WS Schedule

Next Workshop for the Development of Bridge Inspection Manual is scheduled to be at 10:00 on **March 13, 2016 (Sunday)**.

The Chairperson ended the workshop with thanks to all for their fruitful discussions and wished the success of the project within the scheduled time.

Date : February 04, 2016

Peoples Republic of Bangladesh / Japan International Cooperation Agency (JICA)

Bridge Management Capacity Development Project

Workshop 9 (A1-WS5)

ATTENDANCE SHEET

	Name	Belongings	Signature
1		ACE, BMW & PD, BMCDP, RHD	
2		EE, BMMS Division	
3		EE, RHD, Barisal	
4		EE, RHD, Comilla	
5		EE, RHD, Rajshahi	
6		SDE, RHD, BMMS Division	
7		EE, RHD, RHD TC	
8		JICA expert	
9		JICA Team	
10		JICA team	
11		JICA team	
12		JICA team	
13		JICA Team Leader	
14		SE. RHD. APD, BMCDP	
15		JICA team	
16		JICA Team. Coordinator.	
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Minutes of the Workshop10 (A2-WS4)

-Bridge Management Capacity Development Project-

Date	March 13, 2016 10:15-11:35
Venue	Chief Engineer's Conference Room, RHD, Sarak Bhaban, Tejgaon.
Chaired by	Mr. Parimal Bikash Sutradhar Additional Chief Engineer, Bridge Management Wing, RHD Project Director, Bridge Management Capacity Development Project.
Participants	Attendance sheet attached

1. **Opening Address** : The goals of the Project including the importance for developing a standard Bridge Inspection Manual and the application of that manual in practical field work for the most efficient bridge maintenance management system had been addressed by the Project Director.

2. **Gratitude from the Consultants Team**
   Team Leader of the Consultants Mr. Yoshimitsu HIYAMA conveyed gratitude from the Consultants Team to Bangladeshi people for the help and support of Bangladesh during the Great Eastern Japan Earthquake on March 11, 2011.

3. **Explanation of Reference: WS10 (A2-WS4) - "Bridge Inspection Program and Procedure of Inspection".**

A. JICA Consultant Mr. Ikuo HARAZAKI presented and explained the followings.
   a) Bridge Inspection Program
   b) Composition of Inspection Team
   c) Inspection Tools and Access Equipment
   d) Procedure of Inspection
   e) Safety during Inspection

B. Discussion summary on above mentioned topics
   a) Bridge Inspection program
      - Consultants proposed 5(five) types of Inspection program to adopt by RHD. 2(two) types of scheduled inspection- (i) Routine Inspection (ii) Periodic Inspection and 3(three) types of non-scheduled inspection- (i) Interim Inspection (ii) Emergency Inspection (iii) Detailed Investigation.
      - The purpose of Routine Inspection is to check the general serviceability of the bridge and to find out any visible structural damage by means of visual observations combined with vehicle patrol. If any damage is suspected, the inspectors must confirm the damage condition by having a close look. If any

damage is found, emergency report to bridge manager is required.

- The manual should mention specific frequency for Routine Inspection; as example, 1(one) month could be reasonable frequency of Routine Inspection for Bangladesh.
- Based on the report of Routine Inspection, Interim Inspection or Emergency Inspection might be required. Bridge Manager will take the decision about Interim or Emergency Inspection.
- The purpose of Periodic Inspection is to assess the physical and functional condition of every element/component of the entire bridge with close visual observations and to evaluate the necessity for remedial measures. The inspector will use listed tools and instruments such as crack scale, tapping hammer etc. during the visual inspection and ~~but~~ that ~~is~~ will not be defined as mechanical inspection.
- The manual will specify specific frequency for Periodic Inspection. Specific frequency will be proposed in the next workshop for inspection {WS14 (A2-WS6)} by consultation with the Core Members.
- Inspection Team led by SDE will conduct the inspection or outsourced.
- The first Periodic Inspection (called Inventory Inspection) must be carried out within 2(two) years of the bridge open for traffic. The purpose is to collect inventory data for bridge database.
- The purpose of Interim Inspection is to monitor a particularly known or suspected deficiency discovered during Routine, Periodic or Emergency Inspection. Bridge Manager will decide the time of inspection based on the situation; if required he must seek help from Bridge Management Wing.
- The purpose of Emergency Inspection is to check the condition of the bridge after any incidents which could cause structural damage to the bridge, such as collision, flood, earthquake, fire or any other accidents cause structural damage.
- Detailed Investigation is done if recommended in the Periodic Inspection or load capacity assessment of a bridge is required. The main purposes are to investigate the cause of a defect, to grasp detailed behavior and progress of a defect, and to evaluate structural strength.
- Detailed Investigation is very specialized job and includes many types of non-destructive, minute destructive and destructive tests. Modern sophisticated instruments are used for the job. Inspection using these instruments is called mechanical inspection.
- Detailed Investigation is performed by professional engineers with expertise; often consultants are hired. RHD may establish few such Investigation Teams centrally or zone wise by discussing the consultants of the project.

b) Composition of Inspection Team

- Inspection team for periodic inspection is prescribed according to the proposal of Workshop-9. Composition of Inspection team was discussed in detail in that workshop.
- In response to the Core members' query about the team arrangement for different types of inspection, consultants replied that he will propose team arrangements for each type of inspection separately.
- The inspectors must have successfully completed RHD approved comprehensive bridge inspection training course based on "Bridge Inspection and Evaluation Manual".
- Composition of Detail Investigation team is to be suggested by the Evaluator.

c) Inspection Tools and Access Equipment

- Consultants have listed required tools and equipment for visual inspection. Equipment for mechanical inspection will be listed in the detail description of Detailed Investigation in the evaluation part.
- Access equipment includes ladder, stepladder, scaffolds, boat and vehicle mounted inspection equipment (VMIE) such as Manlifts, Bucket Truck, under bridge inspection equipment etc.
- There are both merits and demerits of using above inspection equipment (VMIE). Some questions (listed in the manual) must be answered before using these VMIE; after answering all the questions, if the use of such equipment seems feasible, it shall be used; otherwise it is recommended to avoid the use of these inspection equipment (VMIE).
- If inspection equipment (VMIE) can't be used, distant view inspection using telescopic instruments is the primary solution; if that is not enough, long range high definition camera (remote camera) could be used.
- The use of drone technology in bridge inspection is still under development. Consultants had cumbersome experience about using drone and it is restricted within some specific areas in Japan and USA. The issue may be discussed in details during the "Training in Japan".

d) Procedure of Inspection

- Proper planning of inspection helps the inspection team to do the job in an organized and efficient way. It includes listing of the bridges to be inspected, making of inspection schedule, deploying inspection team staff, arranging required tools and instruments etc.
- Preparation of inspection includes reviewing the bridge inventory files,

developing work plan, preparing notes, forms, organizing equipment, tools etc. One of the very important jobs in this stage is to get approval from the other concerned authorities such as Railway Authority, Police Authority etc.

- Performing the inspection is the ultimate job. Careful and attentive observations are necessary to insure the quality of the job. Details are discussed in the manual.
- Inspected bridges should be marked in such place of both end of the bridge so that it is visible from the approach road. The marks should be made with such material which lasts long enough to avoid the re-inspection of the bridge.
- Procedure of inspection (especially performing the inspection) for each type of inspection should be presented separately. Consultant will present the procedures for each type of inspection in the next workshop.

e) Safety during Inspection

- Safety of inspectors, workers and the public using the bridge must be ensured during inspection.
- Safety plan before going to field inspection is necessary, so that emergency action can be taken in case of any accident.
- Improper attitudes, physical limitations, trying to work in shortcut ways, faulty equipment, inappropriate or loose fitting clothes are the major causes of accidents.
- If anyone has any physical limitation or illness, must not go to field inspection and the inspectors must be very careful and attentive during the inspection.
- Required safety tools must be brought to site and used properly. Inspection team must maintain every safety rules set by the organization during the inspection.

4. **Next WS Schedule**

Next Workshop on Bridge Evaluation Manual is scheduled to be at **11:45 AM** on **March 13, 2016 (Sunday)**.

The Chairperson ended the workshop with thanks to all for their fruitful discussions and wished the successful completion of the project within the scheduled time.

Date : March 13, 2016

Peoples Republic of Bangladesh / Japan International Cooperation Agency (JICA)

Bridge Management Capacity Development Project

Workshop 10 (A2-WS4)

ATTENDANCE SHEET

	Name	Belongings	Signature
1		ACE, RHD, BRIDGE MANAGEMENT WING AND PD, BMCDP	
2		SE. RHD. APD, BMCDP	
3		Consultant Team Leader. IBMCDP.	
4		EE, BMMS Division	
5		EE, Road Div. Barisal	
6		EE, Road Division, Habiganj.	
7		SDE RHD, BMMS Sub-division (DPM, BMCDP)	
8		Executive Engineer, RHD Comilla Road division	
9		EE, RHD, Rajshahi Road Division	
10		JICA Project Team	
11		JICA Project Team	
12		JICA Project Team	
13		JICA Project Team	
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15		JICA Project Team	
16		JICA PROJECT TEAM.	
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Minutes of the Workshop11 (A2-WS5)

-Bridge Management Capacity Development Project-

Date	March 13, 2016 11:45-13:15
Venue	Chief Engineer's Conference Room, RHD, Sarak Bhaban, Tejgaon.
Chaired by	Mr. Parimal Bikash Sutradhar Additional Chief Engineer, Bridge Management Wing, RHD Project Director, Bridge Management Capacity Development Project.
Participants	Attendance sheet attached

1. **Opening Address** : The goals of the Project including the importance for developing a standard Bridge Evaluation Manual and the application of that manual to evaluate field inspection data for the assessment of bridge condition so that timely action can be taken for repair or rehabilitation of the bridge had been addressed by the Project Director.

2. **Explanation of Reference: WS11 (A2-WS5) - "Development of Bridge Evaluation Manual".**

A. JICA Consultants Mr. Toshiyuki KONISHI and Mr. Kenichi HIDA presented and explained the followings.

a) Evaluation method of bridge elements
b) Evaluation method of entire bridge
c) Detailed investigation

B. Discussion summary on above mentioned topics

a) Evaluation method of bridge element

- The damage situation of elements of a bridge are categorized as follows ;
  - A – Countermeasures are not required.
  - B – Countermeasures are required within 5 years.
  - C – Countermeasures are required within 2 years.
  - D – Emergency countermeasures are required.
- To eradicate confusion between the evaluation category of 'element' and 'entire bridge' will be discussed in the next workshop for Evaluation {WS15 (A2-WS7)}.
- In the evaluation of bridge element, judgment of condition category is carried out by each damage type of relevant bridge elements by the span.
- If there are more than one damage rating (a~e) in a type of element, then most severe damage is considered in the evaluation.
- Evaluation of element is done by assessing the information of defects (the location, future progress, effect to durability) and photographs brought from the inspection. There is relations between 'a~e' and 'A~D' but it is not so simple;

especially in judgment of Emergency category D_t. Guidelines for the evaluators will be provided in the manual.

- Sometimes safety of the bridge users falls in danger even if the bridge remains structurally sound; in that case, the condition is evaluated as emergency (category 'D') from the point of public safety.
- If the exact cause of the severe defect can't be understood by visual inspection, detailed investigation is prescribed. Detailed investigation is achieved by mechanical tools.

b) Evaluation method of entire bridge

- Evaluation of entire bridge (A~D) will be done by BMS automatically from the elements condition (A~D) given by the evaluator. Consultants proposed the system/ formula to calculate the condition of the entire bridge from elements condition. BMS will work based on that formula/system.
- Evaluation of the entire bridge is carried out focusing the primary members that affect the structural safety. Primary members have more effect than others in calculation of the condition of the entire bridge.
- Consultants proposed 50% impact level of superstructure, 30% impact level of substructure and 20% impact level of bearings in calculation of the damage degree of the entire bridge. These percentages cannot be applied in culverts, because there are no bearings in culverts; if this formula is applied to culverts with the same impact level then the damage degree will be calculated in 80% instead of 100%, which will lead to wrong results.
- Different values of impact level for the calculation of damage degree of RC/PC girder bridges, Box girder bridges and Culverts will be indicated in the next workshop for Evaluation {WS15 (A2-WS7)}.
- Consultants proposed weight coefficient of the elements for different element types such as girder, deck, abutment, pier etc. These coefficients are currently being used by the Local Government of Japan. In case of Bangladesh, revision of these coefficients might be needed.
- Consultants also proposed weight coefficient of the defects for all the 26 types of defects. These coefficients are currently being used by the Local Government of Japan too. In case of Bangladesh, revision of these coefficients might be needed.
- These coefficients can be used as trial basis. After the development of BMS, these coefficients can be applied; reviewing the obtained results, RHD will decide the final coefficients.
- If only one primary element of a bridge is categorized 'D', the entire bridge will be categorized 'D' regardless of the conditions of the other elements. Because 'D'

indicates the emergency situation; only one element of 'D' category is enough for structural failure if kept untreated.

- If any primary element of the bridge is categorized 'D' or the entire bridge is categorized 'D' by the BMS, Appraisal Committee will crosscheck and verify the condition of the element or the bridge. Members of Appraisal Committee are EE of concerned division, SDE of concerned sub-division and AEs of concerned division, circle and zone. This issue was clarified elaborately in Workshop 9 (A1-WS5).
- Definition of Damage Degree, Damage Point, Evaluated Score and Evaluated point should be clearly mentioned in the manual. If more than one terms have the same meaning, any one of those terms should be used only.
- As these issues are closely related to BMS, PD requested the consultants to have close communications between evaluation experts and BMS development team.

c) Detailed Investigation

- Detailed Investigation is conducted if prescribed by the evaluators.
- The purposes of Detailed Investigation are (i) to specify the cause of severe damage if it is unclear in the visual inspection, (ii) to assure the requisite load carrying capacity of a damaged bridge and (iii) to decide the scope and degree of rehabilitation/strengthening.
- Detailed Investigation includes many types of non-destructive, minute destructive and destructive tests. All of these tests are done by using modern sophisticated instruments and technologies. Engineers with expertise conduct these tests; sometimes adequate consultants are hired for the job.
- Consultants has listed many types of Detailed Investigations methods with each method's applicability, investigation method, required machines and tools with the photographs of all the instruments and machines. These will be included in the manual.
- Concerned engineer has to decide the method of investigation considering the defect condition, presumed cause and feasibility of the application of the method.

3. Next WS Schedule

Next Workshop on Bridge Management System (BMS) is scheduled to be at **10:00 AM** on **March 27, 2016 (Sunday).**

The Chairperson ended the workshop with thanks to all for their fruitful discussions and wished the success of the project within the scheduled time.

Date : March 13, 2016

Peoples Republic of Bangladesh / Japan International Cooperation Agency (JICA)

Bridge Management Capacity Development Project

Workshop 11 (A2-WS5)

ATTENDANCE SHEET

	Name	Belongings	Signature
1		ACE, RHD, BRIDGE MANAGEMENT WING	
2		SE, RHD, APD, ~~BMDP~~ BMCDP	
3		Team Leader of JICA consultant team	
4		EE, BMMS Division	
5		EE, Barisal Road Div.	
6		EE, Habigonj Road Division.	
7		EE, Comilla Road Div.	
8		EE, Rajshahi Road Division	
9		SDE, RHD, BMMS Sub-division (DPM, BMCDP)	
10		JICA Project Team	
11		JICA Project Team	
12		JICA Project Team	
13		JICA Project Team	
14		JICA Project Team	
15		JICA Project Team	
16		JICA Project Team.	
17			
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