

バングラデシュ人民共和国

道路交通国道局 道路国道部 (RHD)

バングラデシュ国
橋梁維持管理プロジェクト
事業完了報告書

平成 30 年 10 月
(2018 年)

独 立 行 政 法 人
国 際 協 力 機 構 (J I C A)

株式会社日本構造橋梁研究所
株式会社オリエンタルコンサルタンツグローバル
一般財団法人橋梁調査会

基盤

JR

18-102

目 次

I. プロジェクトに関する基本情報.....	1
1. 国名.....	1
2. プロジェクト名.....	1
3. プロジェクト期間.....	1
4. プロジェクトの背景.....	1
5. 上位目標とプロジェクト目標.....	2
6. 実施機関.....	2
7. プロジェクトの概要.....	3
7-1 基本情報.....	3
7-2 プロジェクト内容.....	8
II. プロジェクトの結果.....	14
1. プロジェクトの投入および活動.....	14
1-1 日本側投入（計画、実績）.....	14
1-2 バングラデシュ側投入（計画、実績）.....	19
1-3 活動.....	20
2. プロジェクトの達成度.....	28
2-1 成果および指標.....	28
2-2 プロジェクト目標および指標.....	29
3. PDM の変更履歴.....	29
3-1 バージョン2から3への変更.....	29
3-2 バージョン3から4への変更.....	30
3-3 バージョン4から5およびバージョン5から6への変更.....	30
4. その他.....	31
4-1 環境および社会配慮の結果.....	31
4-2 ジェンダー/平和構築/貧困削減の検討結果.....	31
4-3 プロジェクトに影響するその他顕著な問題.....	31
III. 合同評価結果.....	32
1. DAC 評価基準に基づく評価結果.....	32
1-1 妥当性.....	32
1-2 有効性.....	33
1-3 効率性.....	33
1-4 インパクト.....	34
1-5 持続性.....	34
2. 実施と結果に影響を与える要因.....	36
3. プロジェクトリスクマネジメント結果の評価.....	37
4. 反省点・教訓.....	38

IV. プロジェクト完了後の上位目標達成のために.....	40
1. 上位目標達成の見通し.....	40
2. バングラデシュ側の運営・実施計画.....	40
3. RHD への推奨事項	40
4. プロジェクト終了から事後評価までのモニタリング計画.....	41

付録 1 : プロジェクト結果 (派遣された専門家一覧および相手側担当者一覧)

付録 2 : プロジェクトの成果品 (レポート・マニュアル等) 一覧表

付録 3 : PDM (全バージョン)

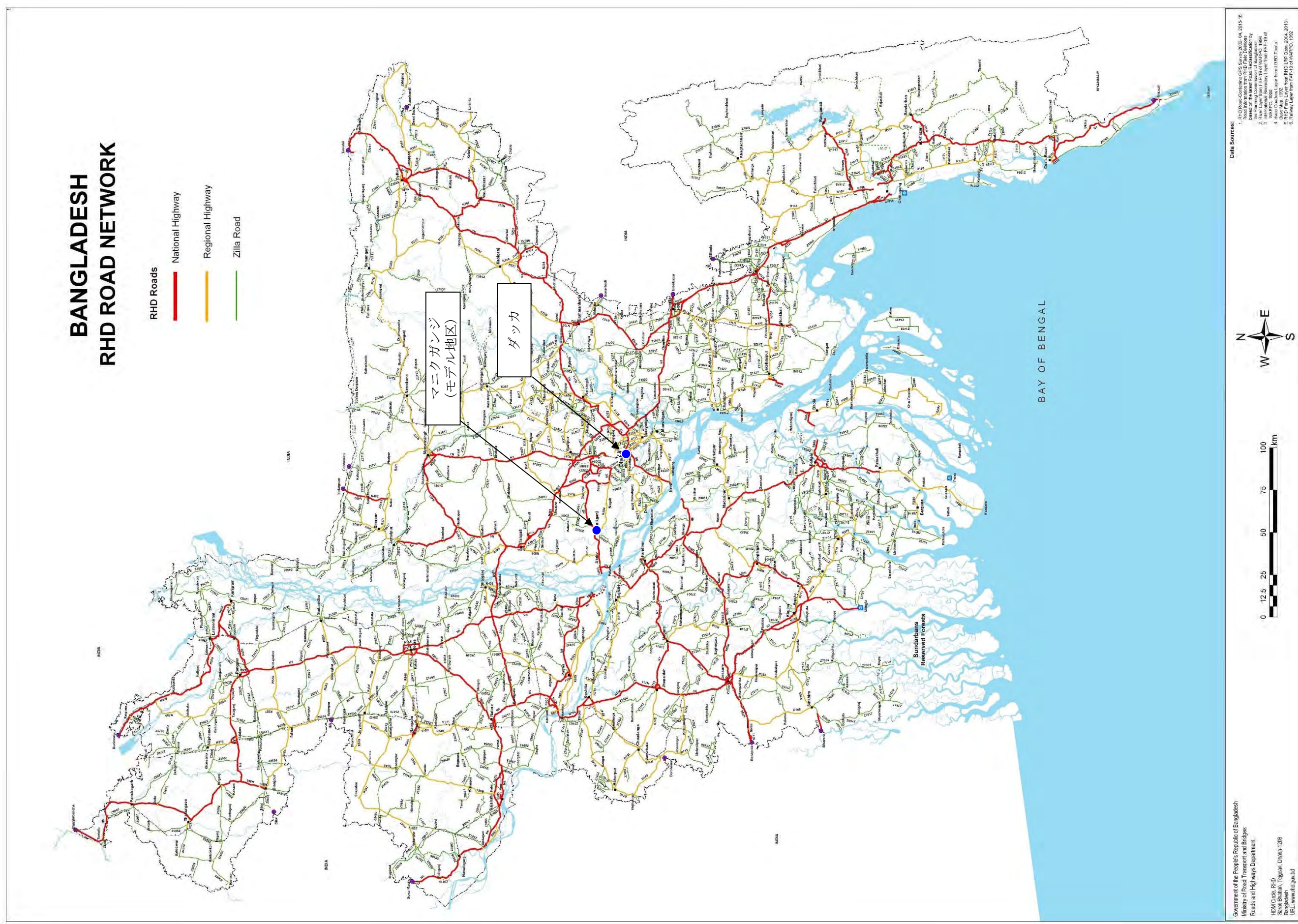
付録 4 : R/D、M/M、JCC 議事録 (写し)

付録 5 : モニタリングシート (写し)

略語表

Organizations : 組織	
GOB	Government of Bangladesh
JICA	Japan International Cooperation Agency (日本国際協力機構)
RHD	Roads and Highways Department (道路交通橋梁省道路交通国道局道路国道部)
MIS	Management Information System (システム管理部門)
BMW	Bridge Management Wing (橋梁維持管理ウィング)
Positions in RHD : RHD 内の役職	
ACE	Additional Chief Engineer
SE	Superintending Engineer
DS	Deputy Secretary
EE	Executive Engineer
SDE	Sub-Divisional Engineer
Others : その他	
TAPP	Technical Assistance Project Proforma/Proposal
BMS	Bridge Management System (橋梁マネジメントシステム)
DAC	Development Assistance Committee (開発援助委員会)
JCC	Joint Coordination Committee (合同調整委員会)
OJT	On-the-Job Training (実地研修)
PDM	Project Design Matrix (プロジェクト・デザイン・マトリクス)
R/D	Record of Discussion (プロジェクト開始前の公式協議記録)
M/M	Minutes of Meeting (プロジェクト実施中に作成した協議記録)
C/M	Core Member (バングラデシュ側主要担当者)
MT	Master Trainer (技術移転の起点となるバングラデシュ側職員)
WS	Work Shop (ワークショップ)
EBBIP	East Bangladesh Bridge Improvement Project (東部バングラデシュ橋梁改良事業)

RHD管轄の路線図



写真

	
<p>2015/8/18 キックオフミーティング</p>	<p>2015/11/11～2016/1/29 WS 1～23</p>
	
<p>2017/7/11～2017/8/10 OJT(1)</p>	<p>OJT(1) 橋梁点検実地訓練</p>
	
<p>2018/1/15～2018/2/1 OJT(2)</p>	<p>2018/2/18～2018/3/8 DTC 支援トレーニング</p>
	
<p>2018/5/3～2018/5/31 BMS トレーニング</p>	<p>2018/7/15, 29, 30 追加OJT</p>

	
<p>2015/8/30 第1回 JCC</p>	<p>2016/1/28 第2回 JCC</p>
	
<p>2017/3/5 第3回 JCC</p>	<p>2017/12/3 第4回 JCC</p>
	
<p>2018/8/29 第5回 JCC</p>	<p>2016/4/16 - 2016/4/29 第1回本邦研修</p>
	
<p>2017/11/5 - 2017/11/18 第2回本邦研修</p>	<p>2018/10/1 機材供与式・閉所式</p>

I. プロジェクトに関する基本情報

1. 国名

バングラデシュ人民共和国

2. プロジェクト名

橋梁維持管理プロジェクト

3. プロジェクト期間

プロジェクト実施期間

当初：2015年7月10日～2018年1月2日

変更：2015年7月10日～2018年9月2日

コンサルタント契約期間

当初：2015年7月10日～2018年3月2日

変更：2015年7月10日～2018年11月2日

(GOB 変更 TAPP 工期：2015年9月1日～2018年12月31日)

4. プロジェクトの背景 (R/D より)

バングラデシュ人民共和国（以下、「バングラデシュ」）では、年率 6%前後の GDP 成長率を維持する近年の堅調な経済発展に伴い、1975 年から 2005 年までの過去 30 年間で貨物取扱量が約 8 倍にまで拡大し、近年では 6～7%のペースで貨物量・旅客数共に増加を続けている。当国の主要運輸交通モードには、内陸水運、鉄道、道路があるが、旅客・貨物双方において道路利用が約 8 割（2005 年）を超え、道路輸送への偏重が進んでいる。しかし、増加する交通量に対し、新規の道路整備が追い付いておらず、また、既存道路の劣化も急速に進行しているため、旅客・貨物輸送に支障が生じている。

バングラデシュ政府は、「第 6 次五か年計画（2011/12～2015/16 年度）」において、バングラデシュの道路セクターでは、効率・近代的な道路輸送システムが同計画および当国の中期目標である「Vision 2021（2009 年）」を達成するために重要な役割を果たすと明記し、道路利用者コストを引き下げるために、現道の適切な維持管理を主要目標の一つに掲げている。「国土交通政策（2004 年）」では、維持管理能力の向上と財源の確保および長期的な整備計画の策定を方針の一つとしており、また、同政策を基に策定された「道路マスタープラン（2009 年）」では、道路・橋梁の資産価値の保全を目標の一つにしている。

バングラデシュの橋梁・カルバートは、1971 年の独立時には 1,112 橋（基）であったが、その後急激に橋梁建設が進められ、2013 年には 18,356 橋（基）まで増加しており、その中には円借款

によって建設された橋梁も含まれている。バングラデシュにおける橋梁維持管理は、定期保守（清掃等の維持作業）を1回/年行うとともに、損傷程度に応じた定期巡回・定期点検を実施することとしているものの、橋梁数の増加に伴い、応急橋であるベイリー橋の落橋や橋梁の早期損傷に対する事後保全が拡大しつつある現状にある。更に、1980年代以降に急増した橋梁の老朽化を見据えた対応が求められることから、橋梁を長期間良好な状態で供するためには、橋梁維持管理の更なる効率化を図っていくことが喫緊の課題である。

かかる状況を踏まえ、バングラデシュ政府は、橋梁維持管理システム（Bridge Management System : BMS 橋梁維持管理データを蓄積し、補修計画策定を行うためのツール）を活用した予防保全型維持管理を導入すべく、我が国に対し技術協力を要請した。これを受け JICA は、本件の必要性、要請の妥当性を確認するために2014年6月に詳細計画策定調査を行い、要請内容の確認および必要な協力内容を検討・整理し、協議を行ったうえで、「橋梁維持管理プロジェクト」（以下、「本プロジェクト」）の枠組みについて合意文書（Record of Discussions : R/D）を2015年2月に締結し、今般実施の運びとなったものである。

なお、我が国の対バングラデシュ JICA 国別分析ペーパー（2013年4月）において「全国運輸交通ネットワーク整備」が重点課題であると分析しており、対バングラデシュ国別援助方針（2012年6月）における重点目標としても、「人とモノの効率的な移動の促進に貢献するために、運輸・交通インフラの整備を進める」と定められており、本プロジェクトはこれら分析、方針に合致するものである。

5. 上位目標とプロジェクト目標（R/Dより）

上位目標：

バングラデシュ全土における RHD（道路交通橋梁省・道路交通国道局・道路国道部 Roads and Highways Department, Road Transport and Highways Division, Ministry of Road Transport and Bridges : RHD）の橋梁維持管理業務が改善される。

プロジェクト目標：

RHD の橋梁維持管理能力が向上する。

6. 実施機関

道路交通橋梁省・道路交通国道局・道路国道部（RHD）

7. プロジェクトの概要

7-1. 基本情報

7-1-1. RHD 道路網

Bangladesh の道路網は、国道 (National Highway)、地域道 (Regional Highway)、ジラ道 (Zila Road)、ウポジラ道 (Upazila Road)、ユニオン道 (Union Road)、村道 (Village Road) から成る。これらのうち、国道、地域道、ジラ道が RHD の管理下にある。他の道路は、地方行政開発協力省 (Ministry of Local Government, Rural Development & Cooperative) の地方行政技術局 (Local Government Engineering Department, LGED) が管轄する。表 1-1 に日本の道路網と比較した Bangladesh の道路延長および舗装率を示す。

表 1-1 Bangladesh の道路網

道路区分		実延長 (Km)		舗装率 (%)		道路密度 (Km/1,000Km ²)	
Bangladesh	Japan	Bangladesh	Japan	Bangladesh	Japan	Bangladesh	Japan
高速道路	高速道路	-	7,431.20	-	100.0	-	20
国道	国道 (指定区間)	3,812.78	22,591.60	92.8	100.0	26	60
地域道	国道 (指定区間外)	4,246.97	31,938.80		98.9	29	85
ジラ道	県道	13,242.33	129,328.90		96.3	90	342
ウポジラ/ユニオン/村道	市町村道	304,379.31	1,009,599.40	27.4	76.2	2,067	2,671
合計		325,681.39	1,200,889.90	31.7	79.6	2,207	3,178

出典) 日本: 2008年道路統計 Bangladesh: RHD, LGED 2015年ホームページ
 注) Bangladesh の舗装率には、簡易舗装等も含まれている。

7-1-2. 橋梁現況

表 1-2 は、橋梁形式毎の橋梁損傷状況を表している。表中、Box Culvert、Slab Culvert、Arch Masonry の数値は 2004 年に実施された全国橋梁点検結果を、その他約 4,500 橋のデータは「東部 Bangladesh 橋梁改良事業 (EBBIP)」(2013 年実施) に含まれていた全国橋梁点検の結果を、旧要領 (BRIDGE CONDITION SURVEY MANUAL: September, 2005) の区分分けに従って整理したものであり、本プロジェクトの結果に基づくものではない。

旧要領に基づく損傷区分 A, B, C, D は、次のとおりである。

損傷区分 A: 損傷なし

損傷区分 B: 軽微な損傷 (Minor Damage)

損傷区分 C: 主要な部材損傷 (Major Elemental Damage)

損傷区分 D: 主要な構造的損傷 (Major Structural Damage)

表 1-2 橋梁形式毎の橋梁損傷状況

	A		B		C		D		Sub-total
	Nos.	Rate(%)	Nos.	Rate(%)	Nos.	Rate(%)	Nos.	Rate(%)	
Box Culvert	7554	79.6	1016	10.7	794	8.4	131	1.4	9495
Slab Culvert	2554	63.7	494	12.3	755	18.8	207	5.2	4010
Arch Masonry	149	44.7	61	18.3	87	26.1	36	10.8	333
Sub-total	10257	74.1	1571	11.4	1636	11.8	374	2.7	13838
RC Slab	127	51.8	34	13.9	68	27.8	16	6.5	245
RC Girder	904	37.8	500	20.9	725	30.3	264	11.0	2393
PC Girder	282	69.5	61	15.0	52	12.8	11	2.7	406
PC Box	2	40.0	0	0	3	60.0	0	0	5
Sub-total	1315	43.1	595	19.5	848	27.8	291	9.5	3049
Steel Girder	76	33.0	35	15.2	89	38.7	30	13.0	230
Truss (SD)	152	74.1	13	6.3	32	15.6	8	3.9	205
Truss (RCD)	17	56.7	4	13.3	8	26.7	1	3.3	30
Truss (TD)	3	50.0	0	0	2	33.3	1	16.7	6
Sub-total	248	52.7	52	11.0	131	27.8	40	8.5	471
Baily (SD)	570	58.5	132	13.6	213	21.9	59	6.1	974
Baily (TD)	11	47.8	2	8.7	6	26.1	4	17.4	23
Sub-total	581	58.3	134	13.4	219	22.0	63	6.3	997
Grand-total	12401	67.6	2352	12.8	2834	15.4	768	4.2	18355

NB: (SD)=(Steel Deck), (RCD)=(RC Deck), (TD)=(Timber Deck)

Source: Box Culvert, Slab Culvert, Arch Masonry=BMMS : 2004 年全国橋梁点検結果

Other Types of Bridges=EBBIP Survey Results : 2013 年全国橋梁点検結果

損傷区分 D が占める比率は、アーチメイソリー（橋・カルバート）、コンクリート桁橋、鋼桁橋で高い。木製床版を有するトラス橋およびベイリー橋においても D の比率は高いが、該当する橋梁数そのものが少ない。一方、ボックスカルバート、PC 橋は他の形式の橋梁と比べると健全である。

7-1-3. 橋梁維持管理予算の推移

表 1-3 に道路・橋梁維持管理予算の推移を示す。なお、バングラデシュの会計年度は 7 月～翌年 6 月である。

表 1-3 道路橋梁維持管理予算の推移

(百万Tk)

予算科目	会計年度					
	2012	2013	2014	2015	2016	2017
Routine Maintenance	530	530	750	800	950	1,000
PMP Minor (Road & Bridge)	4,656	3,064	2,996	4,307	3,285	3,739
PMP Major (Road)	5,500	7,680	8,103	8,080	8,850	10,600
PMP Major (Bridge)	500	1,000	1,200	1,350	1,600	1,500
Emergency Maintenance (Road & Bridge)	170	100	100	100	100	100
Total	11,356	12,374	13,149	14,637	14,785	16,939

橋梁関連予算である PMP Major (Bridge) は、2013 年度に倍増し、以降は順調な増加傾向にある。しかしながら、配分額自体は要求額に遠く及ばない。配分額(予算額)は、前年度実績、要求額、国家政策などを勘案のうえ、財務省(Ministry of Finance)により決定される。

7-1-4. RHD の組織

RHD の組織を次頁 図 1-1 に示す。

RHD の本部はダッカにあり、5つのウィングで構成されている。また地方にはゾーンと呼ばれる10の地方組織が存在する。ウィングおよびゾーンの下には、サークル、ディビジョン、サブディビジョンという組織が配置されている。各組織の長は、ウィングおよびゾーンはアディショナルチーフエンジニア (ACE)、サークルはスーパーインテンディングエンジニア (SE)、ディビジョンはエキゼキユティブエンジニア (EE)、サブディビジョンはサブディビジョナルエンジニア (SDE) である。全ての組織はチーフエンジニア (CE) が統括する。各組織の数は、ウィングが5、ゾーンが10、サークルが21、ディビジョンが65、サブディビジョンが161である。これらに加え、特定のプロジェクト事務所が存在する。

ORGANOGRAM OF ROADS AND HIGHWAYS DEPARTMENT

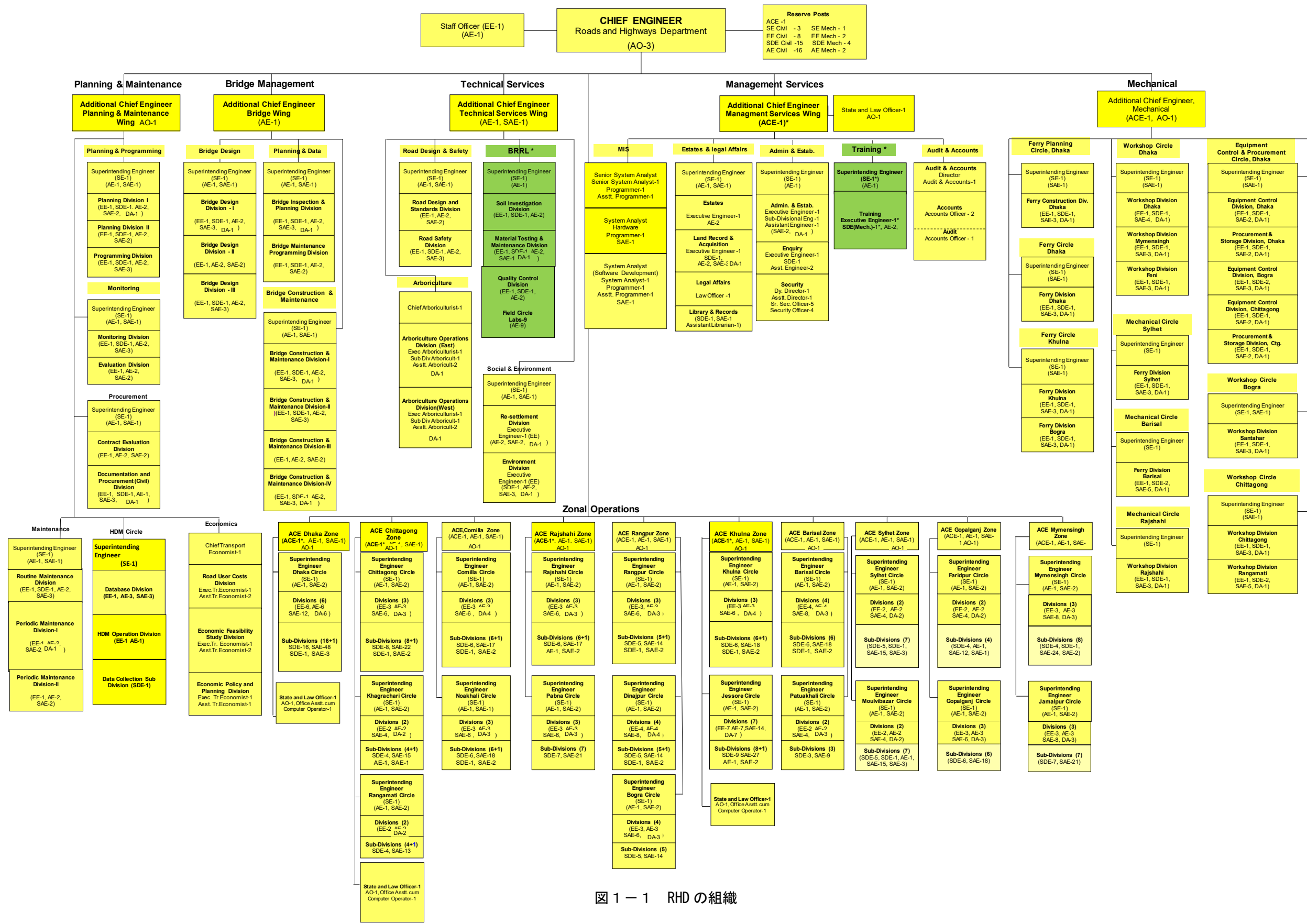


図 1 - 1 RHD の組織

7-1-5. RHD の人員配置

RHD の人員配置を表 1-4 に示す。

RHD には 9,377 のポストが存在するが、実際に配置されている人員はポスト数の 26%に過ぎない。常勤のポスト（クラスⅠ及びⅡ）は比較的定数に近い数値の人員が配置されているものの、現場作業において第一線で従事するクラスⅢおよびクラスⅣの人員が不足しており、必要に応じて臨時雇用しているのが現状である。

表 1-4 RHD の人員配置

Post Name	Number of Posts	Number of Staff	Remarks
Chief Engineer	1	1	
Additional Chief Engineer (Civil)	14	14	
Additional Chief Engineer (Reserved) (Civil)	1	0	
Superintending Engineer Director (SE) (Civil)	35	35	
Superintending Engineer Director (Reserved) (Civil)	3	1	
Executive Engineer (Civil)	99	99	
Executive Engineer (Reserved) (Civil)	8	8	
Sub-Divisional Engineer (Civil)	153	130	
Sub-Divisional Engineer (Reserved) (civil)	15	0	
Assistant Engineer (Civil)	174	137	
Assistant Engineer (Reserved) (Civil)	16	0	
Class I Civil Engineers	519	425	Subtotal A
Class I Mechanical Engineers	97	55	B
Other Class I Specialists	33	16	C
Total Class I Posts	649	496	D=A+B+C
Total Class II Posts	883	768	E
Total Class III Posts	4,540	842	F
Total Class IV Posts	3,305	344	G
Total	9,377	2,450	Total D+E+F+G

※ 各クラスに所属する職員について

- Class I : 学歴 16 年 (大卒相当)
- Class II : 学歴 13 年 (短大卒程度)
- Class III : 学歴 10 年 (高卒程度)
- Class IV : 学歴 8 年 (中卒程度)

7-2. プロジェクト内容

7-2-1. プロジェクトの流れ

プロジェクトの流れを図1-2に示す。

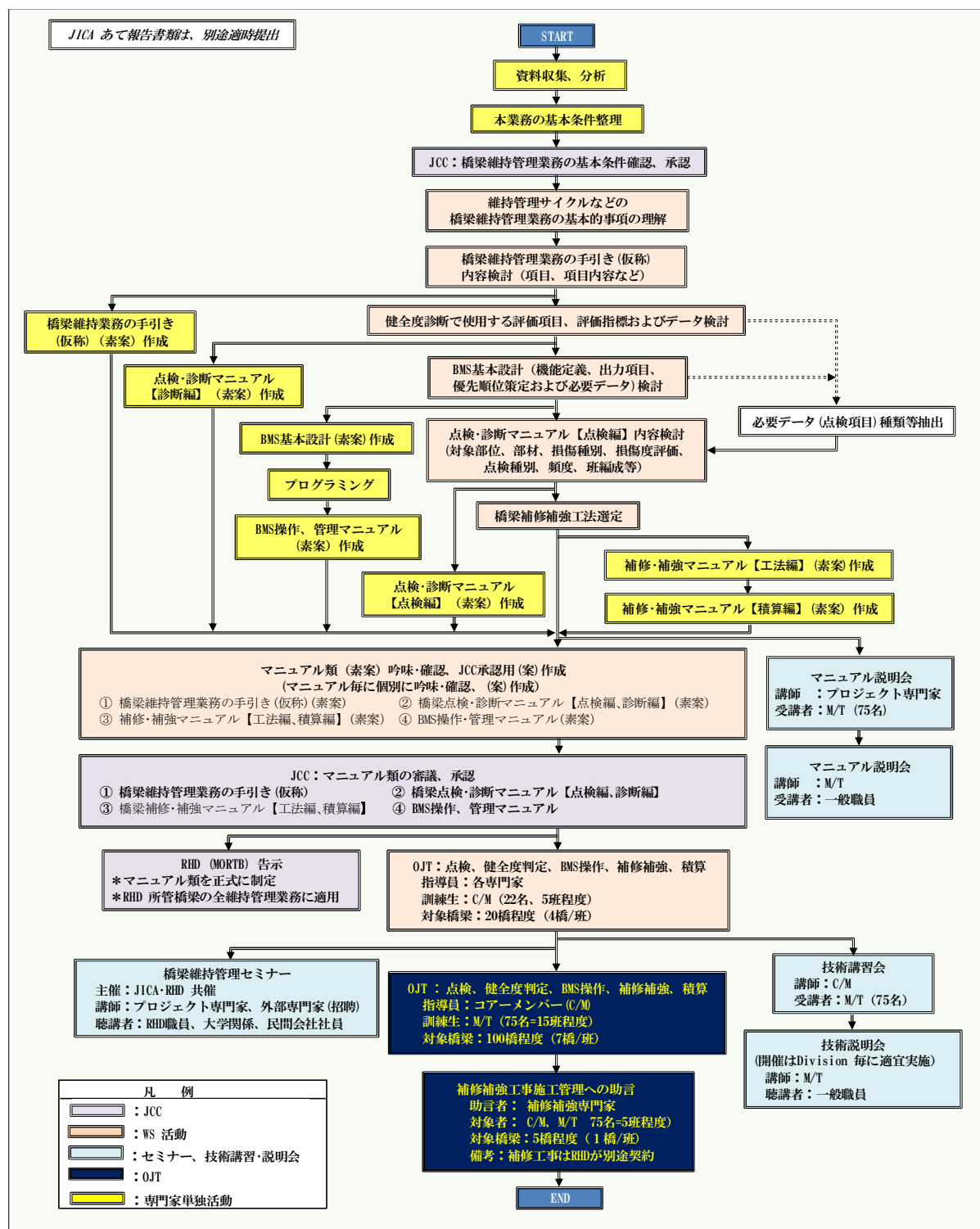


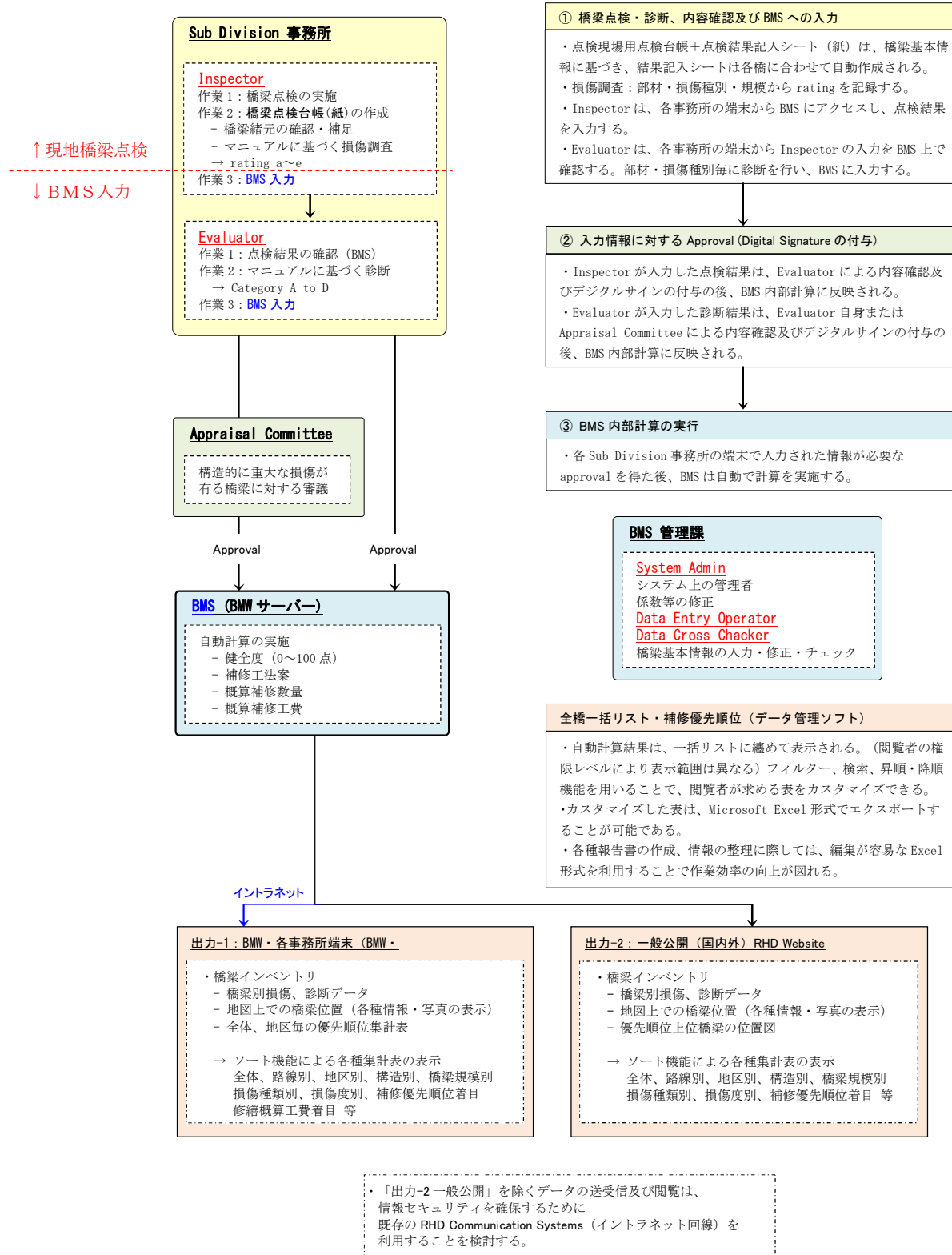
図1-2 プロジェクトの流れ

7-2-2. BMS 開発の流れ

当初、BMS 開発は Microsoft Excel 等の汎用ソフトを利用して実施する予定としていた。これは、将来のシステムアップデートの容易性を確保することを念頭に置いたものであり、極力簡易なシステムとすることを目標としていた。

現地関係者に対するヒアリング、既存システムである BMMS の検証の結果、BMMS が現在有効利用されていないこと、本プロジェクトで想定される入力・出力項目に対して機能性が大きく不足していること、開発時のソースコードが残されておらずアップデートが困難なこと、仮に可能な場合も BMMS は 20 年以上前の古いシステムであり改修して運用を続けることは効率的ではないことが判明したため、予定通り新システムに置き換えることとした。

システムの新規作成に際し、バングラデシュ側はプログラム言語を用いたフルスクラッチのプログラムとすることを強く求めた。検討の結果、将来的なアップデートが容易かつ幅広く実施可能であるシステムを目標として保持しつつ、プログラム言語によるシステムの開発が妥当であると判断した。BMS 運用の流れを図 1-4 に示す。



※ Division 用シートで自動決定される補修工法は、概算工費を算出するための暫定的なものであり、状況次第では最適な工法とならないこともあり得る。該当橋梁の補修実施が決定した際は、再度補修工法の詳細な検討を要する。

図 1-4 BMS の運用フロー

7-2-3. プロジェクトの成果および成果に対する活動方針

本プロジェクトは、以下の4つの成果に期待するものである。成果毎の基本方針を表1-5から表1-8に示す。

表1-5 成果1に対する活動方針

成果1: 橋梁維持管理制度が改善される。	
活動1-1: 橋梁維持管理業務の実態を把握し、整理する。	活動方針: 現況の橋梁維持管理業務実態、RHDの制度等について、RHD担当者からのヒアリングを行う。また、各種基準及び維持管理業務報告書等の資料収集・整理を行う。
活動1-2: 橋梁維持管理サイクルの課題を抽出・整理する。	活動方針: 橋梁維持管理サイクルの概念についてC/Mに説明し、橋梁維持管理サイクルに沿った業務実施の重要性を理解させる。また、活動1-1で把握した現橋梁維持管理の実態を踏まえて、WSにおいて橋梁維持管理サイクルの導入・定着のための課題を抽出整理し、橋梁維持管理サイクルの各ステージにおける課題解消のための方策を検討討議する。また、現在RHDが実施しているRoutine Maintenanceにおいて今後は予防保全を考慮した作業も含めることとし、その作業内容等について検討する。
活動1-3: 橋梁維持管理業務実施体制を検討する。	活動方針: 橋梁維持管理サイクルに則った維持管理業務を適切かつ持続的に実施する上での課題・解決するための方策として、組織面での改善についてWSで検討する。
活動1-4: 橋梁維持管理サイクルに基づく業務、必要な組織を体系的に整理し、とりまとめる。	活動方針: 活動1-1～活動1-3を踏まえて、RHDにおける現状の橋梁維持管理業務を整理し、橋梁維持管理サイクルの導入・定着を図る上で必要な制度面の改善、組織体制、基準類の構成、システム、機材等を体系的に整理し、「橋梁維持管理の手引き(仮称)(案)」を作成する。

表1-6 成果2に対する活動方針

成果2: 橋梁点検・評価マニュアル、橋梁補修・補強マニュアルが整備される。	
活動2-1: 既存の橋梁維持管理関連マニュアルをレビューし、課題を整理する。	活動方針: 既存の橋梁維持管理マニュアル及び基準類等について、課題等を整理する。
活動2-2: 橋梁点検・評価マニュアル案を改訂する。	活動方針: 橋梁点検・評価マニュアルは「点検編」と「評価編」の2編構成とする。点検編には、コンクリート構造物の中性化深度、塩分浸入深度及び鋼構造物の亀裂の有無等の詳細調査方法を含める。健全度評価は、コンクリート構造と鋼構造の構造種別毎に検討し、①部位別、部材別、損傷種別に対応した評価方法 ②損傷原因の分析・区分 ③損傷の進展予測方法 ④緊急性の判定方法を主体に作成する。
活動2-3: 橋梁補修・補強マニュアル案を作成する。	活動方針: 橋梁補修・補強マニュアルに収録する各種橋梁補修・補強工法は、最新の工法を主体に、WSにおいて工事で使用する材料、機械器具の現地調達可否、難易等を検討討議し、C/Mの意見、同意のもとに決定する。また、日本独自あるいは日本業者が得意とする補修・補強工法については、現状では調達に難点がある場合でも、マニュアルへの記載を積極的に推奨する。橋梁補修・補強マニュアルは「工法編」と「積算編」の2編構成とし、「積算編」は、補修・補強工法毎に労務編成・歩掛、材料数量、機械器具、仮設構造・資材の種類数量を計算し、標準単価表を作成する。
活動2-4: RHDマスタートレーナーがRHD職員に橋梁維持管理関連マニュアルに関する説明を行う。	活動方針: 完成した橋梁維持管理マニュアルをMTが他のRHD職員に説明することで同マニュアルの普及を目指す。

表 1-7 成果 3 に対する活動方針

成果 3: 橋梁マネジメントシステム(Bridge Management System : BMS)が構築される。	
活動 3-1: 既存BMMS (Bridge Maintenance and Management System バングラデシュ国内の既存の橋梁維持管理システム)をレビューし、分析する。	活動方針: 現BMMSの機能、操作性、登録データ、出力データ、活用方法等についてシステム開発者及び利用者の観点からレビューし分析する。
活動 3-2: BMSの利用方法をRHDと検討する。	活動方針: 分析結果を基に、WSにおいてBMSの利用方法について討議検討する。また、真に必要なシステムとして継続的に活用されるよう、橋梁維持管理サイクルにおける当該システムの位置づけを理解したうえで、RHDに適した活用方法を検討する。
活動 3-3: BMSの機能を定義し、構築する。	活動方針: 活動 3-2 で検討した利用方法に基づき、BMSの基本設計を実施する。プログラミングは、橋梁BMS専門家とともに現地雇用のシステムエンジニアが実施する。
活動 3-4: RHDが既存BMMSの登録データをBMSに移行する。	活動方針: RHDに対し、OJTモデルDivision以外のZone、Divisionの橋梁点検を早期に実施し、そのデータを本業務で構築したBMSに入力することについて、第1回JCCにおいて要請し、その実施について確認する。
活動 3-5: BMSマニュアル(管理者編・利用者編)案を作成する。	活動方針: 一般の橋梁技術者でも理解できる平易な「利用者編」、及びRHDのシステムエンジニア向けのシステムメンテナンス作業用「管理者編」のマニュアルを作成する。
活動 3-6: RHDのBMS管理者がRHD職員にBMSマニュアルの説明を行う。	活動方針: BMSを利用するRHD職員を対象としたBMSの操作、活用に関する技術講習は、他の分野と連続的に実施する。

表 1-8 成果 4 に対する活動方針

成果 4: OJTやセミナーを通じて、RHD職員が橋梁維持管理業務に必要な知識を高める。	
活動 4-1: 橋梁点検・評価マニュアルを用いて橋梁点検・評価に関するOJTをモデル地区で行う。	活動方針: 作成された橋梁点検・評価マニュアルを用いて、モデル地区において橋梁点検・評価をOJTで実施し、RHDの橋梁点検・評価能力の向上を図る。
活動 4-2: BMSを利用してモデル地区の補修対象橋梁の優先度判定をOJTで行う。	活動方針: モデル地区の橋梁点検・評価結果を基に、BMSを用いて補修工事優先度を算出し、補修対象橋梁を抽出する。OJTを実施することで、RHDのBMS利用能力向上を図る。
活動 4-3: 橋梁補修・補強マニュアルを用いて橋梁補修・補強工法選定及び費用算出に関するOJTをモデル地区で行う。	活動方針: 作成された橋梁補修・補強マニュアルを用いて、活動 4-2 で抽出した補修対象橋梁の補修補強工法の選定、概算費用の算出及び保守計画の立案をOJTで実施し、RHD職員の橋梁補修・補強能力の向上を図る。
活動 4-4: RHDが実施する橋梁補修・補強工事の施工管理に対して専門家が助言を行う。	活動方針: 橋梁補修・補強工事における施工計画審査の要領、品質管理、検査、工程管理、工事安全管理、交通安全管理及び環境管理に関する施工管理事項を重点的に指導、助言する。
活動 4-5: 人材育成計画を作成する。	活動方針: 橋梁維持管理サイクルに従って、効率的かつ持続的に橋梁維持管理を運営するための人材を育成する上で、RHDが取り組むべき施策を人材育成計画として取りまとめる。

II. プロジェクトの結果

1. プロジェクトの投入および活動

1-1. 日本側投入（計画、実績）

プロジェクトに関する日本側投入の計画と実績を表 2-1 に示す。

- (1) 専門家については、2016 年 7 月に発生した重大な安全問題の影響により、当初の計画通りに専門家を派遣することができなくなった。専門家の派遣時期が当初想定した派遣時期と大幅にずれることにより現地に赴くことが困難になった専門家がいたこと、また、その後の諸々の制約（滞在期間の制限、同時期滞在人数の制限、ダッカ外での警察によるエスコート要請）により、専門家派遣時期を度々再検討しなければならなかったが、新たなメンバーを特に追加することなく、主に団内の他のメンバーの業務の兼務により対処した。

橋梁維持管理システム（2）の専門家の追加は、ヒアリングの結果、当初想定した汎用ソフトを用いた簡便なシステムの構築からコンピューター言語を用いた本格的なシステムの構築へと方針転換したことにより、専門的なシステムマネジャーの派遣が必要になったことによる。

アセットマネジメント専門家の削減は、当初、国際セミナー（外部セミナー）の時期に合わせて学識経験者の派遣を想定していたが、安全問題のためにダッカにて国際セミナーを開催することが困難になったため、派遣を取りやめたものである。

- (2) 機材の調達については、地中レーダーの機種を簡易なものに変更した。これは、非破壊検査専門家が、機械の使用目的が鉄筋の位置探査だけであり、簡易な機械に変更しても問題ないと判断したことによる。更に、ロボットカメラが 2 台追加された。RHD からは橋梁点検車の供与要望が強かったが、橋梁点検車のように桁下の点検もでき、稼働時に交通を阻害せず、しかも橋梁点検車に比べ安価なロボットカメラを導入することにしたものである。供与機材および調査用資機材の一覧表を表 2-2（1）～表 2-2（4）に示す。

- (3) 本邦研修については、工期の延長に伴い第 3 回目が計画されたが、最終的に中止となった。これは、研修時期がイード（イード ウル フィトゥル）まで間がなく、イード前の道路改良が急務とされた時期にあり、道路改良を第一線で指揮する現場の責任者が研修生の中に多く含まれていたことによる。またこの時期に、南アジアの他の国々に比べバングラデシュの道路状況が極めて悪いという新聞報道があり、本邦研修実施の最終判断に影響したものと史料される。

- (4) プロジェクトの業務期間については、重大な安全問題発生により現地乗り込みができなかった期間を考慮して、8 か月延長された。

(5) プロジェクト費は大幅な増額となった。当初契約と第4回変更との差額を表2-3に示す。また、主な増額理由は以下に示すとおり、2016年7月に発生した重大な安全問題の影響によるプロジェクト期間の延長に起因しているものが多い。

- ・旅費関係の増額は、滞在期間の制限に伴い渡航回数が増加したことが主な理由である。
- ・一般業務費の増額は、プロジェクト期間延期に伴うローカルスタッフの雇用費の増加が主な理由である。
- ・再委託費の増額は、BMSの構築が当初予定していた汎用ソフトを用いたものから、ヒアリング・RHDからの要請に基づき、コンピューター言語を用いたより高レベルなプログラムに方針転換したこと、プロジェクト期間延長に伴う開発の遅延および開催時期が先延ばしされたOJT等セミナーにおけるRHD側の意見要望に対応するためのシステムマネジャー、プログラマーの業務期間の延長が主な理由である。
- ・直接人件費の増額は、専門家の現地活動期間の再調整、「BMS 専門家(2) (システムマネジャー)の追加」、RHD一般職員向けのトレーニングの追加、マニュアルの最終化に伴う専門家の派遣追加等の理由によるものである。一般管理費の増加には安全問題に伴う一時的な諸経費の増加も含まれている。

表2-1 日本側投入

投入項目	計画	実績 (PDM Ver.6)
(1) 専門家	1. 総括/橋梁維持管理計画 2. 橋梁点検 3. 橋梁健全度評価 4. 橋梁維持管理計画(2) 5. 詳細調査 6. 橋梁補修・補強/橋梁健全度評価(2) 7. コスト積算 8. 橋梁マネジメントシステム 9. アセットマネジメント 10. プロジェクトモニタリング 11. 業務調整/橋梁維持管理計画(補助)	1. 総括/橋梁維持管理計画 2. 橋梁点検 3. 橋梁健全度評価 4. 橋梁維持管理計画(2) 5. 詳細調査 6. 橋梁・補修補強/橋梁健全度評価(2) 7. コスト積算 8. 橋梁マネジメントシステム 9. 橋梁維持管理システム(2) 10. プロジェクトモニタリング 11. プロジェクトモニタリング(2) 12. 業務調整/橋梁維持管理計画(補助)
(2) 機器の調達	1. 付属品付きデータベース用パソコン 2. コンクリート検査機器 ・地中探査レーダー(RCLレーダー) ・コンクリートコアカッター ・電気ドリル	1. データベース用パソコン 11台 2. コンクリート検査機器 ・鉄筋探査機 2台 ・コンクリートコアカッター 2台 ・電気ドリル 2台 3. ロボットカメラ 2台
(3) 本邦研修	2回実施	2回実施、1回中止 1. 第1回目 2016年4月16日より29日にかけて実施。 参加者8名。 2. 第2回目 2017年11月5日より18日にかけて実施。 参加者8名。 3. 第3回目 2018年4月に実施予定であったが、諸々の理由により中止。
(4) 業務期間 プロジェクト実施期間	2015年7月10日から2018年1月2日まで	(工期延期8カ月) 2015年7月10日から2018年9月2日まで
コンサルト契約期間	2015年7月10日から2018年3月2日まで	2015年7月10日から2018年11月2日まで
(5) プロジェクト費	250, 385, 040 円	338, 286, 240 円

表 2 - 2 (1) 供与機材一覧

No.	Name	Specification	Pieces	Purpose of Use	Photos
1	Re-bar detector	HILTI PX10 (electromagnetic induction method)	2	Covering depth, Re-bar position	
2	Concrete core cutter	core size = 100 mm maximum depth = 100 mm	2	Chloride ion concentration, ASR test	
3	Concrete drill	core diameter = 22 mm	2	Carbonization, Salt content	
4	Robot Camera		2	Defect observation by camera	
5	Laptop		11	Recording	

表 2-2 (2) 調査用資機材 (点検用具) 一覧

No.	Name	Specification	Pieces	Purpose of Use	Photos
1	Binocular	Prism Type: Roof Objective Lens: 25mm Magnification: 10	6	Inspection	
2	Inspection hammer	Appellation: #1/2 Length: 420mm Head Diameter: ϕ 17 Head Length: 113mm Head Weight: 200g	6	Inspection	
3	Inspection hammer (Long)	Appellation: #1/2 \times 900 Length: 900mm Head Diameter: ϕ 17 Head Length: 113mm Head Weight: 200g	6	Inspection	
4	Clack Gauge		1000	Inspection	
5	GPS		6	Inspection	
6	Leser Range Finder	Maximum Measurement Distance: 250m	6	Inspection	
7	Reagent	Phenolphthalein solution		Carbonization	

表 2 - 2 (3) 調査用資機材 (記録用具) 一覧



No.	Name	Specification	Pieces	Purpose of Use	Photos
1	Digital camera		6	Recording	
2	Video camera		6	Recording	

表 2 - 2 (4) 調査用資機材 (点検補助用具) 一覧




No.	Name	Specification	Pieces	Purpose of Use	Photos
1	Safety belt			Safety	
2	Helmet, Safety best, Protective glasses, Protective mask etc.			Safety	
3	Work clothes, Work boots, Gloves, etc.			Safety	

表 2-3 プロジェクト費の増減

(単位: 円)

	当初契約 (7/2015)	第4回変更(7/2018)	増減
I. 業務原価	194,041,000	260,931,000	66,890,000
1. 直接経費	84,481,000	125,555,000	41,074,000
(1) 旅費(航空賃)	19,651,000	35,648,000	15,997,000
(2) 旅費(その他)	24,053,000	28,605,000	4,552,000
(3) 一般業務費	21,951,000	29,886,000	7,935,000
(4) 成果品作成費	387,000	387,000	0
(5) 機材費	13,225,000	13,809,000	584,000
(6) 再委託費	4,000,000	15,887,000	11,887,000
(7) 国内研修費	1,214,000	1,333,000	119,000
2. 直接人件費	49,800,000	61,535,000	11,735,000
3. その他原価	59,760,000	73,841,000	14,081,000
II. 一般管理費等	37,797,000	52,297,000	14,500,000
III. 小計	231,838,000	313,228,000	81,390,000
消費税及び地方消費税の 合計金額	18,547,040	25,058,240	6,511,200
IV. 合計	250,385,040	338,286,240	87,901,200

1-2. バングラデシュ側投入 (計画、実績)

バングラデシュ側投入の計画時と実績の比較を表 2-4 に示す。

表 2-4 バングラデシュ側投入

投入項目	計画(PDM Ver.1)	実績(PDM Ver.6)
(1) 人員	1. プロジェクトディレクター 1名	1. プロジェクトディレクター 1名
	2. 副プロジェクトディレクター 1名	2. 副プロジェクトディレクター 1名
	3. プロジェクトマネジャー 1名	3. プロジェクトマネジャー 1名
	4. 副プロジェクトマネジャー 1名	4. 副プロジェクトマネジャー 1名
	5. RHDのカウンターパート	5. ACE 2名
	6. 他のスタッフ	6. SE 3名
		7. DS 1名
		8. EE 8名
		9. SDE 1名
(2) 施設及び設備	1. 事務室(RHD内)	1. 事務室 ミルプールのトレーニングセンター内に 事務所2室が提供された。 設備については、大型及び小型プリンター、 冷蔵庫、デスク、チェアなどの提供があった。
	2. 点検用装備	2. 点検用装備 修正版TAPPにて購入が認められた、距離計、 カメラ、双眼鏡、梯子、点検用小物類が 用意された。
(3) 費用	1. 旅費、日当、宿泊費	1. 旅費、日当、宿泊費
	2. その他経費	プロジェクトに係る予算(TAPP)の承認が 遅れたが支給された。 2. その他経費

1-3. 活動

活動進捗の概要を表2-5に示す。

表2-5 活動進捗の概要

活動	完了	プロジェクト 終了時 (H30.11.2) までに完了	プロジェクト 終了時 までに完了 しない。
[成果1に係る活動]			
活動1-1: 橋梁維持管理業務の実態を把握し、整理する。	✓		
活動1-2: 橋梁維持管理サイクルの課題を抽出・整理する。	✓		
活動1-3: 橋梁維持管理業務実施体制を検討する。	✓		
活動1-4: 橋梁維持管理サイクルに基づく業務、必要な組織を体系的に整理し、とりまとめる。	✓		
[成果2に係る活動]			
活動2-1: 既存の橋梁維持管理関連マニュアルをレビューし、課題を整理する。	✓		
活動2-2: 橋梁点検・評価マニュアル案を改訂する。	✓		
活動2-3: 橋梁補修・補強マニュアル案を作成する。	✓		
活動2-4: RHDマスタートレーナーがRHD職員に橋梁維持管理関連マニュアルに関する説明を行う。	✓		
[成果3に係る活動]			
活動3-1: 既存BMMS (Bridge Maintenance and Management System バングラデシュ国内の既存の橋梁維持管理システム)をレビューし、分析する。	✓		
活動3-2: BMSの利用方法をRHDと検討する。	✓		
活動3-3: BMSの機能を定義し、構築する。	✓		
活動3-4: RHDが既存BMMSの登録データをBMSに移行する。			✓
活動3-5: BMSマニュアル(管理者編・利用者編)案を作成する。	✓		
活動3-6: RHDのBMS管理者がRHD職員にBMSマニュアルの説明を行う。	✓		
[成果4に係る活動]			
活動4-1: 橋梁点検・評価マニュアルを用いて橋梁点検・評価に関するOJTをモデル地区で行う。	✓		
活動4-2: BMSを利用してモデル地区の補修対象橋梁の優先度判定をOJTで行う。	✓		
活動4-3: 橋梁補修・補強マニュアルを用いて橋梁補修・補強工法選定及び費用算出に関するOJTをモデル地区で行う。	✓		
活動4-4: RHDが実施する橋梁補修・補強工事の施工管理に対して専門家が助言を行う。	✓		
活動4-5: 人材育成計画を作成する。	✓		
[合同調整会議]	✓		
[モニタリング]	✓		
[セミナー]	✓		
[外部セミナー]			✓
[本邦研修]	✓		

1-3-1. 成果1に係る活動

「成果1に係る活動」は、2015年8月に実施されたベースライン調査並びに8回に渡り開催されたRHD C/MとのWSを通じて議論され、最終的に「Bridge Maintenance Management Standard」としてまとめ上げられた。表2-6に「成果1に係る活動」のWS概要を示す。

表2-6 成果1に係るWS概要

番号	タイトル	日付	参加人数
A1-WS1	橋梁維持管理サイクルの確立の向けて	2015年11月5日	15
A1-WS2	維持管理業務に関する課題の解決策、年間維持管理業務量の推定、人材確保の必要性	2016年1月10日	14
A1-WS3	懸案事項に関する考察	2016年1月17日	18
A1-WS4	橋梁維持管理事業の流れ	2016年1月17日	17
A1-WS5	1) 橋梁維持管理標準(プレドラフト) 2) 研修開発計画 3) 現行橋梁状況調査要領の見直し	2016年2月4日	16
A1-WS6	橋梁維持管理標準(ドラフト バージョン1)	2016年3月27日	17
A1-WS7	技術力の向上について	2016年4月10日	16
A1-WS8	橋梁維持管理標準(ドラフト バージョン2)	2016年4月10日	16

1-3-2. 成果2に係る活動

「成果2に係る活動」は、2015年8月に実施されたベースライン調査並びに11回に渡り開催されたRHD C/MとのWSを通じて議論され、最終的に「Bridge Inspection and Evaluation Manual」および「Bridge Rehabilitation and Strengthening Manual」としてまとめ上げられた。後者は、工法編と積算編の2分冊から成る。表2-7に「成果2に係る活動」のWS概要を示す。

表2-7 成果2に係るWS概要

番号	タイトル	日付	参加人数
A2-WS1	橋梁点検マニュアルの開発	2015年12月13日	18
A2-WS2	橋梁評価マニュアルの開発	2015年12月13日	18
A2-WS3	耐荷力に関する詳細調査のケーススタディー	2016年1月10日	14
A2-WS4	点検手続き、点検中の安全、橋梁点検マニュアルの目次	2016年3月13日	16
A2-WS5	1) 評価方法と評価基準 2) 橋梁全体の評価方法 3) 現行橋梁状況調査マニュアルの見直し	2016年3月13日	16
A2-WS6	橋梁点検評価マニュアル(点検編)(ドラフト)	2016年4月10日	18
A2-WS7	橋梁点検評価マニュアル(評価編)(ドラフト)	2016年4月10日	18
A2-WS8	橋梁補修・補強マニュアルの開発(工法編) 1) 補修工事概要、基本及び工法 2) 補修・補強工法の実施例 3) 適用及び品質管理 4) 日常管理業務	2016年3月22日	13
A2-WS9	1) 橋梁補修・補強マニュアル Part 2 積算の開発 2) 橋梁点検マニュアルの開発: 点検中の重要事項	2016年3月22日	13
A2-WS10	橋梁補修・補強マニュアルの開発(工法編)	2016年6月19日	18
A2-WS11	橋梁補修・補強マニュアルの開発(積算編)	2016年6月19日	18

活動2-4に関しては、2018年4月に実施されたDTC(Divisional Training Course)において、MT指導の下、少なくとも532名以上のRHD職員が橋梁点検評価マニュアルの教育を受けた。

1-3-3. 成果3に係る活動

「成果3に係る活動」は、2015年8月に実施されたベースライン調査並びに4回に渡り開催されたRHD C/MとのWSを通じて議論され、最終的に「BMS」のおよび「Bridge Management System Manual」としてまとめ上げられた。表2-8に「成果3に係る活動」のWS概要を示す。BMSは、WS完了後の各OJTやモデル地区橋梁点検、DTC等でのレクチャー・訓練の度、RHD職員からの意見要望を受けブラッシュアップされた。

BMSは「橋梁台帳・点検診断結果のデータベース」と「補修補強対象橋梁の選定補助」を目的としており、主な機能は以下のとおりである。

- Bridge List : 橋梁台帳（形状・要素数等の入力含む）
- Bridge Inspection : 点検結果情報の蓄積
- Bridge Evaluation : 評価結果情報の蓄積
- Bridge Remedial Measure : 概算補修工費の算出
- Bridge Remedy List : 算出結果の総括表
- Settings : 損傷種類・係数・補修工法・単価等の管理
- その他検索機能、エクセルへのエクスポート機能等

BMSは、橋梁台帳の情報から対象橋梁の周辺地域における重要度、および点検・評価結果から健全度を自動で点数化しそれらを足し合わせることで対象橋梁の補修・補強優先度を算出する機能と、評価結果に基づき対象橋梁の補修・補強工法の仮定、概算数量および概算工費を算出する機能を有している。橋梁維持管理計画に際して、ユーザーはこれらの情報（優先度・概算工費）に基づき、補修補強対象とすべき橋梁を明確な根拠と共に選定することが可能となった。

BMSマニュアルは、当初「管理者編・利用者編」の2編を作成する予定であったが、RHD職員から寄せられた意見要望、それらに基づく想定される運用上の利便性を鑑み、「システム管理者編・Bridge Management Wing (BMW) 編・点検評価者編、一般利用者編」の4分冊の編成とした。

活動3-4が未完了となっているのは、既存のBMMSデータには間違いや重複が多く、そのまま新BMSにデータを移行した場合に大きな混乱が生じることが想定されることから、第1回全国橋梁点検時に旧データをチェックしながら移行するように変更したためである。モデル地区（マニクガンジ事務所管内橋梁約200橋）の橋梁は、データの移行および点検が完了している。また、RHD管内の他の橋梁については、2018年度に橋梁の全国橋梁点検が実施される予定であり、順次、データの移行が進むものと考えられる。

表2-8 成果3に係るWS概要

番号	タイトル	日付	参加人数
A3-WS1	BMSのプログラム構成	2016年2月4日	16
A3-WS2	BMSに関する要求事項の確認	2016年3月27日	19
A3-WS3	BMSの機能並びに操作手順	2016年3月29日	16
A3-WS4	BMSの導入	2017年1月29日	23

活動3-6に関して、2018年4月に実施されたDTCに於いて、MT指導の下、少なくとも532名以上のRHD職員がBMSマニュアルの教育を受けた。

1-3-4. 成果4に係る活動

活動4-1から活動4-3は、モデル地区のOJTに係る活動である。当初のOJT計画では、マニュアルの説明、モデル地区（マニクガンジ）での橋梁点検評価の実施、点検結果の評価を基にした補修対象橋梁の優先度の判定、補修優先度の高い橋梁の補修工法の選定並びに補修費の算定までを一続きのOJTとして実施する予定であった。しかし、OJTの実施前に重大な安全問題が発生し、諸々の制約のために、一連のトレーニングとして実施することが極めて困難になった。これにより、OJTは、OJT(1)：マニュアルの説明と橋梁点検評価のデモンストレーション、マニクガンジでの橋梁点検とBMSへのインプット、OJT(2)：優先順位の決定、補修工法の選定、補修費の算定の2つのステージに分割して実施することになった。なお、マニクガンジにおける橋梁点検は、2017年11月から12月にかけてマスタートレーナー(MT)自身の手により実施され、安全上の理由からJICA専門家は参加していない。JICA専門家はダッカに待機し、点検計画の作成、点検の準備、点検結果の評価、点検結果のBMSへの入力などについて後方支援を行った。OJT(1)およびOJT(2)の概要を表2-9に示す。

表2-9 OJT(1)およびOJT(2)の概要

OJT(1)						
カリキュラム	期間	日割り	内容			
			午前1	午前2	午後1	午後2
点検及び評価	2017年7月11日-20日	1日目	点検に関する説明		評価に関する説明	詳細調査に関する説明
		2日目	点検及び評価演習		点検機器、ロボットカメラ説明	詳細調査実演
		3日目	点検及びロボットカメラ操作実演(マニクガンジ)			
橋梁維持管理標準及びBMS	2017年7月23日-31日	4日目	橋梁維持管理サイクルの説明		BMS及びBMS操作の説明	
		5日目	現行BMMSから新BMSへのデータの移行		BMS活用演習	
補修及び補強	2017年8月2日-10日	6日目	補修補強工法の説明		補修補強工法の説明	補修費算定の説明
		7日目	補修費算定の説明		補修補強工法演習	補修費算定演習
OJT(2)						
カリキュラム	期間	日割り	内容			
			午前1	午前2	午後1	午後2
橋梁維持管理標準及びBMS	2018年1月15日-22日	1日目	橋梁維持管理計画策定の概要		BMSに使われている計算上の仮定	
		2日目	エクセル表の作成		年度補修計画の作成	
補修及び補強	2018年1月24日-2月1日	3日目	橋梁1の補修計画及び工費算出		橋梁2の補修計画及び工費算出	
		4日目	橋梁3の補修計画及び工費算出		橋梁4の補修計画及び工費算出	

1-3-5. 合同調整会議 (JCC)

JCC は全5回実施された。JCC の日時および議題を表2-10に示す。

表2-10 JCCの概要

JCC番号	第1回	第2回	第3回	第4回	第5回
開催日時	2015.8.30	2016.1.28	2017.3.5	2017.12.3	2018.8.29
議長	次官	次官	次官	副次官	次官
議事次第	1. 開会の辞 2. 歓迎の辞 3. 議題 ①プロジェクトの全体目標 ②プロジェクトの目的 ③プロジェクトの成果 ④プロジェクト実施行程 ⑤専門家の配置計画 4. 承認申請事項 ①PDM及びPO ②モデル地区の選定 ③コアメンバーの構成	1. 開会の辞 2. 歓迎の辞 3. 議題 ①第1回JCC決定事項 ②WSの実績と今後の活動 ③モニタリングシート 4. 討議 5. 閉会の辞	1. 開会の辞 2. 歓迎の辞 3. 議題 ①プロジェクトの進捗 ②マニュアルの概要 ③OJTの詳細計画 ④機材の見直し ⑤モニタリングシート 4. 討議及び結論	1. 開会の辞 2. 歓迎の辞 3. 第3回JCC決定事項 4. 報告事項 ①OJT(1) ②第2回本邦研修 5. プロジェクト行程 ①プロジェクト期間の延長 ②本プロジェクトフェーズ2 6. モニタリングシート (Ver.5) 7. 討議及び結論	1. 開会の辞 2. 歓迎の辞 3. 第4回JCC決定事項 4. 報告事項 ①マニガンジ橋梁点検及びOJT(2) ②DTC支援研修 5. マニュアル(ファイナルドラフト) ①橋梁維持管理標準 ②橋梁点検評価マニュアル ③橋梁補修・補強マニュアル ④BMSマニュアル 6. 制度改革計画(ドラフト) 7. 完了報告書の目次 8. JICA海外留学プログラム 9. BMCDP フェーズ2 10. モニタリングシート (Ver.6) 11. 討議及び結論

1-3-6. モニタリング

モニタリングは全6回行われた。2016年7月に予定されていたJCCが安全問題のために中止となったため、第3回モニタリングシート (Monitoring Sheet Ver.3)、第4回モニタリングシート (Monitoring Sheet Ver.4)は、2017年3月に開催された第3回JCCにおいて承認された。モニタリングの推移を表2-11に示す。

表2-11 モニタリング推移

バージョン	1	2	3	4	5	6
提出日	2015/8/30	2016/1/28	2017/3/5	2017/3/5	2017/12/3	2018/9/7
進捗期間	2015/8/30 まで	2016/1/15 まで	2016/7/15 まで	2017/2/15 まで	2017/11/15 まで	2018/8/15 まで

1-3-7. セミナー

セミナー（名称：DTC Supporting Training）は、RHD の橋梁維持管理を担当する若手技術者に対して2018年2月から3月にかけて開催された。セミナーの内容は、橋梁点検と損傷の評価、BMSおよびBMSの操作についてであり、英語とベンガル語で講義が行われた。セミナーの概要を表2-12に示す。参加人数は約100名であった。

表2-12 DTC Supporting Training の概要

カリキュラム	期間	日割り	内容			
			午前1	午前2	午後1	午後2
点検及び評価	2018年2月18日-3月7日	1日目	橋梁維持管理 サイクル及び橋梁 点検評価の概要	橋梁点検評価演習	橋梁点検評価演習	
BMS	2018年2月19日-3月8日	2日目	BMS及びBMS機能 概要	BMS演習	BMS演習	

1-3-8. 外部セミナー

当初、日本国やバングラデシュ近隣国から橋梁維持管理に関わる学識経験者や専門家をダッカに招聘し、100名規模の国際セミナーを開催することを企画していたが、2016年7月1日に発生した重大な安全問題の影響により、この企画は中止となった。

1-3-9. 本邦研修

本邦研修は2回実施された。

(1) 第1回本邦研修

第1回本邦研修は2016年4月17日から29日にかけて実施され、参加者は8名であった。

第1回本邦研修参加者および研修行程を表2-13、2-14に示す。

表2-13 第1回本邦研修参加者

NO	Name	Title
1	Parimal Bikash Sutradhar	Project Director
2	A.K.M. Manir Hossain Pathan	Additional Project Director
3	Md. Shafikul Islam	Project Manager
4	Md. Sohel Rana	Deputy Project Manager
5	Mohammed Shamim Al Mamun	Executive Engineer
6	Mohammad Saifuddin	Executive Engineer
7	Najmul Hasan	Executive Engineer
8	Md. Khaled Shaheed	Executive Engineer

表2-14 第1回本邦研修行程

日程	研修内容	研修機関
2016年4月17日(日)	来日	
2016年4月18日(月)	ブリーフィング	JICA 東京
	発表：カントリーレポート 講義：Project Cycle Management 研修	国際開発機構 (FASID)
2016年4月19日(火)	講義：Project Cycle Management 研修	国際開発機構 (FASID)
	講義：日本における橋梁維持管理の政策	NEXCO東日本
2016年4月20日(水)	講義：高速道路会社事業及び研修施設概要説明	長岡技術大学
	講義：日本における橋梁維持管理の最新技術	NEXCO東日本
	見学：NEXCO東日本テクニカルトレーニングセンター	群馬県伊勢崎市・田中建設
	見学：龍宮橋耐震補強工事現場	三井住友建設・日立ソリューションズ
2016年4月21日(木)	講義：コンクリート橋の維持管理における先端技術	土木研究所 CAESAR
	見学：各種土木構造物試験	国土交通省国土技術政策総合研究所
2016年4月22日(金)	講義：日本における橋梁最先端技術の紹介	埼玉大学
	見学：橋梁附属物(支承)工場	ビービーエム
	講義：鋼橋の維持管理手法 見学：橋梁部材の各種試験	横河ブリッジホールディングス
2016年4月25日(月)	講義：道守制度	長崎大学
	講義：3D計測による軍艦島調査	
	実習：コンクリート非破壊検査、各種試験	
	見学：長崎自動車道日見夢大橋、女神大橋	
2016年4月26日(火)	見学：鱸岩橋橋梁補修工事現場	長崎県
	見学：湯の花橋橋梁補修工事現場	
2016年4月27日(水)	講義：横浜市の橋梁維持管理の実態	横浜市
	見学：万里橋橋梁補修工事現場	
	講義：アクションプラン作成ガイダンス	国際開発機構 (FASID)
2016年4月28日(木)	発表：アクションプラン	JICA 本部
	評価会	
	研修終了式	JICA東京
2016年4月29日(金)	離日	

(2) 第2回本邦研修

第2回本邦研修は、2017年11月5日から18日にかけて実施され、参加者は8名であった。参加者および行程を表2-15、2-16に示す。

表2-15 第2回本邦研修参加者

NO	Name	Title
1	Rowshan Ara Khanam	Project Director & Additional Chief Engineer, Bridge management Wing
2	Mohammad Shabbir Hasan Khan	Superintending Engineer, Planning & Data Circle
3	ShiShir Kanti Routh	Superintending Engineer, 3 rd Shitalakhya Bridge Project
4	A.K. Shamsuddin Ahmed Nannu	Project Manager & Executive Engineer, BMMS Division
5	Santanu Palit	Deputy Project Manager & Sub-Divisional Engineer, BMMS Sub-Division
6	Md. Shafiul Azam	Executive Engineer, Data Base Division
7	Abdur Rahman Kaoser	Executive Engineer, Bridge Design Division - 3
8	Md. Mohibul Haque	Executive Engineer, Manikgonj Road Division, Manikgonj

表2-16 第2回本邦研修行程

日程	研修内容	研修機関
2017年11月5日(日)	来日	
2017年11月6日(月)	ブリーフィング	JICA 関西
	発表：カンントリーレポート 講義：Project Cycle Management 研修	国際開発機構 (FASID)
2017年11月7日(火)	講義：高速道路会社事業説明	NEXCO 西日本
	見学：NEXCO西日本技術研修センター	
	見学：中国自動車道市川橋補修工事現場 見学：本州四国連絡自動車道明石大橋	
2017年11月8日(水)	見学：トレカクロス工場見学	東レ名古屋事業所
	実習：トレカクロス工法	
2017年11月9日(木)	講義：PC桁製の品質管理	極東興和
	見学：PC桁製作工場	
2017年11月10日(金)	講義：日本における橋梁維持管理の政策	国土交通省
	講義：鋼橋の維持管理手法	横河ブリッジホールディングス
	見学：橋梁部材の各種試験	
2017年11月13日(月)	講義：道守制度	長崎大学
	講義：多点振動計測による構造物の常時健全性モニタリング	
	講義：長崎県の橋梁維持管理の実態	長崎県
	実習：コンクリート非破壊検査、各種試験	長崎大学
	見学：長崎自動車道日見夢大橋、女神大橋	
2017年11月14日(火)	見学：めがね橋	長崎県
	見学：箕島大橋補修工事現場	
2017年11月15日(水)	講義：京都府の橋梁維持管理の実態	京都府
	見学：山城大橋橋梁点検現場	
2017年11月16日(木)	講義：アクションプラン作成ガイダンス	国際開発機構 (FASID)
2017年11月17日(金)	発表：アクションプラン	JICA 本部
	評価会	JICA関西
	研修終了式	
2017年11月18日(土)	離日	

2. プロジェクトの達成度

2-1. 成果および指標

成果の達成状況を表 2-17 に示す。

表 2-17 成果の達成状況

成果の指標		達成状況
成果 1 : 橋梁維持管理制度が改善される。		
1.1	橋梁維持管理手続き及び職員配置の文書がRHDにより承認される。	達成状況 : 達成 橋梁維持管理手続き、および職員配置に関してまとめたスタンダード(維持管理の手引き)は、第3回JCC及び第5回JCCで承認された。
1.2	橋梁維持管理サイクルに基づく橋梁点検がRHDにより開始される。	達成状況 : 達成 橋梁維持管理サイクルに基づく実際の橋梁点検がマニクガンジ事務所管内の橋梁で実施され、橋梁維持管理サイクルがRHDにより開始された。
1.3	BMSによるデータ操作がRHDにより開始される。	達成状況 : 達成 マニクガンジ事務所管内の橋梁について、橋梁基本情報および橋梁点検・評価結果の入力が完了した。
1.4	モデル地区の橋梁維持管理計画が準備された。	達成状況 : 達成 OJT(2)において、マニクガンジ事務所管内橋梁の年度予算がBMSにより算出された補修優先順位に基づき準備された。
成果 2 : 橋梁点検/評価マニュアル及び橋梁補修/補強マニュアルが作成される。		
2.1	橋梁点検/評価マニュアルがRHDにより承認される。	達成状況 : 達成 橋梁点検/評価マニュアル(Draft)が第3回JCCにて、橋梁点検/評価マニュアル(Final Draft)が第5回JCCにて承認された。
2.2	橋梁補修/補強マニュアルがRHDにより承認される。	達成状況 : 達成 橋梁補修/補強マニュアル(Draft)が第3回JCCにて、橋梁補修/補強マニュアル(Final Draft)が第5回JCCにて承認された。
成果 3 : 橋梁維持管理システムが開発される。		
3.1	BMSのデータアクセスビリティが改善する。	達成状況 : 達成 RHDの意見要望に基づくシステムの使用性向上の結果、マニクガンジ事務所管内橋梁の基本情報および点検・評価結果の入力が完了した。
3.2	BMSマニュアルがRHDにより承認される。	達成状況 : 達成 BMSマニュアル(Draft)が第3回JCCにて、BMSマニュアル(Final Draft)が第5回JCCにて承認された。
成果 4 : 橋梁維持管理に必要な知識をRHD職員が習得する。		
4.1	75名の橋梁点検MTが訓練される。	達成状況 : 達成 75名のMTがOJT(1)で橋梁点検の教育を受け、マニクガンジ事務所管内の橋梁を実際に点検・評価した。
4.2	75名の橋梁補修MTが訓練される。	達成状況 : 達成 マニクガンジの橋梁点検結果から優先度の高い4橋を選定し、OJT(2)において補修工法の選定及び工事費の積算を行った。
4.3	75名のBMS管理者が訓練される。	達成状況 : 達成 75名のBMS管理者が、マニクガンジ管内橋梁の基本情報および実際の点検・評価結果の入力を実際に行った。
4.4	制度的能力開発計画が承認される。	達成状況 : 達成 制度改善計画(Institutional Capacity Development Plan)が第5回JCCにて承認された。

2-2. プロジェクト目標および指標

プロジェクト目標の達成状況を表2-18に示す。

表2-18 プロジェクト目標の達成状況

成果の指標		達成状況
1	橋梁維持管理サイクルがRHDにより開始される。	本プロジェクトにおいては、75名のMTが橋梁維持管理サイクルを学び、橋梁点検、評価、BMS操作、維持管理計画、橋梁補修をモデル地区(マニクガンジ事務所管内)の実点検を通して学んだ。 結果的に、橋梁維持管理サイクルがマニクガンジ事務所(RHDの65事務所のうちの一つ)で開始されたといえる。他の事務所では事務所訓練コース(Divisional Training Course, DTC)がEEによって実施され、少なくとも532名以上のRHD職員が橋梁維持管理の教育を受けた。全国的な橋梁維持管理サイクルはすでに準備段階にあり、橋梁の全国点検が今年度(2018年度)の雨期終了後に開始されようとしている。
2	制度的能力改善計画(Institutional Capacity Development Plan)に基づく、必要な訓練がマスタートレーナー(MT)により実施される。	橋梁維持管理標準(Draft)に記載された制度的能力改善計画に基づく事務所訓練コースがRHDの65事務所で開催された。(制度的能力改善計画は、プロジェクト結果に基づき更新され、最終化された。同計画は、第5回JCCに於いて承認された。)

3. PDMの変更履歴

3-1. バージョン2から3への変更

バージョン3では、マニュアルの承認先およびマスタートレーナーの数が追記された。

表2-19 バージョン2からバージョン3への変更

成果	指標		変更理由
	バージョン2	バージョン3	
1. Bridge maintenance framework is developed	1-1. Documents of Bridge maintenance procedure and staff deployment are approved by XX	1-1. Documents of Bridge maintenance procedure and staff deployment are approved by RHD	承認先を記入
	1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD	1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD	
	1-3. Data management by utilization of BMS is commenced by RHD	1-3. Data management by utilization of BMS is commenced by RHD	承認先を記入
	1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared	1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared	
2. Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed	2-1. Bridge inspection / evaluation manual is approved by XX	2-1. Bridge inspection / evaluation manual is approved by RHD	承認先を記入
	2-2. Bridge rehabilitation / strengthening manual is approved by XX	2-2. Bridge rehabilitation / strengthening manual is approved by RHD	
3. Bridge management system is developed	3-1. Data accessibility of BMS is improved	3-1. Data accessibility of BMS is improved	承認先を記入
	3-2. BMS manual is approved by XX	3-2. BMS manual is approved by RHD	
4. Necessary knowledge of bridge management is enhanced by RHD staff	4-1. XX bridge inspection MT are trained	4-1. 75 bridge inspection MT are trained	数値を記入
	4-2. XX bridge rehabilitation MT are trained	4-2. 75 bridge rehabilitation MT are trained	
	4-3. XX BMS administrators are trained	4-3. 75 BMS administrators are trained	承認先を記入
	4-4. Institutional capacity development plan is approved	4-4. Institutional capacity development plan is approved	

3-2. バージョン3から4への変更

バージョン4への変更で、上位目標の数値が追記された。また、プロジェクト目標では、指標に一文が追加された（表2-20）。

表2-20 バージョン3からバージョン4への変更

	指標		変更理由
	バージョン3	バージョン4	
上位目標			
Bridge management under RHD is enhanced	1. Annual ratio of bridge inspection conducted by RHD is increased from XX% to XX%.	1. Annual ratio of bridge inspection conducted by RHD is increased to 50%.	目標数値を記入。
	2. Bridge maintenance cycle is conducted by RHD.	2. Bridge maintenance cycle is conducted by RHD.	
プロジェクト目標			
Bridge maintenance capacity of RHD is improved.	1. Bridge maintenance cycle is commenced by RHD.	1. Bridge maintenance cycle is commenced by RHD.	追加。
	2. Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT).	2. Master Trainers (MTs) are trained.	
		3. Necessary training based on the institutional plan is conducted by Master Trainers (MT).	
バングラデシュ側インプット			
2. Facility and Equipment	1) Offices (inside RHD building)	1) Offices (inside RHD building)	追加。
		2) Engineering Equipment/Inspection Equipment	

3-3. バージョン4から5およびバージョン5から6への変更

プロジェクト期間の変更に伴い、PDMのプロジェクト期間表記を変更した。バージョン5では、契約工期の「2018年11月2日」までとしたが、バージョン6では変更R/Dと一致させるために現地作業工期の「2018年9月2日」までに再変更した。

4. その他

4-1. 環境および社会配慮の結果

該当なし。

4-2. ジェンダー/平和構築/貧困削減の検討結果

<バージョン3>

- ・プロジェクトの当初より女性技術者が当プロジェクトに参画している。

<バージョン4>

- ・2017年1月より本プロジェクトのディレクターとして女性技術者が任命されている。更に多くの女性技術者が本プロジェクトに参画すべきであるが、女性技術者の数が少なく、現状ではかなり難しい。

<バージョン6>

- ・RHD と JICA プロジェクトチームはマニクガンジの橋梁点検、OJT および DTC 支援トレーニングを通じて、女性技術者にも参加しやすい環境を創造した。

4-3. プロジェクトに影響するその他顕著な問題

<バージョン3>および<バージョン4>

- ・TAPP はテクニカルプロジェクトの予算申請書である。TAPP は、まずは RHD から本省（道路交通橋梁省）に提出され、次に計画省の計画委員会の承認を得て予算が成立する。TAPP の承認が得られないと、OJT 等セミナー開催時における RHD 職員の交通費、日当、宿泊費の支出ができない。TAPP の承認が遅いためにプロジェクトの進捗に支障をきたすことがある。

<バージョン3>および<バージョン4>

- ・2016年7月の重大な安全問題の発生によりプロジェクトが遅延した。この遅延により、同年7月に開催が予定されていた第3回 JCC は開催されず、結果的に8ヶ月後に延期され、第3回 JCC は2017年3月に開催された。モニタリングシート<バージョン3>および<バージョン4>は同 JCC で承認された。

<バージョン6>

- ・上述の安全問題とは別の安全問題が発生し、第5回 JCC は当初予定から約1ヶ月延期となった。

III. 合同評価結果

1. DAC評価基準に基づく評価結果

1-1. 妥当性

以下の理由から、本プロジェクトの妥当性は「高い」と判断される。

バングラデシュでは、年率6%前後のGDP成長率を維持する近年の堅調な経済発展に伴い、1975年から2005年までの過去30年間で貨物取扱量が約8倍にまで拡大し、近年では6~7%のペースで貨物量・旅客数ともに増加を続けている。当国の主要運輸交通モードには、内陸水運、鉄道、道路があるが、旅客・貨物双方において道路利用が約8割（2005年）を超え、道路輸送への偏重が進んでいる。しかし、増える交通量に対し、新規の道路整備が追い付いておらず、また、既存道路の劣化も急速に進行しているため、旅客・貨物輸送に支障が生じている。

バングラデシュ政府は、「第6次五か年計画（2011/12~2015/16年度）」において、バングラデシュの道路セクターでは、効率・近代的な道路輸送システムが、同計画および当国の中期目標である「Vision 2021（2009年）」を達成するために重要な役割を果たすと明記され、道路利用者コストを引き下げするために、現道の適切な維持管理が主要目標の一つに掲げられている。「国土交通政策（2004年）」では、維持管理能力の向上と財源の確保および長期的な整備計画の策定を方針の一つとしており、また、同政策を基に策定された「道路マスタープラン（2009年）」では、道路・橋梁の資産価値の保全を目標の一つにしている。

バングラデシュの橋梁・カルバートは、1971年の独立時には1,112橋（基）であったが、その後急激に橋梁建設が進められ、2013年には18,356橋（基）まで増加しており、その中には円借款によって建設された橋梁も含まれている。バングラデシュにおける橋梁維持管理は、定期保守（清掃等の維持作業）を1回/年行うとともに、損傷程度に応じた定期巡回・定期点検を実施することとしているものの、橋梁数の増加に伴い、応急橋であるベイリー橋の落橋や橋梁の早期損傷に対する事後保全が拡大しつつある現状にある。更に、1980年代以降に急増した橋梁の老朽化を見据えた対応が求められることから、橋梁を長期間良好な状態で供するためには、橋梁維持管理の更なる効率化を図っていくことが喫緊の課題である。

我が国の対バングラデシュ JICA 国別分析ペーパー（2013年4月）では「全国運輸交通ネットワーク整備」が重点課題であると分析し、対バングラデシュ国別援助方針（2012年6月）における重点目標としても、「人とモノの効率的な移動の促進に貢献するために、運輸・交通インフラの整備を進める」と定められている。

本プロジェクトは、バングラデシュの政策、課題、および我が国の分析、援助方針に合致したものであると判断される。

1-2. 有効性

以下の理由から、本プロジェクトの有効性は「高い」と判断される。

- ・4つの成果の全てが既に達成されている。一つのスタンダード（手引き）と三つのマニュアル群（点検・診断、補修補強・積算、BMS）が JCC で承認された。それらを用いて OJT や DTC が実施され、600 名（OJT 1・OJT2・Additional OJT において専門家の指導の下 MT 約 100 名 + DTC において各 MT の指導の下 RHD 一般職員 500 名以上）を超える RHD 職員が教育を受けた。これは RHD 全職員の 25%を超える。
- ・橋梁維持管理システム (BMS) のソフトウェアが開発され、モデル地区（マニクガンジ）で実施された橋梁点検に基づき、橋梁基本情報、点検・評価結果が BMS データベースに入力された。BMS ソフトウェアを利用して橋梁補修プロジェクトにおける各橋梁の補修優先順位が決められた。
- ・第 1 回全国橋梁点検は、その予算が既に確保されており、今年度中に開始される予定である。点検終了後、全国橋梁の現況が把握され、それに基づき有効かつ実用的な橋梁維持管理計画が作成される。RHD 職員は橋梁維持管理に関する十分な知識を蓄積した上で、全国規模で実用的な橋梁維持管理サイクルをスタートさせる見込みである。

これらの進捗状況を考慮するとプロジェクト目標指数の達成レベルはポジティブであり、本プロジェクト目標は概ね達成されると判断される。

1-3. 効率性

以下の理由から、本プロジェクトの効率性は「普通」と判断される。

- ・「活動 3-4 RHD が既存の BMMS の既存のデータを BMS に移行する。（理由は前述）」を除き、全ての活動は完了した。しかし、安全問題上の制約条件が要因ではあるものの、工期およびコスト面において、効率性が高いとは言い難い結果となった。
- ・プロジェクト期間は、2016 年 7 月の重大な安全問題の影響で 30 か月から 38 か月に延伸した。
- ・モデル地区での OJT は、当初、「マニュアルの説明⇒橋梁点検⇒点検結果の評価⇒BMS を活用しての補修優先順位の決定⇒施工計画立案⇒補修工事費の積算」という一連の講習を約 1 カ月の間に連続的に実施する予定であったが、安全問題に伴う現地滞在の制約（期間・同時滞在人数）から 3つのステージに分散実施せざるを得なかった。その結果、マニュアルの説明が 2017 年の 7 月、橋梁点検が 2017 年 11 月～12 月、BMS 活用による補修優先順位の決定が 2018 年の 1 月～2 月に実施され、OJT の合計日数が半分になったにも関わらず、実施期間は大幅に伸びることになり、当初見込みよりも効率性に劣った結果となった。

- ・プロジェクト費用は当初から大幅に増加した。これは、安全問題に起因する増額が占める割合が大きい。

以上の要因から、活動の殆どは完了しており、かつ治安の問題の影響が大きいものの、効率的とは言えない部分があると判断せざるを得ない。

1-4. インパクト

以下の理由から、本プロジェクトのインパクトは「高い」と判断される。

本プロジェクトで実施した活動を通して、RHD は橋梁維持管理の必要性、維持管理サイクルのコンセプト等の理解度を十分に強化することができた。引き続き、RHD は今年度(2018 年度)に開始される全国橋梁点検により、実用的な橋梁維持管理計画を作成する。さらに、補修計画に従って補修事業が次年度から開始される。補修事業の終了後、維持管理計画は改めて見直され、必要に応じて修正される。以上の工程の下、RHD は遅くとも 3 年以内に最初の維持管理サイクルを全国で完了させる見込みである。

橋梁維持管理サイクルの第一歩である全国橋梁点検は本プロジェクトの成果に基づくものであり、上位目標である「バングラデシュ全土における RHD の橋梁維持管理業務の改善」に対して、想定通りの効果が実現していると判断される。

1-5. 持続性

以下の理由から、本プロジェクトの持続性は「高い」と判断される。

- ・本プロジェクトでは、施設整備、人材育成計画、橋梁維持管理手順、予算編成などが一連の WS で議論された。その結果は文書化され、橋梁維持管理の手引き (Bridge Maintenance Management Standard) に組み込まれている。それら成果に基づき、RHD は安全・安心かつ信頼性が高く快適な道路網を確保するために橋梁維持管理戦略を策定することが可能である。
- ・同様に、橋梁点検評価、橋梁補修補強および BMS についても一連の WS における議論に基づき文書化され、道路交通橋梁省次官を議長とする JCC において前述の橋梁維持管理の手引きと共に承認された。RHD は、それらに基づき橋梁維持管理戦略を継続的に実施していくことが可能である。
- ・マスタートレーナーによる RHD 職員の橋梁維持管理教育は、「制度改善計画 Part II」に従い継続的に実施される。

- ・DTCにおいて、全国133のサブディビジョンのRHD職員が橋梁点検、橋梁健全度評価、BMS操作、補修計画及び工事費積算の教育を受けた。これは、全国橋梁点検における点検チーム編成のための訓練であり、全国に少なくとも133以上の点検チームが既に存在していることになる。本年度の第1回を始めとして今後継続的に実施される全国橋梁点検においては、表3-1に示す点検チーム編成、および表3-2に示す点検作業量を想定している。サブディヴィジョン毎に橋梁数の偏りがある程度は想定されるものの、RHDにとって十分に実施可能な内容であり、全国橋梁点検が持続されると判断する。

表3-1 各サブディヴィジョンの人員配置と点検チームの構成

名称	ポスト	クラス	1サブディヴィジョン 当りの人数	1点検チーム 当りの員数
上席点検員 Senior Inspector	SDE	Class I	1	1
点検員 Inspector	SAE	Class II	3	1
補助点検員 Assistant Inspector	Staff	Class III	5	2
運転手 Driver	Staff	Class IV	10	1
交通保安要員 Traffic Safety Guard	Staff	Class IV		1

表3-2 1サブディビジョン当たりの橋梁/カルバート点検日数

	基数 橋梁数	サブディヴィジョン 事務所数	1サブディヴィジョン 平均点検日数	備考
カルバート	13,838 基	133 箇所	15 日	稼働率：7基/日
橋梁	4,517 橋		12 日	稼働率：3橋/日

- ・プロジェクト開始前には簡単な橋梁点検要領しかなく、過積載等による落橋事故が毎月のように起こっていたにもかかわらず10年以上も橋梁点検が行われていなかった。本プロジェクトで承認された要領通りに橋梁維持管理が持続されれば、確実に落橋も減少し橋梁への信頼性が向上するはずである。

2. 実施と成果に影響を与える要因

本プロジェクトの実施と成果に影響を与える主要な要因、およびその要因により生じる問題を解決するための措置を表3-1に示す。

表3-1 (1) プロジェクトの実施・成果に影響する主要因とその問題点解決のための方策

実施と成果に影響する主要因	その要因による問題点の解決のための方策
<p><2016年7月1日事件によるプロジェクトへの影響></p> <p>2016年7月1日の事件のために、JICAは2016年7月より2016年12月までバングラデシュへの入国を禁止した。2016年12月9日以降、以下のような条件のもとでバングラデシュに滞在できるようになった。</p> <ul style="list-style-type: none"> > 同時に滞在できる最大人数は3名である。 > バングラデシュでの最長滞在期間は2週間である。 > JICA専門家は、JICAの許可なくダッカ地区から出てはならない。基本的に、JICA専門家は現場調査のような安全上問題のある活動は避けるべきである。 	<p>JICAコンサルタントチームはJICAに対して工期延長を提案し承認された。プロジェクト期限は、2018年3月2日から2018年11月2日に変更された。</p> <p>JICAコンサルタントチームは、バングラデシュへの派遣をルールに則り再調整した。結果的に、全ての予定されたOJTやセミナーが完了した。</p> <p>OJT(1)に於いて、JICAコンサルタントチームは現場点検指導のためにマニクガンジに行くことを計画し、警察のエスコートをつける条件でJICAに認められた。</p>
<p><BMSIに関する開発方針の変更></p> <p>プロジェクト当初、新BMSIは、使用の簡便さのために、Microsoft Officeのような汎用プログラムを用いて構成する計画であった。旧データベースシステム(BMMS)やMIS Circleとの協議の結果、新BMSIはコンピューター言語を用いた本格的なものにするよう、RHD側から強い要望が出された。</p>	<p>JICA専門家はRHDの要求を考慮し、その要求がプロジェクトの目的にも合致し適切であると判断した。JICAコンサルタントは設計計画を再構築し、JICAの承認を得た。JICAコンサルタントチームはAtom APとバングラデシュで契約しコンピューター言語を用いてBMSIを開発した。</p>
<p><2017年雨期の異常な降雨></p> <p>モデル地区(マニクガンジ)での橋梁点検は通常の雨期の終了を考慮して10月に開始するよう計画された。しかしながら2017年の雨期は期間も長く、降雨量も以上に多かった。</p>	<p>マニクガンジ橋梁点検のスタートは2017年11月に延期された。橋梁点検が終了したのは、12月末であった。</p>

表3-1 (2) プロジェクトの実施・成果に影響する主要因とその問題点解決のための方策

実施と成果に影響する主な要因	その要因による問題点の解決のための方策
<p><RHDの要求に基づく追加講習></p> <p>RHDは下記講習会開催するようJICA専門家に要望した。</p> <p>1) DTC(Divisiona Training Course)の効果を高めるための追加講習会</p> <p>2) 2018年5月に実施された新BMS課職員のためのBMS講習会</p> <p>3) 2018年7月に実施された新EEに対する追加講習会</p>	<p>JICAコンサルタントチームはRHDの要望を了解し、以下の講習会を開催した。</p> <p>1) DTC支援トレーニング DTC支援トレーニングは4グループに対してそれぞれ2日間、計8日間、2018年の2月から3月にかけて実施した。参加者は102名のSDE(Sub-Divisional Engineer)であった。</p> <p>2) MIS職員のためのBMSトレーニング MIS職員のためのBMSトレーニングが2018年5月に一か月に渡り実施された。 JICAコンサルタントのシステムマネージャーがシステム及びBMS操作について教育した。3名のMIS職員がトレーニングに参加した。彼らが新BMSシステム課を担当する。</p> <p>3) 追加OJT 追加OJTが2018年7月に3日間開催された。JICA専門家は新たに任命されたEE27名に対して追加OJTを実施した。</p>
<p><BMSサーバーへの新BMSインストールの遅れ></p> <p>BMSの開発は2018年の4月末に完了していたが、予算計画の遅れからRHDは新しいサーバー機械とサーバー室を2018年4月末までに準備できなかった。</p>	<p>JICAコンサルタントチームはサーバーに関する契約図書の作成を支援した。BMSのインストールは2018年9月に完了した。</p>
<p><2016年7月の第3回JCCの遅れ></p> <p>第3回JCCは2016年7月に計画されていたが、重大な安全問題の発生により、JICA専門家はバングラデシュに入国できなくなった。</p>	<p>第3回JCCは、2017年3月5日に開催された。</p>
<p><2018年8月の第5回JCCの遅れ></p> <p>第5回JCCは2018年8月5日に予定されていたが、交通事故に端を発した安全問題の発生により会議が予定されているセクレタリアート地区への立入りができなくなった。</p>	<p>第5回JCCは、2018年8月29日に開催された。</p>

3. プロジェクトリスクマネジメント結果の評価

フィリピン、キルギスおよびスリランカで過去に実施された同種のプロジェクトから、次のような重要な教訓が導き出されている。

- パイロットプロジェクトにおいて現場で点検や補修を経験する機会を提供することは、技術移転に際して極めて有効である。
- 各種マニュアルの作成は、従来のマニュアルを見直し、カウンターパートの技術レベルを認識することにより、カウンターパートからの要望、技術レベルを反映したものでなければならない。

上述の教訓がプロジェクトに取り込まれ、プロジェクトの成果に次のような好結果をもたらした。

- JICA コンサルタントチームは、業務当初にベースライン調査を行い、橋梁維持管理に関するマニュアルの現況や RHD 職員の技術レベルなどを把握した。それらの情報は WS を通じてカウンターパートと共有した。
- JICA コンサルタントチームは、WS、OJT、マニクガンジでの橋梁点検、その他セミナーで寄せられた RHD の意見や要望を取り入れ、新たなマニュアルおよび BMS ソフトウェアを開発した。結果的にマニュアルや BMS ソフトウェアは、バングラデシュにおいて運用するに当り適切なものとなった。
- プロジェクトで訓練された MT 達は、DTC では自らがトレーナーとなり各事務所で部下の訓練 (Divisional Training Course) を行った。彼ら自身が研修参加者からの質問に回答した。この経験が橋梁維持管理に対する理解をさらに深め、トレーナーとしての能力を高めた。

4. 反省点・教訓

制度面、技術面、財務面でいくつかの反省点および教訓を得た。

1) 制度面

(反省点)

- ・点検の法制化、橋梁点検チームの常設、地方局への橋梁課の新設、道路研究所の拡充をマニュアルおよび JCC の場で推奨したが、いずれに対しても RHD の確証は得られていない。組織人員増の課題は、道路交通橋梁省、計画省、財務省、国家経済諮問委員会 (ECNEC・議長は首相) を巻き込む課題のため、解決が非常に難しい。

(教訓)

- ・上記問題の解決には、道路交通橋梁省への長期 JICA 専門家の派遣および助力が必要であると考えられる。そのためには、長期 JICA 専門家に対する JICA および日本大使館による支援が必須である。

2) 技術面

(反省点)

- ・OJT における橋梁点検講習は、代表的な橋梁形式 (コンクリート版桁橋・鋼鈹桁橋・ベイリー橋・カルバート) 1 橋ずつを網羅する形での実習を予定していた。しかし、安全問題の影響による OJT 開催時期の遅延および全体スケジュールの調整に伴い、OJT1 を雨季である 7 月に実施せざるを得ず、河川水量の増加によりほとんどの橋梁の桁下に進入できなかった。そのため、カルバート 1 橋を対象とした実地訓練のみに留まる結果となり、点検技術移転の効率性が低下した。

(反省点)

- ・車両の過積載に対する対策および補修設計に特化したマニュアル作成について強い要望があったが、プロジェクト内で対応出来なかった。

(反省点・教訓)

- ・橋梁の損傷を正しく評価するためには橋梁設計の知識が必要であり、OJT のカリキュラムの中に橋梁設計を取り入れる必要がある。

(教訓)

- ・少数ではあるが英語を苦手とする RHD 職員が、MT の中にすら存在した。本プロジェクトでは技術的マニュアル類は英語版のみを作成したが、ベンガル語でも記述されればより効果が見込める。

(教訓)

- ・BMS システム開発チームの再委託先を現地企業としたことで、専門家不在期間における各種対応がより容易かつ確実に行えた。これにより、現地企業を再委託先とすることは、プロジェクトの円滑化を図る上でより有効であると言える。

3) 財政面

(反省点)

- ・TAPP の承認に半年以上がかかっており、迅速な予算執行に支障をきたしている。予算制度の合理化が必要であるが、RHD は予算制度の改革は自分たちのマターではないという認識でおり、改善には至らなかった。

(反省点)

- ・道路維持管理基金は 2013 年 7 月に国会の承認を受け成立しているが、成立後 5 年が経った現在も稼働していない。政治的背景もあり、この問題に対して RHD は議論を避けており、有効な手段を講じるには至らなかった。

(反省点)

- ・日常管理予算と軽微な補修に使用される予算 (PMP Minor) は道路と橋梁で分離されていない。道路と橋梁を分離することにより、橋梁部分の予算は予防保全のための有力な予算となる。プロジェクトの当初から道路と橋梁の分離を推奨し続けているが、RHD からは確証が得られていない。

IV. プロジェクト完了後の上位目標達成のために

1. 上位目標達成の見通し

本プロジェクトの上位目標は、「バングラデシュ全土における RHD の橋梁維持管理業務が改善される。」である。上位目標指標の達成見通しを表 4-1 に示す。

表 4-1 上位目標達成の見通し

上位目標の指標		達成の見通し
1	RHDにより実施される橋梁点検の年度比率が50%まで向上する。	RHDでは、今年度(2018年度)橋梁の全国定期点検を実施する予定であり、2018年度の橋梁点検比率は、100%に達する。しかしながら、橋梁点検の継続が最も重要であり、次回の橋梁点検が新しい橋梁点検マニュアルに基づいて実施される2年後(2020年)に、上位目標の指標1が達成されるといえる。
2	橋梁維持管理サイクルがRHDにより開始される。	橋梁維持管理サイクルはモデル地区(マニクガンジ)では開始されていることから、指標は既に達成されていると言える。しかしながら、モデル地区で開始した橋梁維持管理サイクルは、橋梁維持管理計画の策定までであり、維持管理サイクルは完結していない。また、2018年度に橋梁全国点検が予定されており、全国で第1回目の橋梁維持管理サイクルが完結するのは3年後と推定される。

2. バングラデシュ側の運営・実施計画

RHD は今年度(2018 年度)の雨期明けから橋梁全国点検を開始する予定であり、そのための予算は既に確保されている。橋梁点検員の養成は、全国 65 の地方事務所において事務所訓練コース(Divisional Training Course)が開催され、少なくとも点検員となるべき 532 名以上も職員が、橋梁点検と BMS 操作の訓練を受けている。点検のための必要最小限の機材も自前の予算で購入されている。BMS ソフトウェアは、RHD の情報を一括管理する MIS サークルのサーバーにインストールされ、全国橋梁点検の結果の入力を待っている。橋梁の全国点検の終了後、橋梁維持管理 5 か年計画や年度計画が策定され、この計画に基づき、橋梁補修・補強工事が実施される段取りになっている。

3. RHD への推奨事項

橋梁維持管理の手引き(Bridge Maintenance Management Standard)並びに JCC にて提示した RHD への推奨事項は以下の通りである。

1) 制度・組織面

- ・橋梁点検の法制化もしくは制度化
- ・橋梁点検組織の常設
- ・地方局への橋梁課の新設
- ・橋梁維持管理教育の制度化
- ・バングラデシュ道路研究所(BRRL)の拡充

2) 技術面

- ・モデル地区における維持管理サイクルの完結
- ・プロジェクト成果の全国展開
- ・橋梁点検員の技術レベルの向上
- ・最新の補修・補強工法の導入
- ・橋梁設計マニュアル、品質管理マニュアル、竣工検査マニュアルの整備
- ・竣工図の永久保存
- ・標準設計図集の整備
- ・補修材料や補修工法に関する知識の集積

3) 財務面

- ・予防保全型橋梁維持管理の速やかな導入
- ・道路維持管理基金の速やかな稼働
- ・日常管理費および軽微な補修費 (PMP Minor) における、道路分野と橋梁分野の分離

4. プロジェクト終了から事後評価までのモニタリング計画

RHD は、JICA バングラデシュ事務所に進捗報告書、特に第1回全国橋梁定期点検に関する報告をすべきである。JICA バングラデシュ事務所は、提出を保証し、必要に応じて進捗に関するアドバイスを提供する。

- 付録 1 : プロジェクト結果 (派遣された専門家一覧および相手側担当者一覧)
- 付録 2 : プロジェクトの成果品 (レポート・マニュアル等) 一覧表
- 付録 3 : PDM (全バージョン)
- 付録 4 : R/D、M/M、JCC 議事録 (写し)
- 付録 5 : モニタリングシート (写し)

- 別冊 1 : 橋梁維持管理業務の手引き (Bridge Maintenance Management Standard)
- 別冊 2 : 橋梁点検・評価マニュアル (Bridge Inspection and Evaluation Manual)
- 別冊 3 : 橋梁補修・補強マニュアル[工法編]
(Bridge Rehabilitation and Strengthening Manual : Part 1 Method)
- 別冊 4 : 橋梁補修・補強マニュアル[積算編]
(Bridge Rehabilitation and Strengthening Manual : Part 2 Cost Estimate)
- 別冊 5 : BMS マニュアル[システム管理者編]
(Bridge Management System (BMS) Manual : for System Administrators)
- 別冊 6 : BMS マニュアル[BMW 職員編]
(Bridge Management System (BMS) Manual : for Bridge Management Wing)
- 別冊 7 : BMS マニュアル[点検・評価者編]
(Bridge Management System (BMS) Manual : for Inspector & Evaluator)
- 別冊 8 : BMS マニュアル[パブリックユーザー編]
(Bridge Management System (BMS) Manual : for Public Users)
- 別冊 9 : 制度改善計画
(Institutional Development Plan)
- その他 : BMS プログラム (DVD)

付 録 目 次

付録1：プロジェクト結果（派遣された専門家一覧および相手側担当者一覧）	付録-1
付録2：プロジェクトの成果品（レポート・マニュアル等）一覧表	付録-3
付録3：PDM（全バージョン）	付録-79
付録4：R/D、M/M、JCC 議事録（写し）	付録-88
付録5：モニタリングシート（写し）	付録-236

付録1：プロジェクト結果（派遣された専門家一覧および相手側担当者一覧）

＜ 派遣された専門家一覧 ＞（日本側）

氏名	担当業務
檜山 義光 Yoshimitsu HIYAMA	総括/橋梁維持管理計画 Team Leader/ Bridge Maintenance Plan
原崎 郁夫 Ikuo HARAZAKI	橋梁点検 Bridge Inspection
小西 俊之 Toshiyuki KONISHI	橋梁健全度評価 Bridge Evaluation
飯塚 力也 Rikiya IIZUKA	橋梁維持管理計画（2） Bridge Maintenance Plan (2)
小西 俊之 Toshiyuki KONISHI	橋梁維持管理計画（3） Bridge Maintenance Plan (3)
肥田 研一 Kenichi HIDA	詳細調査 Detailed Survey
上阪 康雄 Yasuo KOSAKA	橋梁補修・補強 / 橋梁健全度評価（2） Bridge Rehabilitation・Strengthening/Bridge Evaluation (2)
達見 行智 Yukitomo TATSUMI	コスト積算 Cost Estimate
巻島 健吾 Kengo MAKISHIMA	橋梁マネジメントシステム Bridge Management System
大野 完治 Kanji OHNO	橋梁マネジメントシステム（2） Bridge Management System (2)
山田 千晶 Chiaki YAMADA	プロジェクトモニタリング Project Monitoring
巻島 健吾 Kengo MAKISHIMA	プロジェクトモニタリング（2） Project Monitoring (2)
夜差 秀明 Hideaki YASASHI	業務調整 / 橋梁維持管理計画（補助） Coordinator/ Bridge Maintenance Plan (Assistance)

〈 相手側担当者一覧 〉 (バングラデシュ側)

NAME	POSITION
Rowshan Ara Khanam	Project Director & Additional Chief Engineer, Bridge management Wing
Mohammad Shabbir Hasan Khan	Superintending Engineer, Procurement Circle
A.K.M. Manir Hossain Pathan, PEng.	Additional Chief Engineer, Cumilla Zone, Former Additional Project Director
A.K. Shamsuddin Ahmed Nannu	Project Manager & Executive Engineer, BMMS Division
Md. Shafikul Islam	Executive Engineer, Sunamganj Road Division, Former Project Manager (PM)
Santanu Palit	Deputy Project Manager & Executive Engineer, Environment Division
Shishir Kanti Routh	Superintending Engineer, 3rd Shitalakhya Bridge Project
Md. Shafiul Azam	Executive Engineer, Chief Engineer's Office
Mohammed Shamim Al Mamun	Executive Engineer, Chief Engineer's Office
Mohammed Saifuddin	Executive Engineer, Western Bangladesh Bridge Improvement Project, Former Comilla Road Division
Nazmul Hasan	Executive Engineer, Bridge Design Division-1
Md. Khaled Shaheed	Superintending Engineer, HDM Circle
Mohammad Moniruzzaman	Deputy Secretary, Former Executive Engineer, Road Design & Standard Division
Abdur Rahman Kaoser	Executive Engineer, Bridge Design Division - 3
Md. Mohibul Haque	Executive Engineer, Administration & Establishment
Khan Md. Kamrul Ahsan	Additional Project Director & Superintending Engineer, Planning & Data Circle

付録2：プロジェクトの成果品（レポート・マニュアル等）一覧表

成果	業務内容	マニュアル名
1	橋梁維持管理計画	橋梁維持管理業務標準 (Bridge Maintenance Management Standard)
		制度改善計画 パート1 (Institutional Development Plan Part.1)
2	橋梁点検	橋梁点検・評価マニュアル (Bridge Inspection and Evaluation Manual)
	橋梁健全度評価	
	詳細調査	
	橋梁補修・補強	橋梁補修・補強マニュアル[工法編] (Bridge Rehabilitation and Strengthening Manual : Part 1 Method)
	コスト積算	橋梁補修・補強マニュアル[積算編] (Bridge Rehabilitation and Strengthening Manual : Part 2 Cost Estimate)
3	橋梁マネジメントシステム	BMSマニュアル[システム管理者編] (Bridge Management System (BMS) Manual : for System Administrators)
		BMSマニュアル[BMW職員編] (Bridge Management System (BMS) Manual : for Bridge Management Wing)
		BMSマニュアル[点検・評価者編] (Bridge Management System (BMS) Manual : for Inspector & Evaluator)
		BMSマニュアル[パブリックユーザー編] (Bridge Management System (BMS) Manual : for Public Users)
		BMSプログラム (DVD)
4	人材育成計画	制度改善計画 パート2 (Institutional Development Plan Part.2)

成果	業務内容	その他報告書名
1	RHDに対する質問事項	Question/Request : 質問書 (2015年8月) および回答書 (2015年11月)
	ベースライン調査	マニクガンジ 橋梁現地調査報告書 (2015年8月) The Report on the Site Visit Conducted to Select Model Area for OJT
		シラジガンジ 橋梁現地調査報告書 (2015年9月) Report on Site Survey of Existing Bridges along N-5 in Sirajganj Division
4	RHDに対する専門家の助言	Shahbazpur Bridge 橋梁調査報告書 (2018年3月) Survey Report on Condition of Shahbazpur Bridge
		Damdama Bridge 橋梁調査報告書 (2018年3月) Survey Report on Condition of Damdama Bridge
		Nolka Bridge 橋梁調査報告書 (2018年4月) Report on Site Survey of Nolka Bridge along N-405 in Sirajganj Division

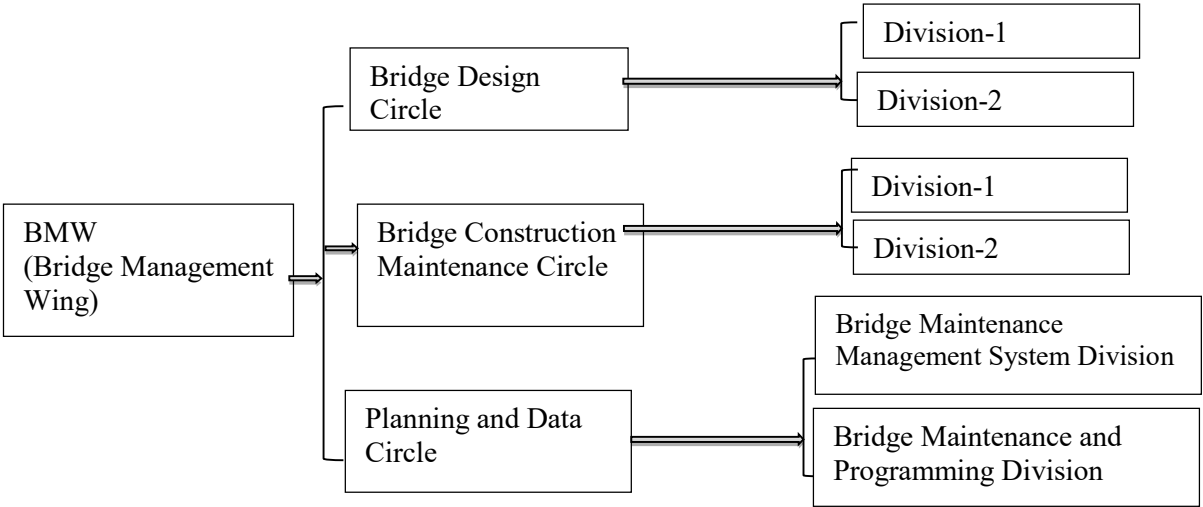
No	Question/Request
1. Bridge maintenance policy	
1-1	Maintenance policy and plan concerning roads and bridges
1-2	Assistance from other donors for bridge maintenance works such as bridge inspection, soundness evaluation, repair works and excessive load vehicle control
2. Bridge maintenance budget	
2-1	Transition of bridges construction and maintenance budget in the past five years
2-2	Breakdown of budget resources including budget from road maintenance fund.
2-3	Amount of toll collected by toll roads and bridges and its way of use
2-4	Allocation system of road and bridge maintenance budget
2-5	Amount of budget which was requested, allocated and consumed for bridge maintenance works in the past 5 years
2-6	In the long term programme regarding bridge maintenance and rehabilitation, is the latest inspection result reflected?
2-7	Breakdown of maintenance budget separating bridge budget from road budget respectively on routine maintenance, PMP minor and PMP major
2-8	Problems concerning maintenance budget resources
2-9	Countermeasures to address the problems on budget resources
2-10	Way of preparation for short-term & middle term bridge maintenance program.
2-11	Budgets of each Zone for bridge routine maintenance works, PMP minor and major works and new bridge construction projects with number of implemented bridges in past 5 years. Answer table is given by Attached paper.
3. Organizations in charge of bridge maintenance works	
3-1	Organogram and work contents (HQ, Zone, Circle, Division, Sub.-Division)
	Number of personnel, rank & position, year of experience after graduation (HQ, Zone, Circle, Division, Sub.-Division)
3-2	The name of the organization/managerial post in charge of following tasks
3-2-1	Conduction of bridge inspection works.
3-2-2	Bridge soundness evaluation.
3-2-3	Selection of the bridges to be repaired or reconstructed.
3-2-4	Prioritization of the bridges to be repaired or reconstructed.
3-2-5	Judgement on whether repair or reconstruction.
3-2-6	Preparation of the bridges list for repair or reconstruction.
3-2-7	Conduction of bridge repair works
3-2-8	Operation of BMMS including data input.
3-3	The number of staff of RHD Head Office, Zone Office, Circle Office, Division Office and Sub-division Office belonging to following categories.
3-3-1	The number of staff in the office by section and rank.
3-3-2	The number of staff mainly in charge of bridge maintenance works by section and rank.
3-3-3	The number of staff mainly in charge of highway maintenance works by section and rank.
3-3-4	The number of staff in charge of both bridge and highway maintenance.
3-4	Flow of works and procedures from a bridges inspection work to implementation of a bridge repair works with the name of each work/procedure, and the name of organizations in charge of each work/procedure.
3-5	Problems and way of solution concerning bridge maintenance and management
4. Existing Manuals/Guidelines to be applied for bridge maintenance works	
4-1	Do you have any manual/guideline/specification for a bridge design, construction works, quality control, cost estimation and procurement?
4-2	Do you have any bridge maintenance manual/guideline/specification?
4-3	Do you have any manual/guideline/specification to be applied for countermeasures against disaster.
4-4	Status of utilization regarding bridge maintenance manuals/guidelines
4-5	Management for the publication, distribution, and explanation of bridge maintenance technical standards.
5. Training for the RHD's staffs in charge of bridge maintenance works	
5-1	Following information are currently to be requested for the establishment of Human Resources Development Program. In case several programs are carried out, information is to be given per program.
5-1-1	The name of Human Resources Development Programs for RHD's staffs in charge of bridge maintenance works.
5-1-2	The name of organizer of the programs.
5-1-3	The type of the Human Resources Development Programs such as a lecture and a seminar.
5-1-4	The venue of the programs such as RHD Training Center in Dhaka.
5-1-5	The period of the programs.
5-1-6	The frequency of the programs.
5-1-7	The organization which participants belong to and their position/class, and number of participants.
5-2	The organization which the instructor/lecturer of the program belong to and their position/class rank if they belong to RHD/MOC.
5-3	What kind of technical training was implemented for bridge inspector's capacity development implemented for the past 5 years?
5-3-1	Inside the country: total number of trainees, training curriculum, training text material
5-3-2	JICA training in Japan: list of attended trainees.

6. Existing bridge inventory/history file	
6-1	Are the history of maintenance/rehabilitation activities described in bridge inventory file ?
6-2	Is Bridge Inventory including history of maintenance/rehabilitation activities updated based on the latest inspection result?
6-3	How can be the data updated and by what organization?
6-4	Is it possible that " Construction Completion Drawings " are utilized for bridge inspection report and bridge inventory?
6-5	2. Inspection Record
6-6	Are there any special bridge s such as suspension bridge, cable-stayed bridge, arch bridge?
6-7	Is the same inspection manual applied for these bridges?
6-8	How many bridges consisted of weathering steel are managed in RHD?
7. Bridge inspection works	
7-1	Are the inspection & evaluation records (BCS-1~3, PBI) properly filed?
7-2	Are " Field Sketch " included in addition to the deficiency photos or not in the inspection record form?
7-3	Is annual bridge survey/inspection implementation programme established and documented?
7-4	Do you have any problem/issue on bridge inspection works and do you have any idea to solve the problem/issue?
7-5	What kind type of contract for outsourcing regarding bridge inspection work are applied?
7-6	To make the best use of " Bridge Condition Survey Manual, May 2014 ", what are the issues to be solved (regarding applicability to inspection work, usability, points to be improved) ?
7-6-1	forms of inspection & evaluation (BCS-1~3)
7-6-2	usability of inspection & evaluation result
7-6-3	frequency of survey
7-6-4	system for carrying out inspection & evaluation (BCS-1~3, PBI)
7-6-5	input into format (BCS-1~3)
7-6-6	category of structural types of bridge and culvert
7-6-7	category of bridge element types
7-6-8	criteria of evaluation
7-6-9	Is the correct human resources defined in the bridge inspection manual? What personnel consists of inspection team?
7-6-10	Is internal rule or regulation on " Safety Management " including safety measures, emergency measures, safety equipments used? Is internal rule or regulation on "Traffic Control" used? If yes, please provide them to us.
7-6-11	To evaluate deficiencies observed by distant view how or what kind of criteria is applied to evaluation generally? "Inspected by DISTANT view" is to be described in inspection record?
7-6-12	How can be deficiency photographs taken when inspected obtained? We would like to use that photographs to be used on the visual criteria in revised inspection manual.
7-7	What kind of equipment & tools for bridge bridge inspection, repair and improvement works?
7-7-1	Do you have an inventory of equipment and tools?
7-7-2	Do you take any measures to maintain equipment & tool?
7-7-3	Are there any problem/issue on maintenance of bridge maintenance equipment & tool? Do you have any idea to solve the problem/issue?
7-7-4	Are necessary equipments & tools for bridge inspection and safety included in the Survey/Inspection Manual ? What are they?
8. Detailed inspection	
8-1	The existence of tests on concrete
8-1-1	Carbonation depth
8-1-2	Chloride ion concentration
8-1-3	Concrete compressive strength.
8-1-4	Elastic modulus of concrete
8-1-5	Coring
8-2	What organizations carry out the concrete tests of the above.
8-3	The method of concrete tests of the above
8-4	The existence of the bridge which caused the alkali-aggregate reaction
8-5	What organizations that carry out the alkali-aggregate reaction tests, and the method of test
8-6	The existence of the test carried out on the fatigue crack of the steel bridge
8-6-1	What organization carry out following tests for identifying steel cracks ?
8-6-2	Penetration Test
8-6-3	Magnetic-Particle Test
8-6-4	Ultrasonic Test
8-10	What organizations carry out the crack tests of the above
8-11	We would like to interview to the enterprise that carry out the tests

9. Bridge condition soundness evaluation	
9-1	Existence of evaluation record of bridge soundness condition
9-2	Do you consider the causes and progression in decision of damage evaluation
9-3	The existence of damage photographs to be used on the evaluation manual
9-4	What kind of evaluation work, do you charge commission to private consultants
9-5	Is the evaluation report of a damaged bridge including the proposal method of repair/strengthening
10. Bridge repair/strengthening works	
10-1	Private companies which can carry out bridge maintenance works(by work-scale)
10-2	Maintenance work classification & contents (routin, PMP minor, PMP major etc)
10-3	Performance & records of bridge maintenance/rehabilitation works
10-4	Contract system on bridge maintenance/rehabilitation works
10-5	Existence of bridge maintenance/rehabilitation work plan
10-6	Problems & way of solution concerning bridge maintenance/management works
10-7	Existence of bridge life prolongation countermeasures
10-8	Bridge replacement option What criteria for the whole bridge replacement/rehabilitation of existing bridge is applied?
10-9	Existence of preventive maintenance countermeasures
10-10	Bridge Inventory including history of maintenance/rehabilitation activities
10-11	Existing status of implementation of bridge maintenance works.
10-12	What kind of a contract type is applied for bridge maintenance works?
10-13	Outlines of each bridge improvement project implemented past 5 years such as a type of bridges, purpose and contents of improvement works, and contract method.
10-14	Performance & records of emergency response in the case of serious damage is found
10-15	Performance & records of emergency response in the case of serious damage is found
10-16	How many repair and strengthening contracts per year were made in past 5 years for bridges
10-17	What kind of concrete repair method were chosen in last years, the existence of repair documents(drawing and photos)
10-18	What kind of concrete beam strengthening method were chosen in past 5 years, the existence of documents(drawing and photos)
10-19	What kind of steel girder repair method were chosen in last years, the existence of repair documents(drawing and photos)
10-20	What kind of steel girder strengthening method were chosen in last years, the existence of repair documents(drawing and photos)
10-21	Have you found the fatigue crack on the steel girder, How did you repair
11. Cost estimation for bridge maintenance works	
11-1	Regulation and manual of cost estimation for construction of new bridge and box culvert
11-2	Regulation and manual of cost estimation for maintenance and rehabilitation of existing bridge and box culvert
11-3	Unit price of labors, equipment/ plant and materials for construction and repair works
12. Bridge management system (BMS)	
12-1	Bridges and culverts list which RHD manages(bridge type, bridge length, completion year, damaged rank, bridge width, sub-div. in charge etc.) Incorporate bridges and culverts which are not yet included in BMMS database.
12-2	How is the implementation status regarding "Review" on the website of BMMS in RHD Databases? That is, "The BMMS Database upgradation is going on. The information being shown here is under review. "
12-3	Are there any problem/issue on existing BMMS?
12-4	Do you have any idea to solve above problem/issue?
13. Over loading vehicle issues	
13-1	The existence of concerning Law/Regulation regarding excessive loading vehicles. Present condition of enforcement activities against excessive loading vehicles and actual status of enforcement effects. Measuring results of axis loads and vehicle weights by enforcement activities.
13-2	Decision method of the load restriction (BCS-1)
13-3	The existence of the data that reveals design live load of bridges

No	Question/Request
1. Bridge maintenance policy	
1-1	<p>Maintenance policy and plan concerning roads and bridges.</p> <p>* The RMMS database and the HDM-4 model are used to derive yearly maintenance budget demand (Routine, Periodic, Rehabilitation and Reconstruction etc work classes) for RHD. HDM Circle with its manpower conducts road roughness survey using Roughometer III. The other surveys such as Road Condition Survey (RCS), Traffic Count Survey (TCS) and Pavement Inventory Survey (PIS) are carried out by engaging consultants. These survey data are stored in RMMS Database. This database is the input of HDM-4 model analysis. By analysis, location, extent and type maintenance requirement for the RHD Road network are identified and prioritized in accordance with NPV/Cost ratio. The analysis also develop a 5-year investment plan to meet acceptable levels of service provision for the RHD network and provide a database for preparing RAMS map that combines all relevant information and shows decision makers where they can most effectively allocate funds for maintenance and rehabilitation.</p> <div data-bbox="252 667 1485 831" style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <pre> graph LR A["Traffic Data Road Condition Data Roughness Data Pavement Inventorv"] --> B["RMMS Database"] B --> C["Run HDM -4 Model"] C --> D["Process HDM Results"] D --> E["Determining Priority on basis of NPV/Cost"] E --> F["RAMS Map"] </pre> </div> <p>The HDM-4 Model analysis is carried out in the two sequences. Firstly, all roads have been analyzed to assess the overall long-term maintenance need of the RHD road network. Secondly ongoing projects, which are in progress and were not completed before the start of Roughness survey, have been excluded from the HDM run to project the immediate maintenance requirement for avoiding the duplication.</p> <p>The maintenance works and their associated priorities are shown in a GIS map known as RAMS map</p> <p>There is no such procedural programme for Bridge work. A system should be developed for bridges.</p>
1-2	<p>Assistance from other donors for bridge maintenance works such as bridge inspection, soundness evaluation, repair works and excessive load vehicle control.</p> <p>* Few/No assistance from other donors.</p>
2. Bridge maintenance budget	
2-1	<p>Transition of bridges construction and maintenance budget in the past five years.</p> <p>* Given in the table attached.</p>
2-2	<p>Breakdown of budget resources including budget from road maintenance fund.</p> <p>* The total allocation of road maintenance fund for FY-2015-2016 is Tk. 136,845.39 Lac amount this the break down is as follows :</p> <p>a) PMP (Major) - Tk. 82,800.00 Lac b) PMP (Bridge) - Tk. 15,000.00 Lac c) PMP (Minor) - Tk. 30,073.50 Lac d) Routine Maintenance - Tk. 7,500.00 Lac e) Emergency Maintenance - Tk. 1,000.00 Lac e) Emergency Rehabilitation Project - Tk. 471.89 Lac.</p>
2-3	<p>Amount of toll collected by toll roads and bridges and its way of use</p> <p>* Toll collection for FY 2014-2015 from roads is Tk. 132,414.40 Lac. and Bridges is Tk. 12,000.00 Lac. It is deposited as Government Revenue.</p>

2-4	Allocation system of road and bridge maintenance budget. * The allocation of road and bridge maintenance budget is done to each division against its roads and bridges on the basis of HDM needs report, demand of the division. The demand of field division is again verified in the chief engineer office.
2-5	Amount of budget which was requested, allocated and consumed for bridge maintenance works in the past 5 years . * Expressed in the table.
2-6	In the long term programme regarding bridge maintenance rehabilitation, is the latest inspection result reflected? * Latest inspection result will be reflected in RHD's long term maintenance program.
2-7	Breakdown of maintenance budget separating bridge budget from road budget respectively on routine maintenance, PMP minor and PMP major. * Expressed in the table.
2-8	Problems concerning maintenance budget resources . * The main problem regarding budget of maintenance fund is its insufficiency. HDM Needs report following we for example needed Tk. 7772.00 crore. for FY 2013-2014 for road and Bridge maintenance, but we got Tk. 123.00 and 964.00 crore for FY 2013-2014 which is only 16% of the total demand.
2-9	Counter measures to address the problems on budget resources. * Donor's attention may be drawn to resource constraint.
2-10	Way of preparation for short-term & middle term bridge maintenance program. * Utilization of Bridge condition survey report.
2-11	Budgets of each Zone for bridge routine maintenance works, PMP minor and major works and new bridge construction projects with number of implemented bridges in past 5 years. * Table enclosed.
3. Organizations in charge of bridge maintenance works	
3-1	Organogram and work contents (HQ, Circle, Division, Sub-Division) * Link: RHD web (www.rhd.gov.bd) --- RHD data base --- Organization Data base (Internet version) --- Chief Engineer's office---
3-2	The name of the Organization/managerial post in charge of following tasks. * RHD data base.
3-2-1	Conduction of bridge inspection works. * There is no periodical programme of bridge inspection work. Bridge condition survey is done in 2004/2005 for first time. Bridge condition survey is done partly through EBBIP in 2013.
3-2-2	Bridge soundness evaluation. * No tools, no technology, no specific skills, no trained person for soundness evaluation of bridges.

3-2-3	<p>Selection of the bridges to be repaired or reconstructed.</p> <p>* According to the report of field office. Selected list is approved by the ministry.</p>
3-2-4	<p>Priritization of the bridges to be repaired or reconstructed.</p> <p>* Existing damage condition is evaluated for taking decision whether repair or reconstruction is needed. The availability of fund/ resources is also taken into consideration., According, classification of roads National Highway is given first priority then regional highway and Zilla road.</p>
3-2-5	<p>Judgement of whether repair or reconstruction.</p> <p>* Same.</p>
3-2-6	<p>Preparation of the bridges list for repair or reconstruction.</p> <p>* There is no annual programme for the preparation of bridge list for repair or reconstruction. According to the report of field office. Selected list is approved by the ministry.</p>
3-2-7	<p>Conduction of bridge repair works.</p> <p>* Routine repair is done by RHD field offices. For major repair contractors are engaged.</p>
3-2-8	<p>Operation of BMMS including data input</p> <p>* Existing BMMS has not the facility to update.</p>
3-3	<p>The number of staffs of RHD Head Office, Zone Office, Circle Office, Division Office and Sub-division Office belonging to following categories.</p> <p>* Stated in the RHD web data base.</p>
3-3-1	<p>The number of staffs in the office by section and rank.</p> <p>* Design circle/const & maintain circle/P&D circle and BMW.</p>  <pre> graph LR BMW[BMW (Bridge Management Wing)] --> BDC[Bridge Design Circle] BMW --> BCMC[Bridge Construction Maintenance Circle] BMW --> PDC[Planning and Data Circle] BDC --> D1_1[Division-1] BDC --> D2_1[Division-2] BCMC --> D1_2[Division-1] BCMC --> D2_2[Division-2] PDC --> BMMSD[Bridge Maintenance Management System Division] PDC --> BMDPD[Bridge Maintenance and Programming Division] </pre>
3-3-2	<p>The number of staffs mainly in charge of bridge maintenance works by section and rank.</p> <p>* Staff of RHD field offices.</p>

3-3-3	<p>The number of staffs mainly in charge of highway maintenance works by section and rank.</p> <p>* Field office perform the highway maintenance work as per RHD organogram.</p>
3-3-4	<p>The number of staff in charge of both bridge and highway maintenance.</p> <p>* The staff of field offices does this.</p>
3-4	<p>Flow of works and procedures from a bridges inspection work to implementation of a bridge repair works with the name of each work/procedure, and the name of organization in charge of each work/procedure.</p> <p>Flow diagram of Approval.</p> <p>* Section office---> Sub-division office---> Division office--->Circle office--->Zone office. ACE--->CE--->MRTB.</p> <p>Implementation of work is done by Division offices with the assistance of Sub division and section offices.</p> <p>For minor and routine repair work, program is approved by ACE (Zone office) with the recommendation from field staff (Sub-Assistant Engineer/Sub-Divisional Engineer/Executive Engineer).</p>
3-5	<p>Problems and way of solution concerning bridge maintenance and management.</p> <p>* Problems are the theme of BMCD and solutions will be the outcome of the project.</p>
<p>4. Existing Manuals/Guidelinges to be applied for bridge maintenance works</p>	
4-1	<p>Do you have any manual/guideline/specification for a bridge Design, Construction works, Quality control, Cost estimation and procurement?</p> <p>* For design of RCC & PC girder bridge RHD have “ RHD Bridge Designer’s handbook”-2nd Edition(Published 1999). It is handbook based on AASHTO Edition 16 (1996). The handbook was done by Bridge Improvement & Maintenance Project Phase 2(BIMP-2).</p> <p>For Construction works and quality control RHD has own Specification(vol 3 of 4). RHD Schedule of Rates is used for cost estimation. PPR is followed for any procurement.</p>
4-2	<p>Do you have any bridge maintenance manual/guideline/specification?</p> <p>* We have several manual/guideline/Specification which has been produced by the consultant of EBBIP project(Published May 2014). These are as follows:</p> <ol style="list-style-type: none"> 1.Material for preparation of Bridge Maintenance Needs Report, 2.Major Repair Manual. 3.Bridge Maintenance Standard 4.Bridge Condition survey Manual 5.Routine Maintenance Works and Minor Repair Manual.
4-3	<p>Do you have any manual/guideline/specification to be applied for counter measures against disaster.</p> <p>* We have not any manual/guideline/Specification to be applied for counter measures against disaster of Bridges.</p>
4-4	<p>Status of utilization regarding bridge maintenance manuals/guidelines.</p> <p>* RHD Bridge maintenance is not properly done by following bridge maintenance manuals/guidelines.</p>

4-5	<p>Management for the publishment, distribution and explanation of bridge maintenance technical standards.</p> <p>* When one manual /guideline/Specification is published by one project then concern authority of that project is responsible to publish and distribute of that specification.</p>
5. Training for the RHD's staffs in charge of bridge maintenance works	
5-1	<p>Following information are currently to be requested for the establishment of Human Resources Development Program. In case several programs are carried out, information is to be given per program.</p> <p>* There is no information.</p>
5-1-1	<p>The name of Human Resources Development Programs for RHD's staffs in charge of bridge maintenance works.</p> <p>* <u>Fiscal Year 2013-2014 & 2014-2015</u></p> <ol style="list-style-type: none"> 1. Maintenance of pot-hole bearings of bridge-Seminar. 2. Quality Control of Bridge Construction-Lecture. 3. Material Test & Quality Control of Bridge/Culverts. 4. Construction Site Management. <p><u>Fiscal Year 2015-2016</u></p> <p>Training:</p> <ol style="list-style-type: none"> 1. Construction & Supervision work of Bridge/Culverts. 2. Material Test & Quality Control of Bridge/Culverts. 3. Restoration & Retrofitting Techniques of Bridges. 4. Base isolation device installation, management & Maintenance. <p>Seminar: Application of Weathering Steel Technology for RHD Bridge Construction.</p>
5-1-2	<p>The name of organizer of the programs.</p> <p>* RHD Training Center (RHDTTC).</p>
5-1-3	<p>The type of the Human Resources Development Programs such as a lecture and a seminar.</p> <p>* Class Lecture, On job Training & Seminar.</p>
5-1-4	<p>The venue of the programs such as RHD Training Center in Dhaka.</p> <p>RHDTTC, Chief Engineer's Conference Room.</p>
5-1-5	<p>The period of the programs.</p> <p>* Training-2/3/5/7/10 days Seminar-1 day</p>
5-1-6	<p>The frequency of the programs.</p> <p>* Seminar-At least two times in a year. Training-At least three times in a year.</p>
5-1-7	<p>The organization which participants belong to and their position/class, and number of participants.</p> <p>* Designation-CE, ACE, SE, EE, SDE, AE, SAE, number of participants-At least 80 in a Seminar. EE, SDE, AE, SAE, ARO, work Assistant, number of participants-At least 25 in a Training program.</p>

5-2	The organization which the instructor/lecturer of the program belong to and their position/class rank if they belong to RHD/MOC. * Roads & Highways Department, Rank-SDE/EE/Se/ACE/Project Director.
5-3	What kind of technical training was implemented for bridge inspector's capacity development implemented for in past 5 years? * No Such training yet.
5-3-1	Inside the country : total number of trainees, training curriculum, training text material. * N/A.
5-3-2	JICA training in Japan: list of attended tarinee's * 1. MD. SHAHADAT HOSSAIN, Executive Engineer, Bridge Design Division-1, East 2. MD. YOUSOUF, Executive Engineer, Bandarban. 3. MD. ABDUR RAHMAN KAOSER, Executive Engineer, Bridge Design Division-2, East
6. Existing bridge inventory	
6-1	Is it possible that "Construction Completion Drawings" are utilized for bridge inspection report and bridge inventory? * Based on availability of "AS built drawings" in some cases. When bridges are built earlier, it is difficult to collect "as built drawing". In this case assessment is done on the basis of present condition.
6-2	Is Bridge Inventory including rehabilitation history of maintenance/rehabilitation activities updated based on the latest inspection result? * Up dated partly under EBBIP. in 2014.
6-3	Are the history of maintenance/rehabilitation activities described in bridge inventory file? * Not described in bridge inventory file. But in annual programme approved by ACE, we can see the repair works done on the which bridges/culverts.
6-4	How can be the data updated and by what organization? * Appointing consultant with the support from exiting RHD setup.
7. Bridge inspection works	
7-1	Existence of bridge inspection records. * RHD has a primary data base on bridges which is shown on RHD web site. This BMS need to be up dated. About one third of the bridges were surveyed in 2013 under EBBIP.
7-2	What kind type of contract regarding bridge inspection work are applied? * By appointing consultant as per PPR.
7-3	If inspection work is outsourced by contract, please inform the process of bidding and the contents of its implementation of work. * As per PPR (Public Procurement Regulation).
7-4	Existence of annual bridge inspection programme. * We have not definite programme. Field offices do the inspection of individual bridge and culverts as the part of their responsibility. But it is not sufficient.

7-5	<p>Can we see it if you have?</p> <p>* Field offices do not maintain the record of inspection normally. But in case of emergency field office keep the record inspection.</p>
7-6	<p>Does bridge inspection work implemented along with annual bridge inspection programme?</p> <p>* Not according to programme.</p>
7-7	<p>How many bridges consisted of weathering steel are managed in RHD?</p> <p>* Data not available at present. But there is a plan to construct some weathering steel bridges under WBBIP.</p>
7-8	<p>Are there any special bridges such as suspension bridge, cable-stayed bridge, arch bridge?</p> <p>* The 3rd Karnafully is a cable-stayed bridge in RHD. The bridge located at chittagong over karnafully river.</p>
7-9	<p>Is the same inspection manual applied for these bridges?</p> <p>* RHD has no specific idea about this.</p>
7-10	<p>Is the correct manpower resource defined in the bridge inspection manual? What peronnel consists of inspection team?</p> <p>* In "Bridge Condition Survey Manual May 2014" a team is defined for inspection work. SDE or a nominated SAE will be team leader. Who will be assisted by an work assistant and two flagmen. Team leader may be a AE. Discussion is needed.</p>
7-11	<p>Is internal rule or regulation on "Safety Management" including safety measures. emergency measures, safety equipments used? Is internal rule or regulation on " Traffic Control" used? If yes, please prvide them to us.</p> <p>* The following manuals are published by the Ministry of Road Transport and Bridges under BRTA (Bangladesh Road Transport Authority) which are also applicable for Roads and Bridges.</p> <ol style="list-style-type: none"> 1. National Road Safety Strategic Action Plan, 2002-2004 2. Road Safety Audit Reports. 3. Road Safety Education Hand Book for Children and Adult Pedestrians in Rural Areas. 4. Road Safety Engineering toolkit. 5. Road Safety Training Documents. <p>All the above documents are available in RHD web Site.</p> <p>There is no rule or regulation on " Traffic Control" in RHD.</p>
7-12	<p>Are " Field Sketch" included in addition to the defficiency photos or not in the inspection record form?</p> <p>* In some cases, "Field sketch" are included in the inspection report. But it is not done in every case.</p>
7-13	<p>To make the best use of "Bridge Condition Survey Manual, May 2014", what are the issues to be solved (redarding applicability to inspection work, usability, points to be improved)?</p> <p>* The survey form may be more simplified. The manual may be included some cases of damages which lead to the failure of the bridges. A discussion may be held on the improvement of the manual.</p>

7-14	To evaluate deficiencies observed by distant view or what kind of criteria is applied to evaluation generally? "Inspected by DISTANT view" is to be described in inspection record? * "Inspected by DISTANT View" may not be effective for planning and taking decision. So it is not necessary to include it in the inspection record.
7-15	How can be photographs of deficiencies taken when inspected obtained? We would like to use that photographs to be used on the visual criteria in revised inspection manual. * Photograph should be taken properly for damage bridges and should be included in inspection report.
7-16	Do you have any problem/issue on bridge inspection works and do you have any idea to solve the problem/issue? * There are many problems regarding inspection works. ie lack skilled staff, equipments and technologies etc.
7-17	What kind of equipment & tool for bridge maintenance, repair and improvement works? * Very conventional equipment and tools are used at present. A discussion is needed to improve in this work.
7-18	Equipments & tools for bridge inspection and safety. *Discussion needed.
7-19	Are necessary equipments & tools for bridge inspection and safety included in the inspection manual? What are they? * May be included other sophisticated equipment/instrument. Suggestion is needed in this case.
7-20	Do you have an inventory of equipment and tools? * Not definite
7-21	Do you take any measures to maintain equipment & tool? * Not definite
7-22	Are there any problem/issue on maintenance of bridge maintenance equipment & tool? * At present few equipments are maintained. There is not specific problems related to this.
7-23	Do you have any idea to solve above problem/issue? * Do not have specific idea.
7-24	Existence of inspection & evaluation records (BCS-1-3, PBI). * Partly.
7-25	Present issues of "BRIDGE CONDITION SURVEY MANUAL". * Need to be improved.
7-25-1	Problems and solution concerning the three forms of inspection & evaluation (BCS-1-3). * Need simplification.
7-25-2	Problems and solution concerning to use inspection & evaluation result. * Inspection & evaluation result should be incorporated in BMMS. But existing BMMS is not updated. and it is not possible to update it.

7-25-3	Problems and solution concerning frequency of survey. *There is no annual survey programme. BCS is performed occasionally. Lack of skilled manpower/staff, lack of resources and lack of technology/equipment are the problems of frequent /annual survey.
7-25-4	Problems and solution concerning the system for carry out inspection & evaluation (BCS-1-3, PBI). * Need specific/periodic program. The no of staff of RHD field office should be increased and trained.
7-25-5	Problems and solution concerning to enter in format (BCS-1-3). * Unknown, Since the matter is not verified and survey is not performed by RHD staff. Detail will be discussed latter.
7-25-6	Problems and solution concerning the applicable structural types of bridge and culvert. * It will not be a problem when trained up of field officers.
7-25-7	Problems and solution concerning the applicable element types of bridge and culvert. * The same Q.
7-25-8	h) Problems and solution concerning the criteria of evaluation. * Sometime it is a problem for evaluation of “Extent of Damages”.
7-26	Performance & records of PBI. * No separate record for PBI.
8. Detailed inspection	
8-1	The existence of tests on concrete. * As per RHD specification.
8-1-1	Carbonation depth. * The test is not carried out in BRRL.
8-1-2	Chloride ion concentration. * The test is not carried out in BRRL.
8-1-3	Concrete compressive strength. * The test is carried out in BRRL.
8-1-4	Elastic modulus of concrete. * The test is not carried out in BRRL.
8-1-5	Coring. * The test is not carried out in BRRL.
8-2	What organizations carry out the concrete tests of the above. * BRRL carry out concrete compressive strength test of serial 8-1-3.

8-3	The method of concrete tests of the above. * The method of concrete compressive strength test is attached herewith.
8-4	The existence of the bridge which caused the alkali-aggregate reaction. * Information not available.
8-5	What Organizations that carry out the alkali-aggregate reaction tests, and the method of test. * The test is not carried out in BRRL.
8-6	The existence of the test carried out on the fatigue crack of the steel bridge. * Information not available.
8-6-1	What organization carries out following tests for identifying steel cracks? * Information not available.
8-6-2	Penetrant Test. * The test is not carried out in BRRL.
8-6-3	Magnetic-Particle Test. * The test is not carried out in BRRL.
8-6-4	Ultrasonic Test. * The test is not carried out in BRRL.
8-10	What organizations carry out the crack tests of the above. * The test is not carried out in BRRL.
8-11	We would like to interview to the enterprise that carry out the tests. * May be discussed about interview time schedule.
9. Bridge condition soundness evaluation	
9-1	Existence of evaluation record of bridge soundness condition. * Not recorded.
9-2	Do you consider the causes and progression in decision of damage evaluation. * Not methodically.
9-3	The existence of damage photographs to be used on the evaluation manual. *Damage photograph should be used on the evaluation manual.
9-4	What kind of evaluation work, do you charge, commission to private consultants. * In case of large structure, consultants are engaged.
9-5	Is the evaluation report of a damaged bridge including the proposal method of repair/strengthening.

	* No/Not active.
10. Bridge repair/strengthening works	
10-1	Private companies which can carry out bridge maintenance work (by work-scale). * Work is performed adopting tendering process. Any private party qualifying in the tender do the maintenance work.
10-2	Maintenance work classification & contents (routine, PMP minor, PMP major etc). *Maintenance work is classified into three class based on the nature and extent/scale of work. Routine: Very small and applicable to all kind (road/bridge/others) of repair where mainly laborious method is adopted. PMP (Minor): Applicable to both roads and Bridges. PMP (Major): This includes PMP (Roads) and PMP (Bridge/Culvert).
10-3	Performance & records of bridge maintenance/rehabilitation works. * Not Systematically.
10-4	Contract system on bridge maintenance/rehabilitation works. * As per PPR-(Public Procurement Regulation).
10-5	Existence of bridge maintenance/rehabilitation work plan. * Not active
10-6	Problems & way of solution concerning bridge maintenance/management works. * Lack of inspection, lack of skilled staff, lack of technology, lack of equipment.
10-7	Existence of bridge life prolongation countermeasures. * None.
10-8	Bridge replacement option What criteria for the whole bridge replacement/rehabilitation of existing bridge is applied. * Extent of damage.
10-9	Existence of preventive maintenance countermeasures. * Not known and practiced.
10-10	Bridge Inventory including history of maintenance/rehabilitation activities. * Not maintained. But it is the purpose of this project.
10-11	Existing status of implementation of bridge maintenance works. * Many bridges are needed to repair/reconstruct, But due to resource constraint bridge maintenance/replacement work is done on priority basis.
10-12	What kind of a contract type is applied for bridge maintenance works? * Mainly open Tendering Method following PPR. Online Tendering is applicable.

10-13	Outlines of each bridge improvement project implemented past 5 years such as a type of bridge, pupose and contents of improvement works, and contract method. * Need wide discussion. Information may be given latter.
10-14	Performance & records of emergency response in the case of serious damage is found. *Record is not systematic. But field office which do this work, maintain files..
10-15	Performance & records of emergency response in the case of serious damage is found. * Ans. in previous Q.
10-16	How many repair and strengthening contracts per year were made in past 5 years for bridges. * Repair/strengthening contracts are few number. Mainly replacement/reconstruction work is done. List will be given latter.
10-17	What kinds of concrete repair method were chosen in last years, the existence of repair documents (drawing and photos). * Not systematic.
10-18	What kinds of concrete beam strengthening method were chosen in past 5 years, the existence of documents (drawing and photos). * Not have knowledge.
10-19	What kinds of steel girder repair method were chosen in last years, the existence of repair documents (drawing and photos). * Not have knowledge.
10-20	What kinds of steel girder strengthening method were chosen in last years, the existence of repair documents (drawing and photos). * Not present, Not recorded.
10-21	Have you found the fatigue crack on the steel girder, How did you repair. * No data record.
11. Cost estimation for bridge maintenance works	
11-1	Regulation and manual fo cost estimation for construction of new bridge and box culvert. * RHD Schedule of Rate is followed.
11-2	Regulation and manual fo cost estimation for construction and rehabilitation of existing bridge and box culvert. * Same.
11-3	Unit price of labours, equipment/plant and materials for construction and repair works. * Same.
12. Bridge maintenance system (BMS)	

12-1	Bridges and culverts list which RHD manages (Bridge type, bridge length, completion year, damage rank, bridge width, sub-div, in charge etc.) Incorporate bridges and culverts which are not yet included in BMMS database. * Existing BMMS contains old data and need update. This data base does not have sufficient information. New BMMS is needed.
12-2	How is the implementation status regarding " Review" on the website of BMMS in RHD Databases? That is, "The BMMS Database upgradation is going on. The information being shown here is under review." * It is not possible to update existing BMMS. New BMMS is necessary to be developed.
12-3	Are there any problem/issue on existing BMMS? * There are no updating facilities of BMMS.
12-4	Do you have any idea to solve above problem/issue? * New BMMS should be developed.
13. Over loading vehicle issues	
13-1	The existence of concerning Law/Regulation regarding excessive loading vehicles. Present condition of enforcement activities against excessive loading vehicles and actual status of enforcement effects. Measuring results of axis loads and vehicle weights by enforcement activities. * There is a draft for "Policy for Axle load control of Motor Vehicle, June 2012."
13-2	Decision method of the load restriction (BCS-1). * "Policy for Axle load Control of Motor Vehicle" may be followed for BCS-1 form.
13-3	The existence of the data that reveals design live load of bridges. *Traffic data available in HDM (Highway Data Management) unit which is used by design unit.

Attached table

Bridge maintenance and construction budget

BDT.lacs

Zone	Financial year	Routine maintenance budget	PMP minor		PMP Major		Construction	
			Amount of budget	Number of bridges	Amount of budget	Number of bridges	Amount of budget	Number of bridges
Barisal	2010	40.00	346.00		150.00	1	1515.12	2
	2011	58.00	350.00		305.65	1	1125.00	1
	2012	75.00	650.00		1960.91	2	1700.61	3
	2013	65.00	300.00		3176.55	3	5389.15	5
	2014	100.00	350.00		997.88	1	4767.89	7
Chittagong :	2010							
	2011							

	2012							
	2013							
	2014							
Comilla :	2010							
	2011							
	2012							
	2013							
	2014							
Dhaka :	2010							
	2011							
	2012							
	2013							
	2014							
Gopalganj :	2010						997.08	3
	2011		28.34	10			290.91	1
	2012		27.30	10	97.0200	5	846.26	2
	2013		33.94	11	950.6600	7	729.71	3
	2014		31.80	11	564.6600	6	21550.00	5
Khulna :	2010							
	2011							
	2012							
	2013							
	2014							
Rajshahi :	2010	6.00	483.00	8				
	2011	467.00	33.47	6	240.35	1		
	2012	35.68	15.00	3	239.60	1	147.71	
	2013	8.00	90.18	6	898.04	3	1305.01	
	2014			5		3	495.87	17
Rangpur :	2010	36.00	38.59	3	33.05	4	1650.65	10
	2011	51.00	75.60	4	482.88	2	2283.46	12
	2012	72.00	65.85	5	135.93	2	1533.96	7
	2013	91.50	0.00	0	0.00	0	548.92	1
	2014	17.60	41.00	5	113.41	9	2092.22	6
Sylhet :	2010							
	2011							
	2012							
	2013							
	2014							
Mymansingh	2010		4.00	8	91.32	1	5127.91	3
	2011		3.00	3	160.36	1	1294.41	2
	2012		28.07	6	59.63	1	2093.74	2
	2013		7.00	6			735.15	5
	2014		23.88	10	298.08	1	282.93	1

Report on
Site Survey of Existing Bridges
along N-5 in Sirajganj Division

4 September, 2015

Joint venture of

Japan Structure and Bridges Institute Inc. (JBSI)

Oriental Consultants Global Co., Ltd.. (OCG)

Japan Bridge Engineering Center (JBEC)

Outline

1. Purpose
 - 1) Understanding of the present situation of the existing bridges in order to proceed the project
 - 2) Accessibility for close and distant visual inspection
2. Date 23-24 August, 2015
3. Bridges to be surveyed 10 Bridges managed by Sirajganj Division
4. Attendants Nine JICA Expert of the Consultant guided by the staff of Sirajganj Division Office

Table 1 List of the Surveyed Bridges

No	Zone	Division	Road No	LRP Name	Structure Name	Chainage (km)	Bridge Type	No of Spans	Total Length (m)	No of Beams	Year of Construction	Width (m)
<u>6</u>	Rajshahi	Serajganj	N-5	176a	Bhuyagati Bridge	173.833	RCC Girder Bridge,	3	73.7	3	1975	7.37
<u>10</u>	Rajshahi	Serajganj	N-5	140a	Jugnidaha Bridge	138.201	RCC Girder Bridge,	3	53.4	4	1975	8.6
<u>14</u>	Rajshahi	Pabna	N-5	118a	Punduria Bridge	117.143	RCC Girder Bridge,	5	81.4	4	1963	7.09
<u>15</u>	Rajshahi	Pabna	N-5	126a	Vitapara Bridge	125.093	RCC Girder Bridge,	3	76.3	3	1965	7.16
<u>19</u>	Rajshahi	Sirajganj	R-451	7a	Chondi Das Bridge	6.561	Bailey with Steel Deck,	2	58.8	0	1985	8.35
<u>21</u>	Rajshahi	Serajganj	N-5	128a	Goilhar Bridge	127.046	RCC Girder Bridge,	3	43.5	4	1968	7
<u>26</u>	Rajshahi	Serajganj	N-5	127a	Palgari Bridge	126.806	RCC Girder Bridge,	3	43.08	4	1968	7.1
<u>27</u>	Rajshahi	Serajganj	N-5	158a	Purbodalua Bridge	155.583	RCC Girder Bridge,	3	78.35	3	1965	7.03
<u>47</u>	Rajshahi	Serajganj	N-5	172a	Notun Dhoh Bridge	169.626	RCC Girder Bridge,	3	43.8	4	1972	7.52
<u>48</u>	Rajshahi	Serajganj	N-5	179a	Dhatia Bridge	176.746	RCC Girder Bridge,	3	54.9	3	1975	7.45
<u>66</u>	Rajshahi	Sirajganj	R-451	1a	Naiori Bridge	0.907	Bailey with Steel Dec	2	50	X	1980	8.35

Bold: The summary of the surveyed result is attached.

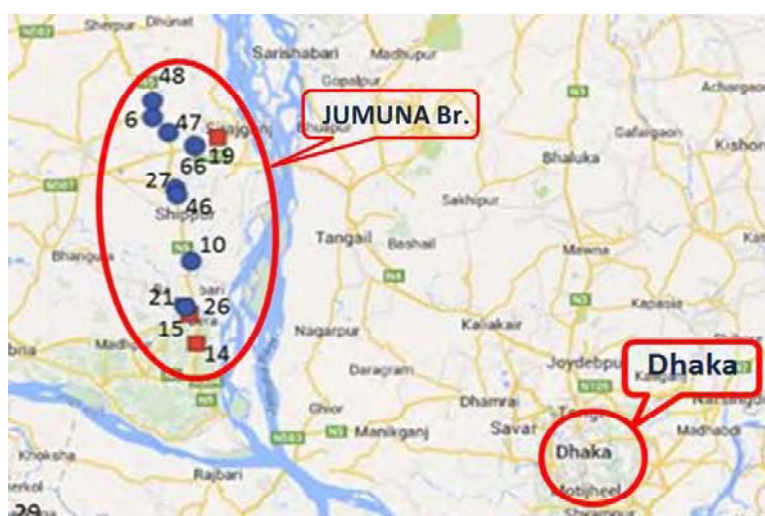


Figure 1 Location of the Surveyed Bridges

1. Location

Zone:	Rajshahi	Circle:	Pabna	Division:	Sirajganj	SubDivision:	Sirajganj-1
Road No.:	N5	Road Name:	Dhaka (Mirpur)-Utholi-Paturia- Natakholo-Kashinathpur- Bogra-Rangpur-Beldanga- Banglabandh Road			Chainage:	155.583
Structure ID:	111501	Structure No.:		Structure Name	Purbodalua Bridge		

2. Summary of Defficiencies

Element	Defficiencies
Approaches	
Guide Posts	-----
Slope Protection	-----
Toe Wall	-----
Railing	Damaged concrete railing (both side), Photo 1 and 6
Side Walk	No side walk, Photo 2
Deck	Severe damage at concrete deck over the additional pier, covered with temporary steel plates, Photo 3
Concrete Beam	Need to pay attention at Gerber-hinges (crack, spalling), Photo 5
Steel Beam	-----
Truss	-----
Bailey	-----
Abutment	no access
Pier	Additional pier, Photo 1
Wing Wall	no access
Pier Cap	-----
Bearing Seat	Accumulated debris need to remove around bearings
Bearing	Indirect support at the pier(concrete block between pier and superstructure), Photo 4
Expansion Joint	Functional disorder/deformation, need to repair at Gerber-hinges, Photo 5
Pile Cap	-----
Foundation Protection	-----

3. Comment

<p>1) Concrete deck is severely damaged, due to the structural change of support (additional pier).</p> <p>The steel plates layed on the deck as the temporary remedial measure is too thin for strengthening.</p> <p>2) RCC beams need to pay attention periodically at Gerber-hinges (progress of crack, spalling).</p> <p>3) Break of railing may lead to an accident of road users. This damage is suggested to be rehabilitated urgently.</p> <p>4) The superstructure is supposed to be RCC girder, not PC girder whichi is listed on RHD Database.</p> <p>The year of construction is 1965.</p>
--

4. Photo



Photo 1 Side view, additional pier under Gerber-hinge



Photo 2 Bridge Surface, damaged RCC railing



Photo 3 Damaged surface with steel plate as temporary measure



Photo 4 Indirect support (concrete block)



Photo 5 Damaged expansion joint above Gerber-hinge



Photo 6 Break of railing

1. Location

Zone:	Rajshahi	Circle:	Pabna	Division:	Sirajganj	SubDivision:	Sirajgonj-1
Road No.:	R451	Road Name:	Nalka-Sirajganj Road			Chainage:	0.907
Structure ID:	100072	Structure No.:		Structure Name	Nalori Bridge		

2. Summary of Defficiencies

Element	Defficiencies
Approaches	Unevenness and pavement crack of approach surface, Photo 2
Guide Posts	-----
Slope Protection	Washed away of approach shoulder, Photo 3
Toe Wall	-----
Railing	No railing
Side Walk	No side walk
Deck	Cracks of steel deak plate, Photo 5
Concrete Beam	-----
Steel Beam	-----
Truss	-----
Bailey	Minor corrosion
Abutment	no access
Pier	no access
Wing Wall	no access
Pier Cap	-----
Bearing Seat	Sediment is deposited around bearings, Photo 4
Bearing	no access
Expansion Joint	no access
Pile Cap	-----
Foundation Protection	-----

3. Comment

<p>1) Due to high water-level in rainy season, we could not inspect the components under the bridge.</p> <p>2) The collapse of the masonry behind the tment is caused by erosion. In order to prevent slope failure, repair is required.</p> <p>3) By the level difference between the apprch road surface and bridge pavement surface, cracks of deck plate is caused due to impact of wheel load. It requires replacement of pavement for maintaining flatness.</p> <p>4) By the impact of the wheel load, the crack has occurred at the deck plate surface. It needs cover plate reinforcement, or weld repairs.</p> <p>5) Due to accumulation of debris around the bearing, the functional damage in movement may occur. Accumulated debris should be removed out at daily maintenance work.</p> <p>6) Loading capacity of Bailey Bridge is considered to be limited.</p> <p>7) Installation of railing is proposed from the view point of safety of pedestrians .</p>
--

4. Photo

	
<p>Photo 1 Side view of Bridge</p>	<p>Photo 2 Unevenness and pavement crack of approach</p>
	
<p>Photo 3 Collapsed masonry of approach shoulder</p>	<p>Photo 4 Accumulated debris around bearings</p>
 <p>Cracks</p> <p>Unevenness</p>	
<p>Photo 5 Cracks of Deak Plate and unevenness of surface</p>	<p>Photo 6 Lower surface of steel deck (H-type steel) with minor corrosion</p>

1. Location

Zone: Rangpur	Circle: Bogra	Division: Bogra	SubDivision: Sherpur (Bogra)
Road No.: N5	Road Name: Dhaka (Mirpur)-Utholi-Paturia- Natakholo-Kashinathpur- Bogra-Rangpur-Beldanga- Banglabandh Road		Chainage: 176.746
Structure ID: 111517	Structure No.:	Structure Name: Dhatia Bridge	

2. Summary of Defficiencies

Element	Defficiencies
Approaches	Minor pavement crack, Photo 2
Guide Posts	-----
Slope Protection	-----
Toe Wall	-----
Railing	Missing (10 m) and spalling/rebar exposure due to vehicle collision, Photo 3 and 4
Side Walk	-----
Deck	no access
Concrete Beam	no access
Steel Beam	-----
Truss	-----
Bailey	-----
Abutment	no access
Pier	no access
Wing Wall	no access
Pier Cap	no access
Bearing Seat	no access
Bearing	no access
Expansion Joint	Buried expansion joint under pavement with water leakage, Photo 5 and 6
Pile Cap	-----
Foundation Protection	no access

3. Comment

- 1) Railing is missing and severely damaged due to vehicle collision.
And spalling and exposure of reinforcing bar due to corrosion will lead to break of railing.
From the viewpoint of safety of road users, this break of railing is suggested to be rehabilitated urgently.
- 2) The components under the superstructure were not observed due to difficulty of access.
- 3) Abnormal vibration was detected with heavy traffic passing.
The superstructure of this bridge vibrates horizontally as well as vertically.
- 4) The followings are considered as the cause of horizontal vibration.
Suspected scoured Pier
Insufficient stiffness of superstructure (structural deficiency)
- 5) These suspected causes may indicate insufficient structural safety of the bridge.
Therefore, detailed investigation is required to identify the the location of damage in the structural member, causes/sources of damage, interactions with other damage at other components.
The items of this detailed investigation are as follows:
Measurement of vibration (vibration frequency and vibration mode)
Detailed inspection of scour by diver

4. Photo



Photo 1 Side view



Photo 2 Bridge Surface



Photo 3 Missing of railing



Photo 4 Spalling/Rebar exposure of railing



Photo 5 Buried expansion joint



Photo 6 Buried expansion joint above Gerber-hinge

Summary and Recommendations

1. Observed Result

- 1) Among 10 bridges, representative 3 bridges (superstructure type; 2 RCC girder and a steel girder) are selected. Surveyed results for these bridges are summarized at P.3-8.
- 2) Regarding the rest of 7 bridges surveyed, the similar damages as that of the bridges reported, such as missing of railing (spalling of concrete, pavement crack/wearing above expansion joint, were found in some bridges.
- 3) Loading capacity of brick masonry abutment must be limited.
- 4) Some bridges with narrow width were found. It is recommended that these bridges will be modified.

2. Remarks for implementation of bridge inspection in OJT

- 1) In bridge inspection, “Close” visual inspection is fundamental.
However, the close visual inspection for overall bridge structural elements without any access equipment was almost impossible due to limited or no access condition under the bridge in rainy season.
- 2) To inspect the whole components/elements by close visual inspection, it is recommended to install the inspection platform around bearings on piers and abutment, and vertical approach (ladders) to the top of piers, and using of boat if necessary.
It is desirable that installation of access equipment is considered at design stage.
- 3) It is desirable that each inspection team will prepare GPS memory to identify the location of the bridge efficiently.
- 4) At the training of inspection at bridge site, it is recommended to implement traffic control such as temporary lane closure by traffic control personnel for frequent traffic passing and heavy traffic.



Example:
Inspection Platform and Ladder

3. Acknowledgement

With the kind cooperation and guide by the staff of Sirajganj Division this survey was implemented successfully. We would like to express sincere thanks to all of them, especially to Mr. Azaad, Executive Engineer and his staff.

Photos



Sirajganj Sub-division Office



Visit to a Sub-Division Office



Heavy traffic passing



Mr. Azaad and his staff



Briefing by RHD staff



Talking of Team leader with RHD



Site survey of brick abutment



No side walk
(Insufficient width of shoulder)

The Report on the Site Visit
Conducted to Select Model Area for OJT

August 28, 2015

Bridge Management Capacity Development Project
JICA Consultant Team

Joint venture of
Japan Structure and Bridges Institute Inc. (JBSI)
Oriental Consultants Global Co., Ltd.. (OCG)
Japan Bridge Engineering Center (JBEC)

Table of contents

1. Purpose of Site Visit	1
2. Date of of Site Visit.....	1
3. Participants	1
4. Recognized roads and bridges	1
5. Confirmed facts.....	2
6. Conclusion through the Site Visit.....	3
Appendix	4

1. Purpose of Site Visit

Understanding of the JICA Team is that the Manikganj Division is the most suitable division for Model Area for OJT among Dhaka Zone from the viewpoint of (i) Number of bridges in the division, (ii) Traffic condition between the Base (RHD Training Center) and sites, and movement from a bridge to the next bridge, (iii) Possibility of communication disruption.

Purpose of the Site Visit is to confirm whether Manikganj Division is suitable for Model Area of OJTs from above point of view, mainly traffic condition from the Base to the area and the bridge to the next bridge.

2. Date of Site Visit

Time and Date: 9:30 ~ 20:00, 20 August, 2015

3. Participants

The Site Visit was carried out by following participants under the cooperation of the staff from the Manikganj Division Office.

(1) The Manikganj Division Office

Mr. Md. Mohibul Haque (EE of the Manikganj Office)

Mr. Monirol Alam (AE of the Manikganj Division Office)

Mr. Md. Shakhawat (WA of the Manikganj Office)

(2) The JICA Team

Mr. Hiyama (Team Leader/Expert on Bridge maintenance management plan)

Mr. Harazaki (Expert on Bridge inspection)

Mr. Konishi (Expert on Bridge soundness evaluation)

Mr. Iizuka (Expert on Bridge management plan)

Mr. Hida (Expert on Detailed Survey)

Mr. Kosaka (Expert on Bridge soundness evaluation/Bridge repair method)

Mr. Makishima (Expert on Bridge maintenance management system)

Mr. Yasashi (Project coordinator)

Mr. Anis Sharif (Local coordinator)

4. Recognized roads and bridges

The Site visit was carried out on the roads shown in **Fig. 1**.

The JICA Team confirmed road traffic condition such as traffic jam, traffic volume, driving speed of vehicles; impact to traffic flow due to temporary parking near the bridges during inspection, and inspected the condition of approx. 14 bridges on the roads.

Fig. 1 Traveling route map



5. Confirmed facts

Following facts were confirmed through the Site Visit.

i. Traveling time between the Base and the site

Several traffic jam points were confirmed on the way between the Base and the site. However, it can be said that jam condition was not so serious because the JICA Team could pass all the jam sections within 10 minutes. It took approx. 1 hour between the Base to the starting point of the NH5 section where Manikganj Division Office is managing. The Northern route was shorter than Southern route in traveling time.

ii. Traffic volume

Traffic volume was not so high on NH5 and RH was very small, therefore, any negative effects to bridge inspection works were not anticipated.

iii. Parking space

Vehicles for bridge inspection works can park near the bridges because of smaller traffic volume. It is expected that the inspection teams of OJT can find the parking space near the bridge easily.

iv. Possibility of communication disruption

The JICA Team could not find any large sized Industrial Park along the trip route. Almost the area along the trip route were farming area, therefore, it is expected that possibility of communication disruption will be very low.

6. Conclusion through the Site Visit

It can be concluded that Manikganj Division is the most suitable division for Model Area of Dhaka Zone from following points of view;

- (i) Suitable number of bridges in the division (298 bridges).
- (ii) Traffic condition between the Base and sites, and movement condition from a bridge to the next bridge were acceptable.
- (iii) Parking space for the vehicle of the inspection team can be found near the bridge easily.
- (iv) Possibility of communication disruption will be low.

Appendix

Photo 1

Explanation by Executive Engineer,
Manikganj Division



Photo 2

A bridge condition overview



Photo 3

Hearing to Executive Engineer
Related to bridge maintenance activities



Survey Report
on
Condition of Shahbazpur Bridge



March 8, 2018

BMCDDP

Hiyama, Yoshimitsu

Konishi, Toshiyuki

Contents

- 1. Itinerary of Survey Trip**
- 2. Preliminary Survey**
 - 2.1 Basic Data of Shahbazpur Bridge**
 - 2.2 Results of Preliminary Survey**
- 3. Results of Survey**
 - 3.1 Conditions and Characteristics of Defects**
 - 3.2 Estimation on Causes of Defects**
- 4. Advices for Remedial Measures**
- 5. Detailed Investigation for Strengthening Design**

Appendix-1:

Preliminary Survey Report by Mr. Asaduzzaman, Local Bridge Engineer of JICA Consultant Team.

1. Itinerary of Survey Trip

1.1 Place: Shahbazpur Bridge Site (Fig-1.1)



Fig.1-1 Location of Shahbazpur Bridge

1.2 Date: March 3rd (Saturday)

1.3 Participants:

RHD

Madam Rowshan Ara Khanam, ACE of BMW, RHD

Mr. Mohammad Yousuf, EE of Bridge Design Div.-2, RHD

Mr. Arun Alo Chakum, SE of Comilla Circle, Comilla Zone

Mr. Abu Ehtesham Rashed, EE of B. baria Div., Comilla Zone

Mr. Bhuiya Redwanur Rahman, SDE of B. baria Sub-Div.,

Comilla Zone

Mr. Md. Imdad Hossain, Ex. ACE of Barisal, RHD

JICA Consultant Team:

Mr. Yoshimitsu Hiyama, Team Leader

Mr. Toshiyuki Konishi, Bridge Evaluation

Mr. Asaduzzaman, Local Bridge Engineer

1.4 Itinerary

7:30 Departure from Six Seasons Hotel

10:00 Arrival at Shahbazpur Bridge Site

10:00 - 12:00 Bridge Survey

12:00 - 14:00 Lunch and Meeting

14:00 Departure from Brahmanbaria

16:30 Arrival at Dhaka

2. Preliminary Survey

2.1 Basic Data of Shahbazpur Bridge

Basic data of Shahbazpur Bridge is shown as Table 2-1.

Table 2-1 Basic Data of Shahbazpur Bridge

File Number	N2- LRP093a-20180227					Date	27-Feb-18			
Zone	Comilla	Circle	Comilla	Division	Brahmanbaria	Sub-Division	Brahmanbaria	SO	SO-4	
District	Brahmanbaria		Upazila	-	Union	-			Village	-
Road No.	N2	Road Name	Dhaka-Bhairab-Jagadishpur-Sylhet-Tamabil-Jaflong		LRP Name	LRP093a	GPS	Lat	24° 24' 47" N	
								Long	90° 10' 38" E	
Bridge Name	Shahbazpur Bridge		LRP+Offset	-			Chainage	92.673 (m)		
Year of Construction	1965	Design Standard	-			Design Load	-	Load Restriction	-	
Public Utilities Carried	-									
Bridge Length	203.75 (m)	No. of Spans	9	Span Arrangement	7.5+18.3+25.45+28.45+39.75+34.3+23.9+18.5+7.6			Skew Angle	-	
Superstructure	Bridge Type	Type	Material		Deck Slab	Type	Material			
		RC Girder Bridge	Concrete		-	-	-			
Substructure	Abutment	Unknown	-		Foundation (Abutment)	Unknown	-			
	Pier	Column Type	-		Foundation (Pier)	Unknown	-			
Other Elements	Pavement	Asphalt	-		Bearings	-	-			
	Expansion Joint	-	-		Railing	-	-			
Width	Total Width	10.63 (m)	Curb-L	Sidewalk-L	Carriage way-L	Median	Carriage way-R	Sidewalk-R	Curb-R	
	Effective Width	8.09 (m)	0.73 (m)	0.58 (m)	6.63 (m)	-	-	0.58 (m)	0.73 (m)	
Traffic Conditions	Census (Year)	-				Condition Category for Entire Bridge	-			
	Traffic Volume	15,000 to 20,000 Vehicles				-				

2.2 Results of Preliminary Survey

Preliminary survey was carried out on 26th of November, 2017 by RHD project officials and a local bridge engineer of JICA consultant team. The report is attached in Appendix-1.

3. Results of Survey

3.1 Conditions and Characteristics of Defects

The defects are mainly as follows. (Refer to Fig.3-1)

- 1) P1-P2 Fallen-out of deck slab concrete**
- 2) P1-P2 Shear force cracks on main girders**
- 3) P4-P5 Mending moment cracks on main girders**
- 4) P2-P3、 P4-P5、 P6-P7 Abnormal space, gap and vibration at hinge parts**

The conditions and characteristics are as follows.

1) P1-P2 Fallen-out of Deck Slab Concrete (Fig.3-2)

- *The concrete slabs on the line where many heavy vehicles are running are damaged.
- *Falling-out of slab is occurring at two points and two-direction cracks are progressing toward fallen-out at a point.
- *The slabs other than P1-P2 are not so damaged yet.

2) P1-P2 Shear Force Cracks on Main Girders Fig.3-3)

- *The shear force cracks which can be confirmed by distant view are taking place on the girder webs near P1 bearing and P2 bearing.
These cracks are penetrating the girder webs because the cracks exist on the both sides of the webs.
There are no free limes and rust fluid from the cracks.
The re-bars at the points of honey combs and delamination are rusting and concrete covers on re-bars are also very thin.
The cracks are occurring near all girder ends (three girders therefore six ends) and especially the crack width of G1 girder near P1 is large. However, main girders between P6-P7 are not damaged although the structure is same as the girders between P1-P2.

3) P4-P5 Bending Moment Cracks on Main Girders Fig.3-4)

- Bending moment cracks which can be confirmed by distant view are taking place around the center of span.
There are no free limes and rust fluid from the cracks.
The re-bars in delaminated area are rusting and their concrete covers are thin.
The cracks are taking place on all the girders and their damage levels are almost same.

4) P2-P3、 P4-P5、 P6-P7 Gerber Hinge Parts (Fig.3-5)

Abnormal spaces, gaps and vibrations were observed at gerber hinge parts. Regarding abnormal spaces, the space of one side of the birders is around 50mm and the supporting girders are largely separate from suspension girders while that of opposite side is almost none. Gaps with 20-30 mm in vertical and horizontal direction are produced between the railing of supporting girders and that of suspension girders. This makes imagine that the suspension girders may be inclined. The vibration of suspension girders are severe.

3.2 Estimation on Causes of Defects

1) P1-P2 Fallen-out of Deck Slab Concrete

The causes are fatigue fracture due to running vehicles. Furthermore, the slab thickness with 125 mm was not enough to bear traffic loading.

The progress of damage is fast at ponding area but the reason why the damages are occurring only between P1 and P2 is not clear.

2) P1-P2 Shear Force Cracks on Main Girders

It seems that the cracks are caused by insufficient load bearing capacity due to due to low girder height.

The reason why the crack width of G1 girder near P1 is especially large is not clear. Since the rigidity of deck slab between G2 girder and G3 girder decreased due to the fallen-out of deck slab concrete, the burden onto G1 girder might have increased. The honey combs due to improper construction on G1 girder near P1 might have been a trigger of cracks.

The reason why the defects are taking place only between P1 and P2 is not clear. Since the thickness of concrete is thin, the influence of carbonization should be considered.

3) P4-P5 Bending Moment Cracks on Main Girders

The cracks might be caused by that the girder height is not enough for the load carrying capacity.

4) P2-P3、 P4-P5、 P6-P7 Gerber Hinge Parts

It can be estimated that the cracks and spalling of concrete, abnormal spacing and gaps, and abnormal vibration are occurring due to the defects of anchorage.

As the damages at gerber hinge parts might lead to bridge collapse, urgent countermeasures would be required.

4. Advices for Remedial Measures

1) P1-P2 Falling-out of Deck Slab Concrete

As urgent countermeasures, the place of steel plate which are now executed is common.

Permanent countermeasures to increase load carrying capacity are as follows. ③。

- To increase the thickness of deck slab.
- To bond carbon fiber sheet on the bottom surface of slab.
- To bond steel plate on the bottom surface of slab.

According to Japanese specification, the slab thickness of this bridge is calculated 230 mm. Compared to that, actual thickness of this bridge, 125 mm is too thin.

As the increase of slab thickness caused the increase of dead loads, it influences the capacity of other elements.

The bonding of carbon fiber might exceed the limit of bonding thickness to secure slab rigidity.

Therefore, steel plate bonding methods are recommended. However, the part of deck slab which are already fallen out should first be reconstructed.

2) P1-P2 Shear Force Cracks on Main Girders

As the emergency countermeasures, temporary steel support or sand bag support is proper to reduce cracks.

Permanent countermeasures are as follows.

- To increase main girder section.
- To bond carbon fiber sheets.
- To bond steel plates.

As the cracks which are now occurring are large in width, significant increase of capacity is required.

The increase of girder section requires traffic control until the concrete hardens. Furthermore, dead load largely increases.

The bonding of carbon fiber can't expect sufficient capacity increase as the increase of section rigidity is small.

Therefore, steel plate bonding method is recommended.

3) P4-P5 Bending Moment Cracks on Main Girders

The temporary countermeasure using Bailey bridge is now applied to control cracks. As other countermeasures, the method by temporary steel pipe support can be applied.

As permanent countermeasures, steel plate bonding can be recommended as well as 2).

4) P2-P3、 P4-P5、 P6-P7 Gerber Hinge Parts

In order to prevent suspension girders from falling down, temporary countermeasures such as supporting suspension girders on temporary bents (steel posts) or placing Bailey bridge on suspension girders are applied.

In case of Shahbazpur Bridge, three Bailey bridges are to be placed on three Gerber parts. This leads to the worsening of trafficability. Furthermore, long time traffic control to place Bailey bridges are required.

Therefore, the method to support Gerber parts by temporary bents is recommended.

Permanent countermeasures are as follows.

- To support Gerber hinge parts by newly constructed piers.
- To break Gerber hinge parts and to make new Gerber hinge parts.
- To set steel devices for strengthening on the bottom of Gerber hinge parts.
- To unite Gerber hinge parts by concrete filling and PC tendons.

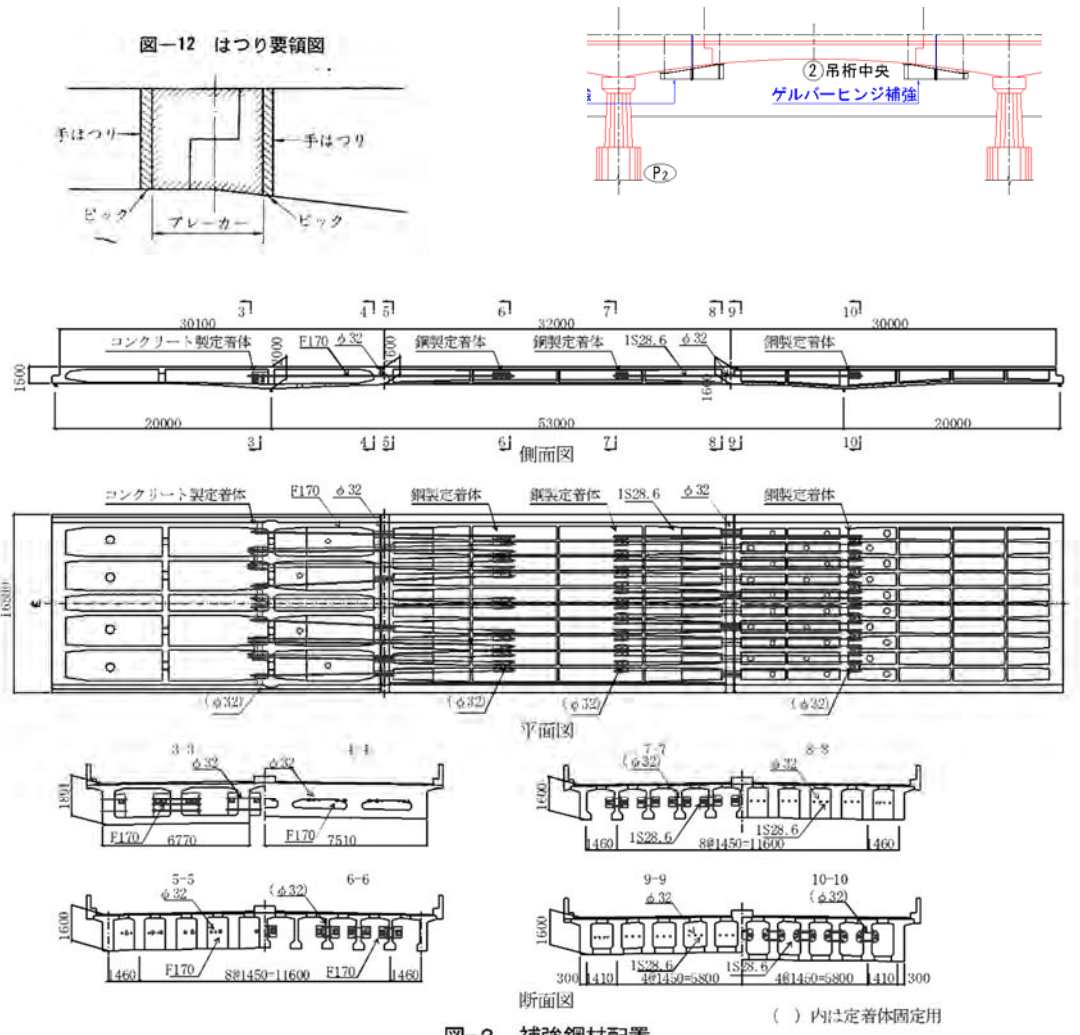


図-2 補強鋼材配置

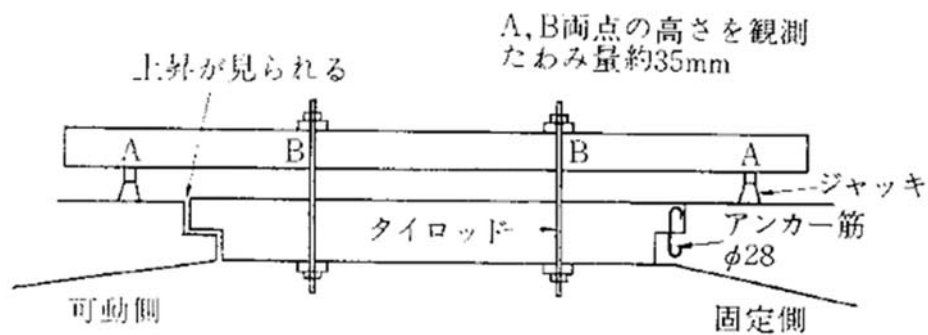
5. Detailed Investigation for Strengthening Design

The information required for strengthening design is as follows.

- 1) Basic Conditions
 - Design year
 - Applied standard and design load
 - Design drawing, bar arrangement drawing
 - Construction year
 - Repair records
- 2) Slab
 - Slab thickness

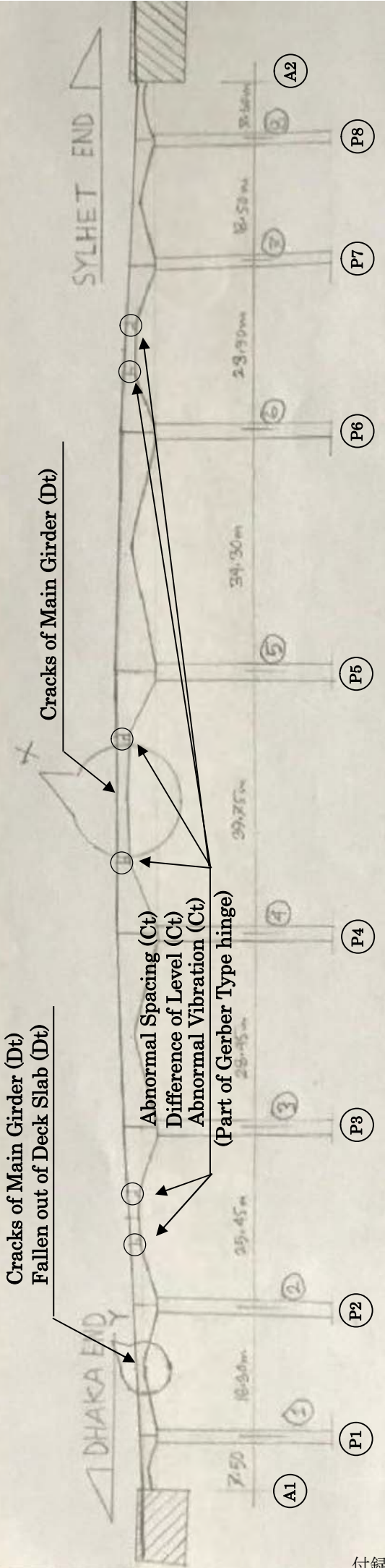
- Bar arrangement
- 3) Main Girders
- Girder height
 - Girder width
 - Bar arrangement
 - Concrete cover thickness
 - Carbonization
- 4) Gerber Hinge Parts
- Damage conditions such as cracks
 - Structural size
 - Bar arrangement
 - Anchorage bar

The confirmation of hinge parts becomes large scale as following figure.

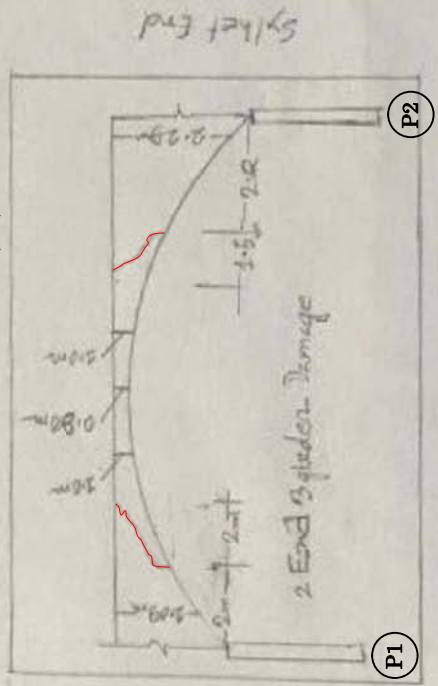


- 5) Structural Change
- Fixation of girder ends
 - Malfunction of bearings

Shahbazpur Bridge



Cracks of Main Girder (Dt)



Note:

- 1) Length of Bridge = 203.75 m
- 2) Bridge width = 8.090 m
- 3) No of Span = 9 Nos
- 4) Girder width = 0.430 m
- 5) Nos of girder in Each Span = 3 Nos.
- 6) Suspended girder Span = 3 Nos.

P1-P2 : Fallen out of Deck Slab

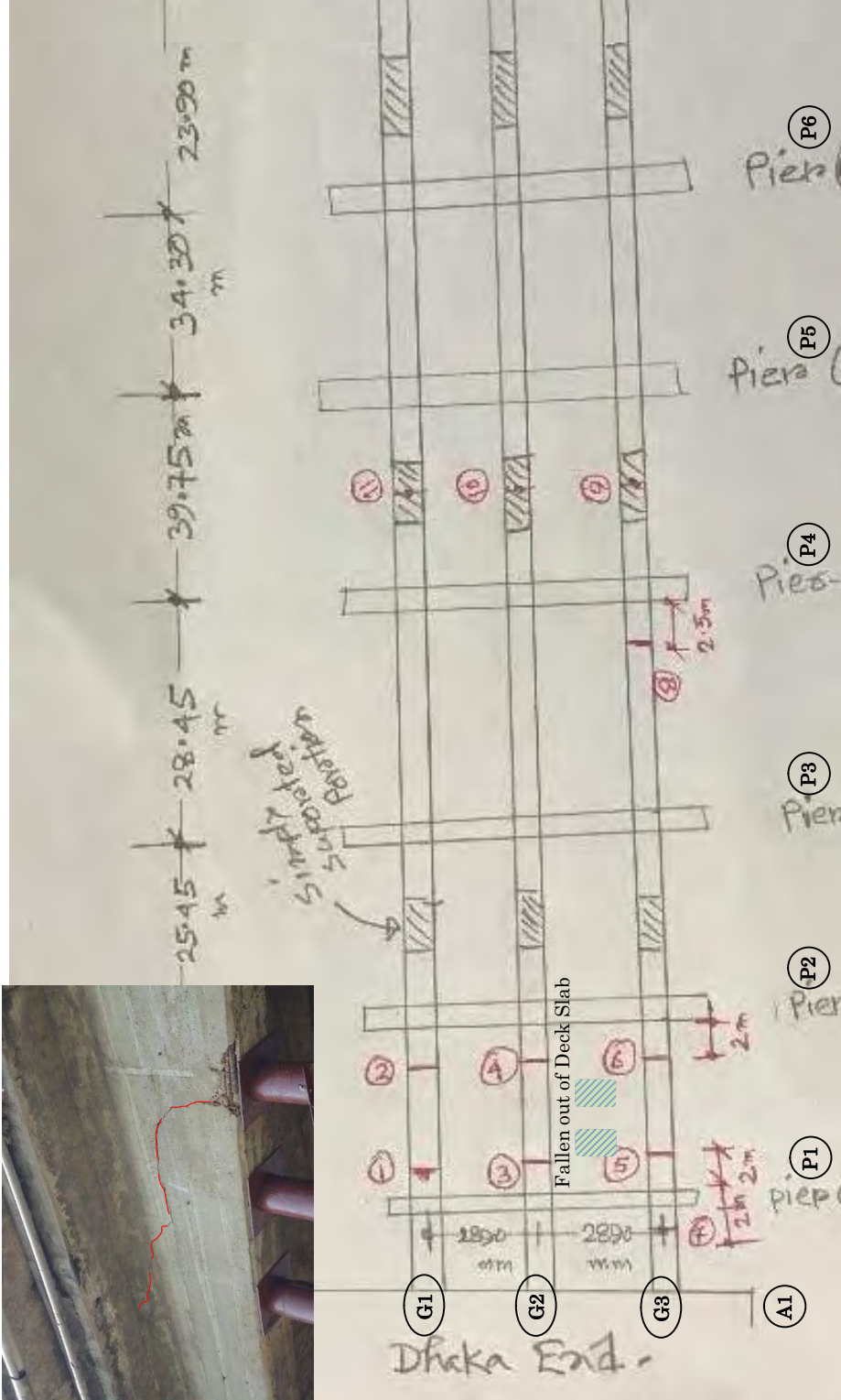


Fallen out of Deck Slab (Dt)

1 G1 : Cracks of Main Girder



P1-P2 : Cracks of Main Girder



2 G1 : Cracks of Main Girder



7 G3 : Cracks of Main Girder



8 G2 : Cracks of Main Girder



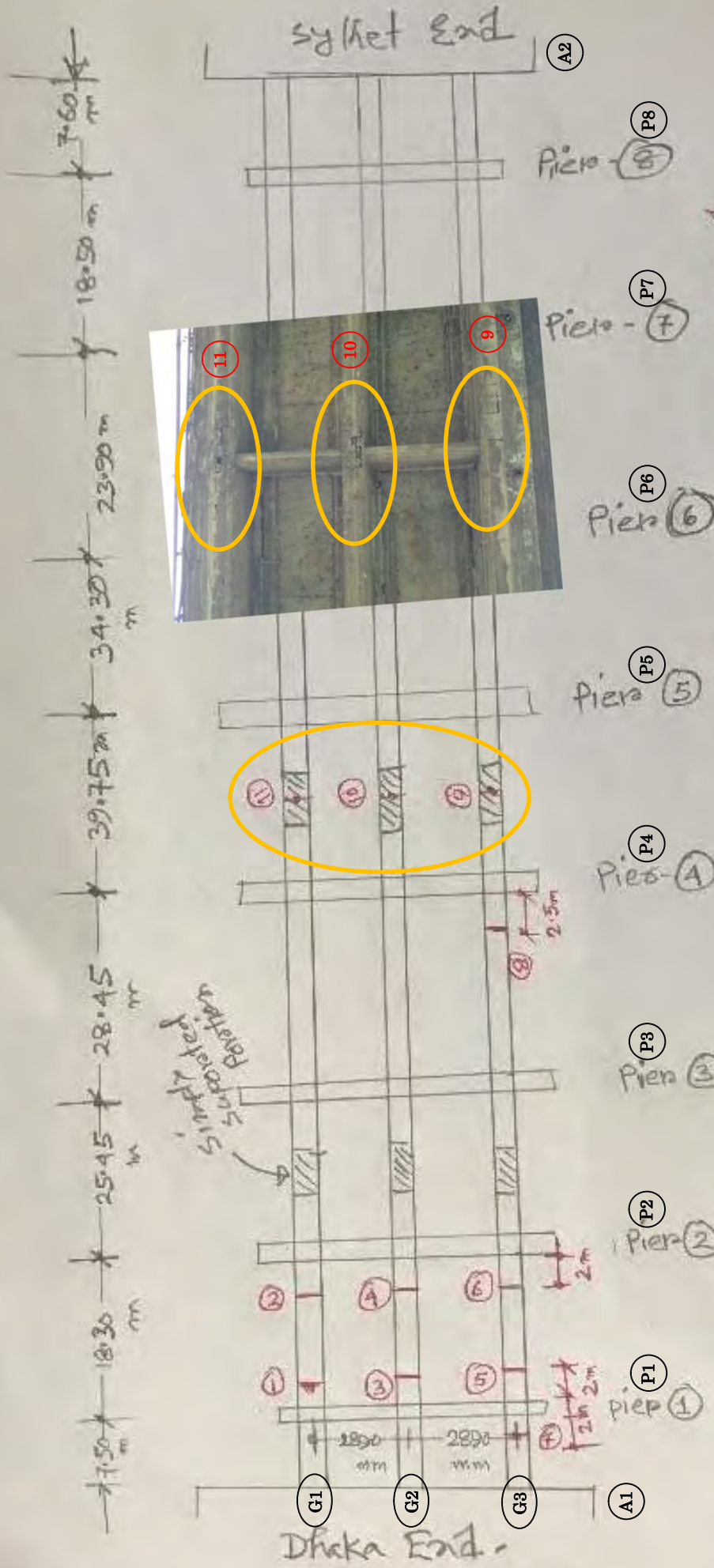
5 G3 : Cracks of Main Girder



6 G3 : Cracks of Main Girder



P4-P5 : Cracks of Main Girder



11 G3 : Cracks of Main Girder



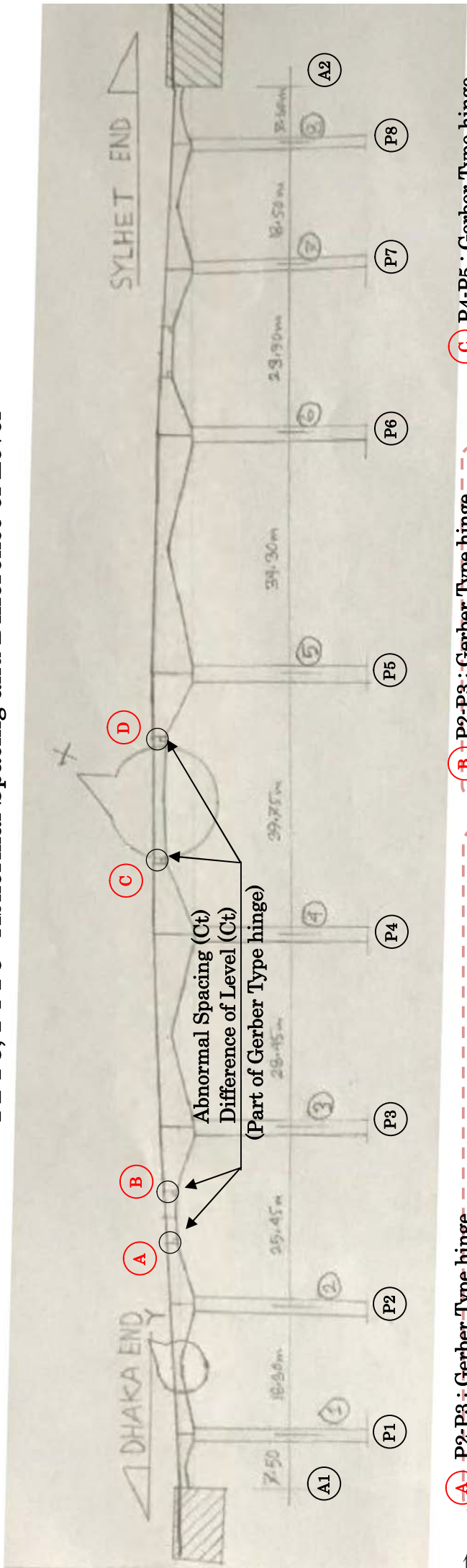
10 G2 : Cracks of Main Girder



9 G1 : Cracks of Main Girder



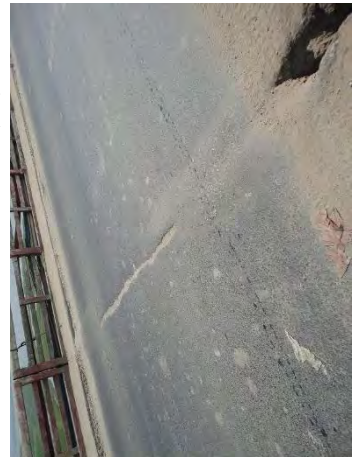
P2-P3, P4-P5 : Abnormal Spacing and Difference of Level



(A) P2-P3 : Gerber Type hinge



Difference of Level (Ct)



(B) P2-P3 : Gerber Type hinge



Abnormal Spacing ($\neq 0$ mm:Ct)

Difference of Level ($\neq 25$ mm:Ct)

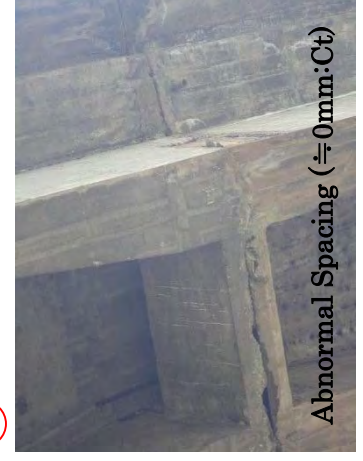


(C) P4-P5 : Gerber Type hinge



Abnormal Spacing (?0mm:Ct)

(D) P4-P5 : Gerber Type hinge



Abnormal Spacing ($\neq 0$ mm:Ct)

Survey Report
on
Condition of Damdama Bridge



March 13, 2018

BMCDP

Hiyama, Yoshimitsu

Konishi, Toshiyuki

Contents

- 1. Itinerary of Survey Trip**
- 2. Preliminary Survey**
 - 2.1 Basic Data of Damdama Bridge**
 - 2.2 Results of Preliminary Survey**
- 3. Results of Survey**
 - 3.1 Conditions and Characteristics of Defects**
 - 3.2 Estimation on Causes of Defects**
- 4. Advices for Remedial Measures**
- 5. Detailed Investigation for Strengthening Design**

1.4Itinerary:

7:00 Start from Six Seasons Hotel

9:00 Departure from Shah Jalal Airport (US Bangla BS151)

10:00 Arrival at Saidpur Airport

11:00 Arrival at Damdama Bridge Site

11:00 - 12:30 Bridge Inspection

13:00 – 15:30 Lunch and Meeting

18:00 Departure from Saidpur Airport (US Bangla BS156)

18:45 Arrival at Shah Jalal Airport

19:30 Arrive at Six Seasons Hotel

2. Preliminary Survey

2.1 Basic Data of Damdama Bridge

Basic data of Damdama bridge is shown as Table 2-1.

Table 2-1 Basic Data of Damdama Bridge

File Number	N5-319a-20180304					Date	4-Mar-18				
Zone	Rangpur	Circle	Rangpur	Division	Rangpur	Sub-Division	Rangpur	SO	SO-5		
District	-		Upazila	-		Union	-		Village	-	
Road No.	N5	Road Name	Dhaka -Paturia-Kashimathpur- Bogra- Rangpur-Beldanga- Banglabandha Road			LRP Name	319a	GPS	Lat	25° 40' 45"	
									Long	89° 16' 26"	
Bridge Name	Damdama Bridge			LRP-Offset	618 (m)		Chainage	317.089 (m)			
Year of Construction	1983	Design Standard	Others			Design Load	-	Load Restriction	-		
Public Utilities Carried	-										
Bridge Length	60.70 (m)	No. of Spans	3	Span Arrangement	18+24+18			Skew Angle	-		
											Type
Superstructure	Bridge Type	RC Girder Bridge		Concrete		Deck Slab	-		-		
		Abutment	Unknown		-		Foundation (Abutment)	Unknown		-	
Substructure	Pier	Unknown		-		Foundation (Pier)	Unknown		-		
		Pavement	Asphalt		-		Bearings	-		-	
Other Elements	Expansion Joint	-		-		Railing	-		-		
		Total Width	8.30 (m)	Curb-L	Sidewalk-L	Carriage way-L	Median	Carriage way-R	Sidewalk-R	Curb-R	
Width	Effective Width	6.70 (m)		-		-		-			
		-		-		-		-			
Traffic Conditions	Census (Year)	-				Condition Category for Entire Bridge	-				
	Traffic Volume	10,000 to 15,000 Vehicles				-					

2.2 Results of Preliminary Survey

Preliminary survey of Damdama Bridge was carried out by Rangpur Division, RHD.

The results of survey are shown by the following figure and photos.

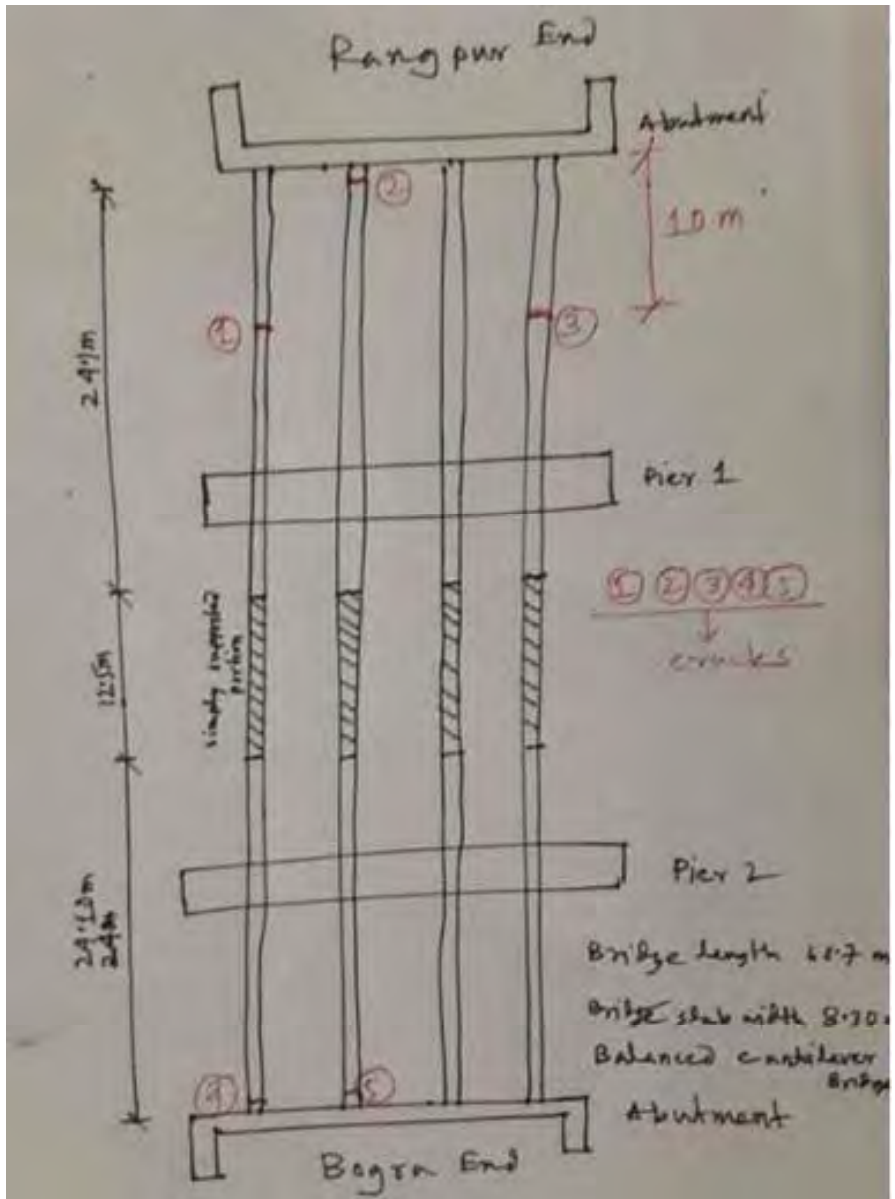


Fig.2-1 Position of Damages



Photo 2-1 Position of Crack-1



Photo 2-2 Position of Crack-2



Photo 2-3 Position of Crack-3



Photo 2-4 Position of Crack-1 to Crack-3

3. Results of Survey

3.1 Conditions and Characteristics of Defects

The defects are mainly following two types. (Fig.3-1)

- 1) Shear force cracks on main girders near A1 support and A2 support.
- 2) Bending moment cracks around span center between A1 abutment and P1 pier.

The conditions and characteristics of defects are as follows.

1) Shear force cracks on main girders near A1 support and A2 support (Fig.3-2)

Shear force cracks occurring on G3 girder and G4 girder near A2 support. They can be confirmed even by distant view.

The crack width is 1.7 mm on G4 girder and 1.3 mm on G3 girder.

These cracks are perforate cracks because the cracks are produced at the same position on both sides of the girder.

No free lime and no rusting fluid from the cracks can be seen.

G4 girder end is touching with the parapet of abutment.

On the other hand, shear force cracks are occurring only on G3 girder near A1 support. The cracks are perforate. No free lime and rusting fluid can be observed.

The lower part of G4 girder is touching with the parapet of abutment.

2) Bending moment cracks around span center between A1 abutment and P1 pier (Fig.3-3)

Some bending moment cracks are taking place around span center on outside girders G1 and G4. They can be observed even by distant view. Two lines of cracks on G1 girder and 7 lines of cracks on G4 girder can be seen.

On the other hand, there are no cracks between P2 pier and A2 abutment.

3.2 Estimation on Causes of Defects

1) Shear Force Cracks near A1 Support and A2 Support

It is estimated that the stresses exceeding shear capacity are acting on the girder section. Shear reinforcement might be insufficient around girder end.

The crack width of G4 girder is wider than that of G3 girder at A2 side. It seems that first, the shear crack took place on G4 girder. And next, due to the stress release following cracks, the burden of G3 girder increased and the cracks of G3 girder were caused.

As the occurrences of stress are complicated near end support, the touch of girder with abutment might have given influence to stress occurrences and have led to the cracks. Furthermore, the malfunction of roller bearings at intermediate support might have also given influence to the progress of cracks.

In future, the cracks may spread to no damaged girders.

2) A1-P1 Bending Moment Cracks on Main Girders

It seems that the cracks were caused by insufficient bearing moment capacity against acting loads.

The cracks are occurring only on outer girders. It seems that this is because outer girders are bearing more loads than inner girders and the amount of re-bars of outer girders are not relatively enough considering the dead loads of cantilever slab.

There's also possibility that the mal function of roller bearings on intermediate support contributed to the progress of cracks.

G4 girder seems to have been repaired previously but the cracks have occurred again. The amount of reinforcement may not be sufficient. However, as the cracks haven't spread to inner girders yet, the possibility that the cracks of outer girders will immediately develop will not be large under current loading conditions.

Further, the reason why there are no cracks on outer girders in other spans can't be explained clearly.

4. Advices for Remedial Measures

1) Shear Force Cracks on Main Girders near A1 and A2 Support

It can be judged that the risk of collapse would not so high because not so wide cracks only exist on one or two girders out of four girders.

It is appropriate to apply temporary bents (vertical steel pipe support) or sand bags as immediate countermeasures to control cracks.

As permanent countermeasures, first, to secure the space between girders and abutment and to recover the function of bearings are required.

Furthermore, the methods like the followings are to be applied to strengthen the load carrying capacity of girders.

- To thicken girder section.
- To bond carbon fiber sheets.
- To bond steel plates.

It is recommended that in case of small excess of stress, carbon fiber sheet bonding is to be applied and in case of large excess amount of stress, steel plate bonding is to be applied under current loading condition.

In either case, strengthening measures are to be carried out after current crack repair. As the crack width is more than 0.5 mm, the concrete is cut in U-shape along crack line and filling materials are injected into cracks.

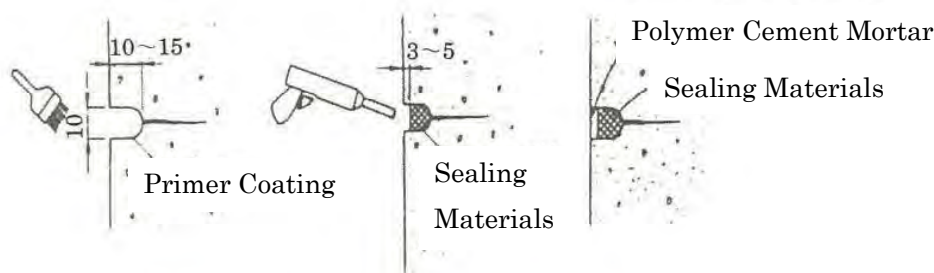


Fig.4-1 Filling Method

2) A1-P1 Bending Moment Cracks on Main Girders

It seems that the risk of collapse would not so high because the cracks are occurring only on outer girders. It is proper to apply temporary bents or sand bag support as immediate countermeasures to control cracks.

Permanent countermeasures are same as 1).

5. Detailed Investigation for strengthening

The information required to strengthening design is as follows.

1) Basic Conditions

- Design Year
- Applied Specification and Design Load
- Design Drawings and Bar Arrangement
- Construction Year
- Repair Records

2) Main Girder

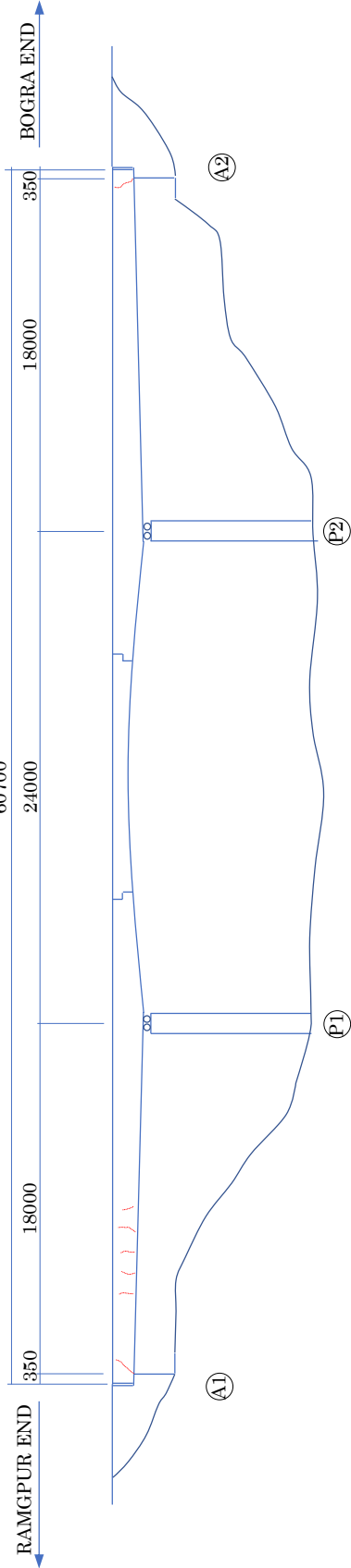
- Girder Height
- Girder Width
- Bar Arrangement
- Concrete Cover Thickness
- Depth of Carbonization

3) Structural Change

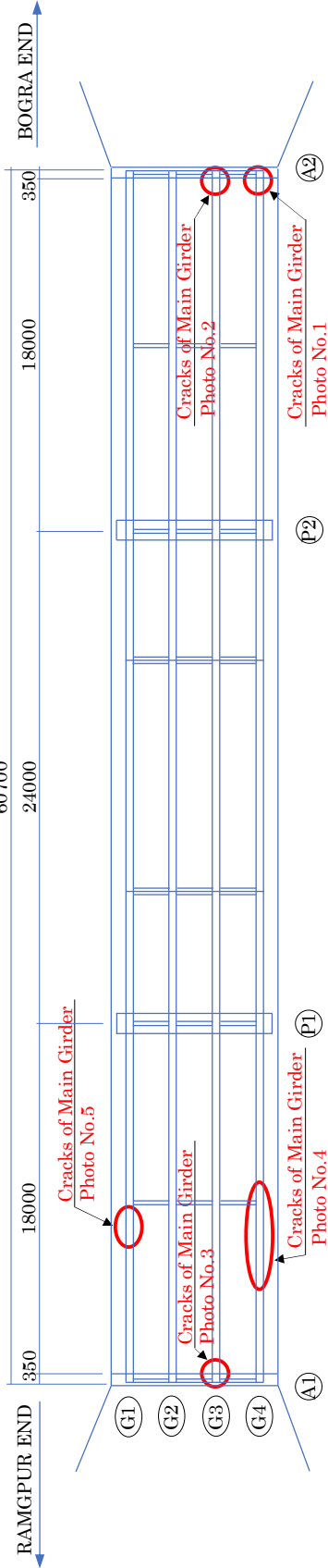
- Fixation of Girder End
- Mal Function of Bearing

DAMDAMA BRIDGE GENERAL VIEW

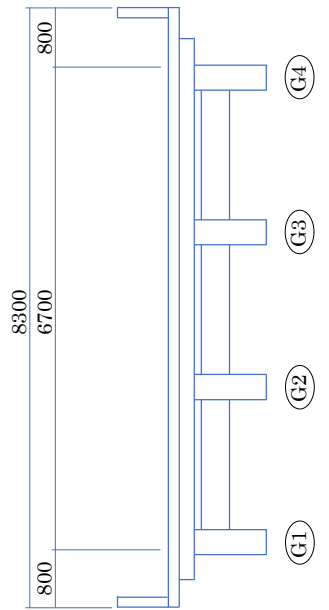
SIDE VIEW



PLAN



CROSS SECTION



SIDE VIEW



FRONT VIEW



Shear Cracks of main Girder

Photo No.3 A1-P1 G3 : Shear Cracks of main Girder



Photo No.2 P2-A2 G3 : Shear Cracks of main Girder

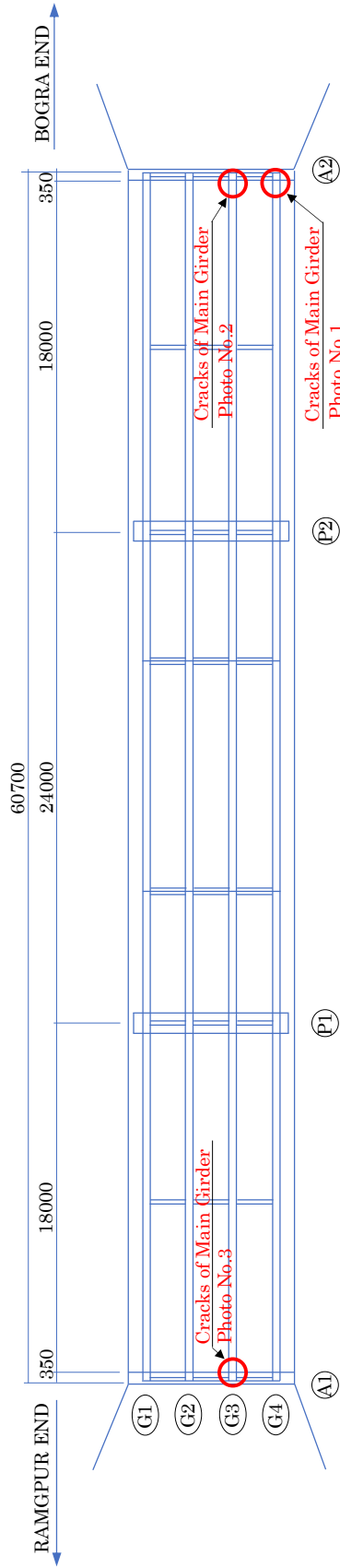


Photo No.1 P2-A2 G4 : Shear Cracks of main Girder



Flexural Cracks of main Girder

Photo No.5 AI-P1 G1 : Flexural Cracks of main Girder

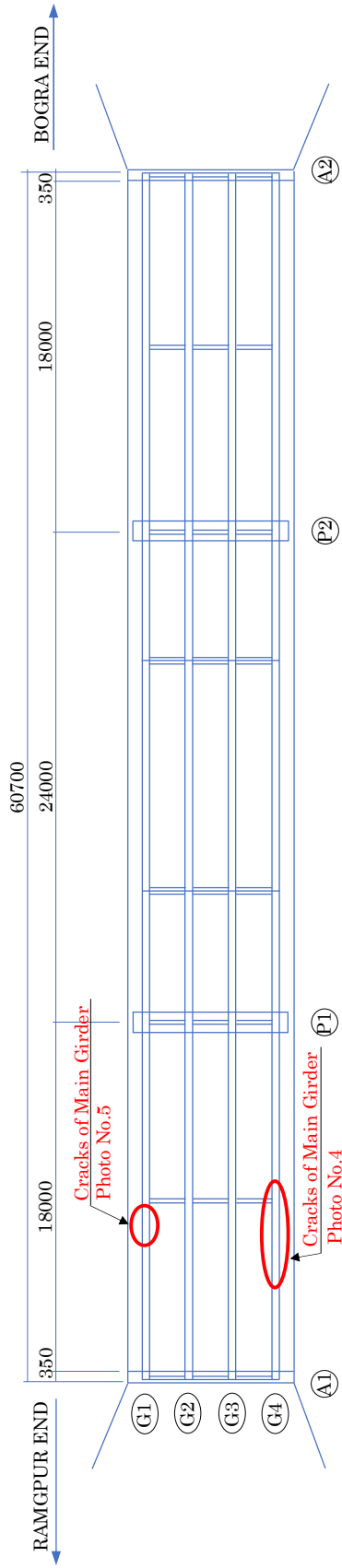


Photo No.4 AI-P1 G4 : Flexural Cracks of main Girder



**Report on
Site Survey of Nolka Bridge
along N-405 in Sirajganj Division**

19 April 2018

- JICA Project Team

Outline

1. Purpose
 - a) To understand the present situation of this bridge.
2. Date: 05 April, 2018
3. Attendants:
 - Mr. Abdullah Al Mamun, Bridge Engineer, JICA Consultant Team.
 - Mr. Md. Asaduzzaman, Bridge Engineer, JICA Consultant Team.
 - Mr. Abul Kalam Mahmmad Zahurul Alam Khan, SDE, Sirajganj Sub-division-2, RHD

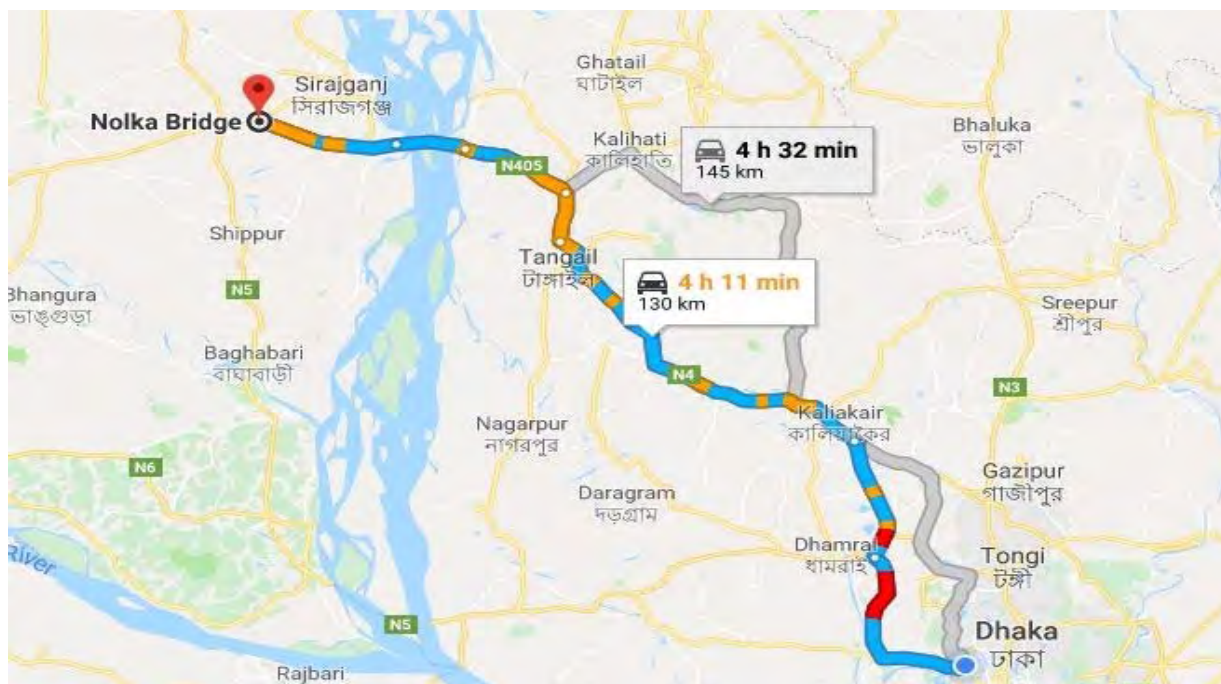


Figure : Location of Nolka Bridge

Basic Bridge Information

Structure Name	Nolka Bridge
Zone	Rajshahi
Circle	Pabna
Division	Sirajganj
Sub-Division	Sirajganj-2
Road No.	N-405
Road Name	Elenga-Nalka-Hatikamrul Road
Chainage	36.629 Km
Structure ID	
Structure No	
Location	Lat: 24.423233, Long: 89.592267
Year of Construction	1988

Structural Information

Bridge Type	RC Girder (2 end span) + PC Girder (6 middle spans)
Bridge Length (m)	236.4
Bridge width (m)	9.6
Effective Width (m)	7.3
No. of span	8
Suspended Span No.	-
No. of girder in each Span	5
Girder Width (m)	--
Distance between girders (m)	--
Large vehicles rate per 20	--

Summary of Deficiencies

Element	Deficiencies
Approaches	Severe Pothole (Photo 2)
Guide Posts	-----
Slope Protection	-----
Toe Wall	-----
Railing	-----
Side Walk	-----
Deck	-----
Concrete Beam	Spalling & Exposed Rebar exist (Photo 7) Crack & Spalling at Girder end exist (Photo 6 & 8)
Steel Beam	-----
Truss	-----
Pavement	Rutting & Wave (Photo 3) Pothole (Photo 5)
Abutment	-----
Pier	-----
Wing Wall	-----
Pier Cap	-----
Bearing Seat	-----
Bearing	-----
Expansion Joint	2 Feet wide T-shaped Steel plate is used as expansion joint. The connection is loose & sometimes misaligned & abnormal noise is present because of that. (Photo 4)
Pile Cap	-----
Foundation Protection	-----

Comments:

The bridge has moderate to heavy vibration in both horizontal & vertical axis. Severe Crack exist at the Girder end (Photo 8), so that RHD has put temporary Support to the damaged Girder (Photo 6).

Photo



Photo 1: Side View (Dhaka End)



Photo 2: Back View (Rajshahi End)



Photo 3: Rutting & wave on Bridge Pavement



Photo 4: Damaged Expansion Joint (2 feet wide T-shaped steel plate is used as expansion joint all through the bridge)



Photo 5: Pothole near expansion joint

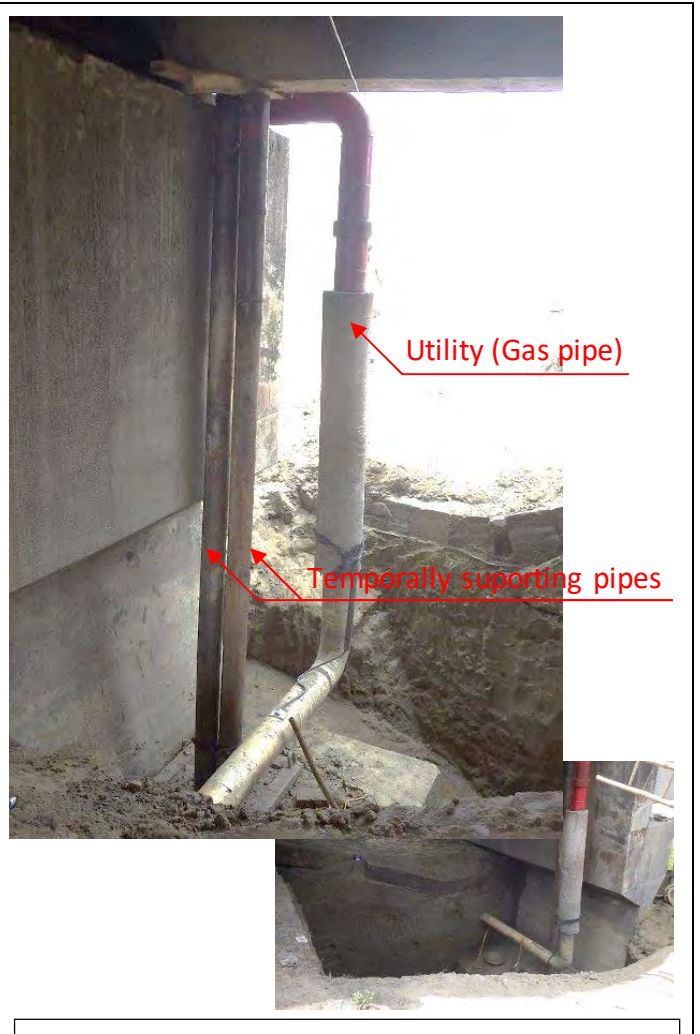


Photo 6: Temporary Support on the damaged Girder & excavation to build brick support (P1, Dhaka side)



Photo 7: Spalling & Exposed Rebar on Main Girder (A2, Rajshahi End)



Photo 8: Crack & Spalling on Main Girder (P1, Dhaka end side)



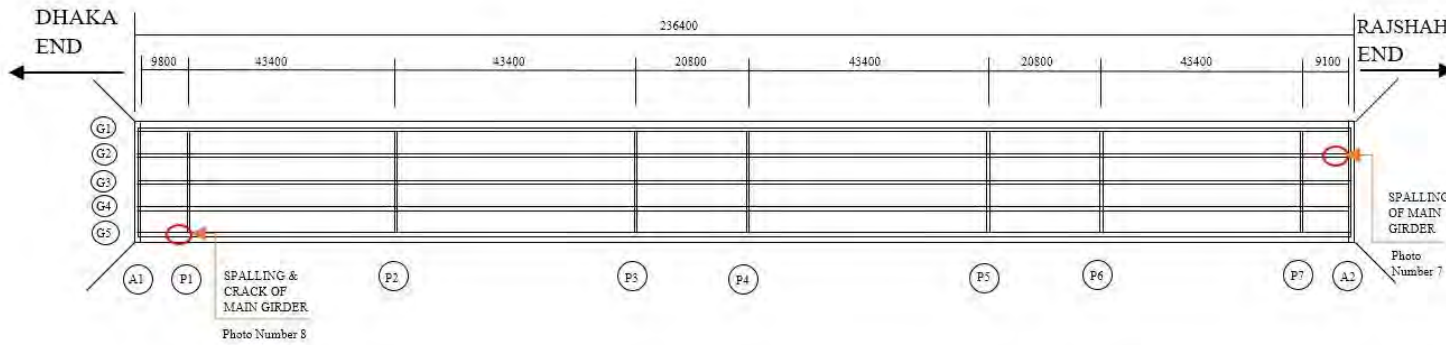
Photo 9: Underside of the Bridge (PC portion)

NALKA BRIDGE GENERAL VIEW

PLAN

1st & Last span is RC structure & rest of the spans are PC structure

Unit: Millimeter.



Recommended Repair Methods

BMCDP Yasuo KOSAKA

1. Exposed Rebar Damage

For the damaged Girder, close to the A2 (Photo 7), the usage of Repair Mortar with good bond ability and less shrinkage property is efficient, see our Rehabilitation manual, Appendix Plate 3-3, Hand applied mortar (B).

2. Crack & Spalling at Girder end

For the Crack Repair of the Girder End (Photo 8), the Crack Filling with Epoxi resin is recommended. As the Alternative repair, Hand applied mortar after making U-formed cut can be taken, too.



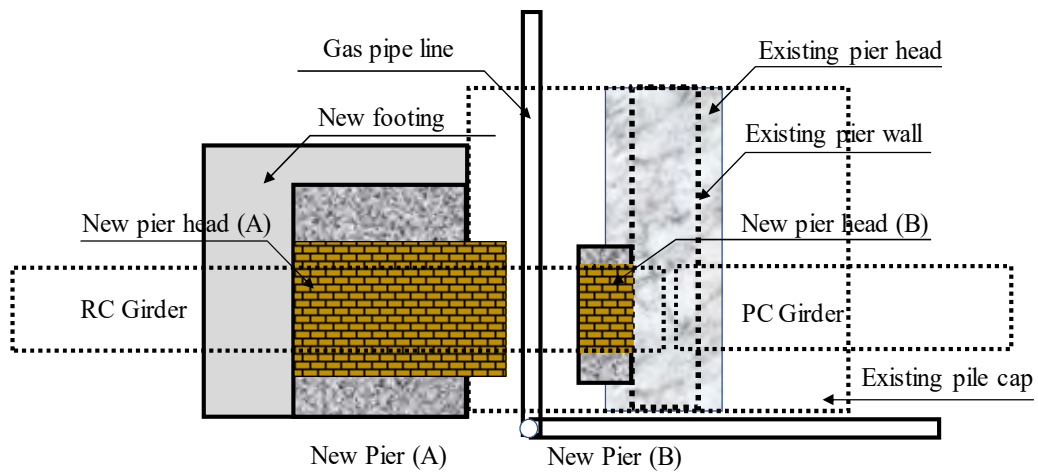
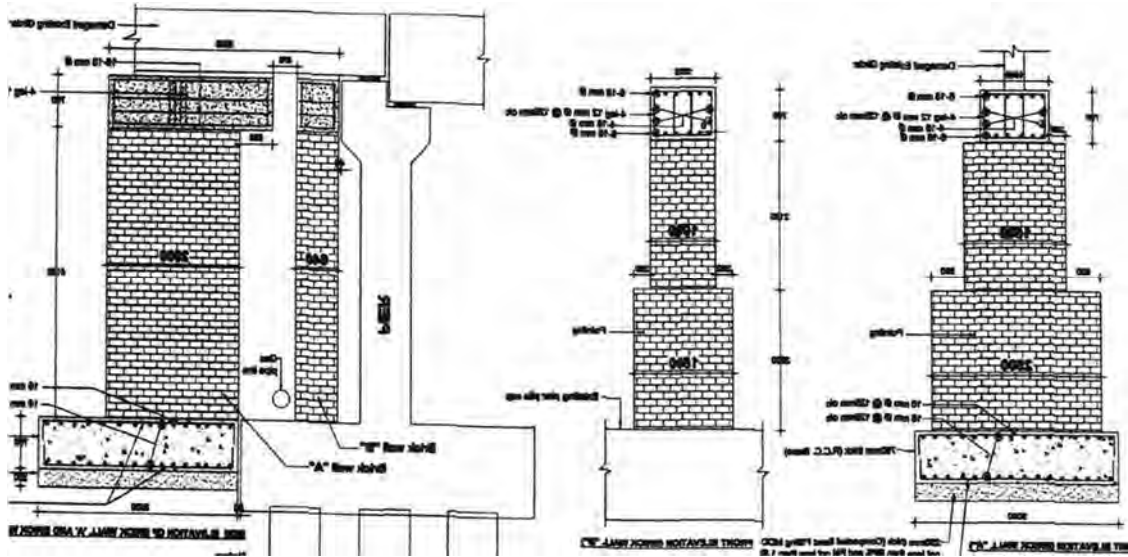
Photo 9 crack Filling

The reason of the crack is assumed, as temperature crack. Therefore, the annual crack inspection for all Girder ends of P1 & P7 (shorter Span sides) is advisable.

For the Spalling damage, the same Repair as Hand applied mortar (B) is useful.

The planned additional Support (by Division Office, see next page) is helpful for the Traffic Safety, but as the first step, the Crack repair is important. By the additional Support, the Gap to the Girder should set around 10-15 mm.

Supposed Additional Support by RHD



付録 3 : PDM (全バージョン)

Ver. 0	2015 年 2 月 15 日
Ver. 1	2015 年 8 月 30 日
Ver. 2	2016 年 1 月 28 日
Ver. 3	2017 年 3 月 5 日
Ver. 4	2017 年 3 月 5 日
Ver. 5	2017 年 12 月 3 日
Ver. 6	2018 年 8 月 15 日

Project Design Matrix

Version 0
Dated ●●,●●,2014

Project Title: Bridge Management Capacity Development Project

Implementing Agency: Organizations: Ministry of Communication, Roads and Highways Department (RHD)

Target Group: Staff in RHD head office and zone offices

Period of Project: XX 2014 – XX 2016, 30 months

Project Site: RHD Head office

Model Site: XX district

Overall Goal	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Bridge management under RHD is enhanced	1. Annual ratio of bridge inspection conducted by RHD is increased from XX% to XX% 2. Bridge maintenance cycle is conducted by RHD	• Record of bridge inspection • Input-output data of BMS			
Bridge maintenance capacity of RHD is improved	1. Bridge maintenance cycle is commenced by RHD 2. Necessary training based on the human resource development plan is conducted by Master Trainers (MTs)	• Record of bridge inspection • Input-output data of BMS • Report on training conducted by Master Trainers (MTs)	• Budgets for bridge maintenance are secured • Staff for bridge management is continuously allocated		
Bridge maintenance framework is developed	1-1. Documents of Bridge maintenance procedure and staff deployment are approved by XX 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared 2-1. Bridge inspection / diagnosis manual is approved by XX 2-2. Bridge rehabilitation / retrofitting manual is approved by XX 3-1. Data accessibility of BMS is improved 3-2. BMS manual is approved by XX 4-1. XX bridge inspection MTs are trained 4-2. XX bridge rehabilitation MTs are trained 4-3. XX BMS administrators are trained 4-4. The human resource development plan is approved	• Documents of Bridge maintenance procedure and staff deployment • Bridge maintenance plan (annual budget and work plans) in model area(s) • Bridge inspection / diagnosis manual • Bridge rehabilitation / retrofitting manual • Access log of BMS • BMS manual • Report on training conducted by Experts • Human resource development plan			
Bridge inspection / diagnose manual and bridge rehabilitation / retrofitting manual are developed					
Bridge management system is developed					
Necessary knowledge of bridge management is enhanced by RHD staff					

Activities	Inputs	The Bangladesh Side	Important Assumption
1-1. Actual condition of bridge maintenance is reviewed 1-2. Problems / issues on bridge maintenance cycle are identified 1-3. Institutional framework of bridge maintenance is reviewed 1-4. Documents of bridge maintenance procedure and standard of staff deployment are prepared 2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed 2-2. Bridge inspection / diagnosis manual is updated 2-3. Bridge rehabilitation / retrofitting manual is prepared 2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MTs) 3-1. Existing BMMS is reviewed and analysed 3-2. Utilisation of BMS is examined together by RHD 3-3. Function of BMS is defined and developed 3-4. Data in existing BMMS is entered into BMS by RHD 3-5. BMS manual for administrators and users is prepared 3-6. BMS manual is explained to RHD staff by BMS administrators 4-1. On the job trainings (OJTs) on bridge inspection / diagnosis in model area(s) are conducted with bridge inspection / diagnosis manual 4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS 4-3. OJTs on selection of bridge rehabilitation / retrofitting measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / retrofitting manual 4-4. Advices on supervision of bridge rehabilitation / retrofitting works are given by Expert 4-5. Human resource development plan is prepared	<p>The Japanese Side</p> <p>1. Experts 1) Bridge Maintenance Plan 2) Bridge Inspection 3) Bridge Soundness Evaluation 4) Bridge rehabilitation / retrofitting 5) Bridge Management System 6) Cost Estimation (Bridge Maintenance) 7) Project Coordinator</p> <p>2. Procurement of machinery and equipment 1) Computers for database with accessories 2) Concrete testing equipment • Ground penetrating radar (RC Rader) • Concrete core sampling apparatus • Electric drill</p> <p>3. Training in Japan 2 times</p> <p>4. Expenses 1) Operational expenses for workshop and seminars 2) Other expenses needed for the Project implementation</p>	<p>The Bangladesh Side</p> <p>1. Personnel 1) Project Director 2) Additional Project Director 3) Project Manager 4) Deputy Project Manager 5) Counterpart (C/P) of RHD 6) Other staffs</p> <p>2. Facility and Equipment 1) Offices (inside RHD building) 3. Expenses for activities 1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs</p> <p>Pre-Conditions</p> <p>• Skilled and appropriate engineers are allocated in RHD • Policy priority on bridge maintenance is not drastically decreased</p> <p><Issues and countermeasures></p>	

Project Design Matrix (Project Monitoring Sheet I)

Version 1
Dated 30, August, 2015**Project Title: Bridge Management Capacity Development Project****Implementing Agency: Organizations: Ministry of Communication, Roads and Highways Department (RHD)****Target Group: Staff in RHD head office and zone offices****Period of Project: 10 July 2015 – 2 March 2018, 32 months****Project Site: RHD Head office****Model Site: Matikganj Division**

Overall Goal	Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
	Bridge management under RHD is enhanced	1. Annual ratio of bridge inspection conducted by RHD is increased from XX% to XX% 2. Bridge maintenance cycle is conducted by RHD	<ul style="list-style-type: none"> Record of bridge inspection Input-output data of BMS 			
Project Purpose Bridge maintenance capacity of RHD is improved		1. Bridge maintenance cycle is commenced by RHD 2. Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT)	<ul style="list-style-type: none"> Record of bridge inspection Input-output data of BMS Report on training conducted by Master Trainers (MT) 	<ul style="list-style-type: none"> Budgets for bridge maintenance are secured Staff for bridge management is continuously allocated 		
Outputs 1. Bridge maintenance framework is developed 2. Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed 3. Bridge management system is developed 4. Necessary knowledge of bridge management is enhanced by RHD staff		1-1. Documents of Bridge maintenance procedure and staff deployment are approved by XX 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared 2-1. Bridge inspection / evaluation manual is approved by XX 2-2. Bridge rehabilitation / strengthening manual is approved by XX 3-1. Data accessibility of BMS is improved 3-2. BMS manual is approved by XX 4-1. XX bridge inspection MT are trained 4-2. XX bridge rehabilitation MT are trained 4-3. XX BMS administrators are trained 4-4. Institutional capacity development plan is approved	<ul style="list-style-type: none"> Documents of Bridge maintenance procedure and staff deployment Bridge maintenance plan (annual budget and work plans) in model area(s) Bridge inspection / evaluation manual Bridge rehabilitation / strengthening manual Access log of BMS BMS manual Training report Institutional capacity development plan 			
	Activities 1-1. Actual condition of bridge maintenance is reviewed 1-2. Problems / issues on bridge maintenance cycle are identified 1-3. Institutional framework of bridge maintenance is reviewed 1-4. Documents of bridge maintenance procedure and standard of staff deployment are prepared 2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed 2-2. Bridge inspection / evaluation manual is updated 2-2-1. Bridge inspection / evaluation manual (Inspection) is updated 2-2-2. Bridge inspection / evaluation manual (Evaluation) is prepared 2-3. Bridge rehabilitation / strengthening manual is prepared 2-3-1. Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared 2-3-2. Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared 2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT) 3-1. Existing BMMS is reviewed and analysed 3-2. Utilisation of BMS is examined together by RHD 3-3. Function of BMS is defined and developed 3-4. Data in existing BMMS is entered into BMS by RHD 3-5. BMS manual for administrators and users is prepared 3-6. BMS manual is explained to RHD staff by BMS administrators 4-1. On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge 4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS 4-3. OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual 4-4. Advices on supervision of bridge rehabilitation / strengthening works are given by Expert 4-5. Institutional capacity development plan is prepared	Inputs The Japanese Side 1. Experts 1) Team Leader/Bridge Maintenance Plan 2) Bridge Inspection 3) Bridge Evaluation 4) Bridge Maintenance Plan (2) 5) Detailed Survey 6) Bridge Rehabilitation Strengthening/Bridge Evaluation (2) 7) Cost Estimate 8) Bridge Management System 9) Asset Management 10) Project Monitoring 11) Coordinator/Bridge Maintenance Plan (Assistance) 2. Procurement of machinery and equipment 1) Computers for database with accessories 2) Concrete testing equipment • Ground penetrating radar (RC Rader) • Concrete core sampling apparatus • Electric drill 3. Training in Japan 2 times 4. Expenses 1) Operational expenses for workshop and seminars 2) Other expenses needed for the Project implementation	The Bangladesh Side 1. Personnel 1) Project Director 2) Additional Project Director 3) Project Manager 4) Deputy Project Manager 5) Counterpart (C/P) of RHD 6) Other relevant units 2. Facility and Equipment 1) Offices (inside RHD building) 3. Expenses for activities 1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs	Important Assumption • Bridge rehabilitation / strengthening works for advisory activity (Activity 4-4) are implemented by RHD Pre-Conditions • Skilled and appropriate engineers are allocated in RHD • Policy priority on bridge maintenance is not drastically decreased <Issues and countermeasures>		

Project Design Matrix (Project Monitoring Sheet I)

Version 2

Dated 28th January, 2016

Project Title: Bridge Management Capacity Development Project**Implementing Agency: Organizations: Ministry of Communication, Roads and Highways Department (RHD)****Target Group: Staff in RHD head office and zone offices****Period of Project: 10 July 2015 – 2 March 2018. 32 months****Project Site: RHD Head office****Model Site: Manikganj Division**

Overall Goal	Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Bridge management under RHD is enhanced		<ol style="list-style-type: none"> Annual ratio of bridge inspection conducted by RHD is increased from XX% to XX% Bridge maintenance cycle is conducted by RHD 	<ul style="list-style-type: none"> Record of bridge inspection Input-output data of BMS 			
Bridge maintenance capacity of RHD is improved		<ol style="list-style-type: none"> Bridge maintenance cycle is commenced by RHD Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT) 	<ul style="list-style-type: none"> Record of bridge inspection Input-output data of BMS Report on training conducted by Master Trainers (MT) 	<ul style="list-style-type: none"> Budgets for bridge maintenance are secured Staff for bridge management is continuously allocated 		
<p>Outputs</p> <ol style="list-style-type: none"> Bridge maintenance framework is developed Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed Bridge management system is developed Necessary knowledge of bridge management is enhanced by RHD staff 	<p>Activities</p> <ol style="list-style-type: none"> Actual condition of bridge maintenance is reviewed Problems / issues on bridge maintenance cycle are identified Institutional framework of bridge maintenance is reviewed Documents of bridge maintenance procedure and standard of staff deployment are prepared Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed Bridge inspection / evaluation manual is updated Bridge inspection / evaluation manual (Inspection) is updated Bridge inspection / evaluation manual (Evaluation) is prepared Bridge rehabilitation / strengthening manual is prepared Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT) Existing BMMS is reviewed and analysed Utilisation of BMS is examined together by RHD Function of BMS is defined and developed Data in existing BMMS is entered into BMS by RHD BMS manual for administrators and users is prepared BMS manual is explained to RHD staff by BMS administrators On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge inspection / evaluation manual OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual Advices on supervision of bridge rehabilitation / strengthening works are given by Expert Institutional capacity development plan is prepared 	<p>Inputs</p> <p>The Japanese Side</p> <ol style="list-style-type: none"> Experts Team Leader/Bridge Maintenance Plan Bridge Inspection Bridge Evaluation Bridge Maintenance Plan (2) Detailed Survey Bridge Rehabilitation - Strengthening/Bridge Evaluation (2) Cost Estimate Bridge Management System Asset Management Project Monitoring Coordinator/Bridge Maintenance Plan (Assistance) Procurement of machinery and equipment Computers for database with accessories Concrete testing equipment Ground penetrating radar (RC Rader) Concrete core sampling apparatus Electric drill Training in Japan 2 times Expenses Operational expenses for workshop and seminars Other expenses needed for the Project implementation <p>The Bangladesh Side</p> <ol style="list-style-type: none"> Personnel Project Director Additional Project Director Project Manager Deputy Project Manager Counterpart (C/P) of RHD Other relevant units Facility and Equipment Offices (inside RHD building) Expenses for activities Personal and travel expenses and daily allowances for C/P Other necessary costs 				
				<p>Important Assumption</p> <ul style="list-style-type: none"> Bridge rehabilitation / strengthening works for advisory activity (Activity 4-4) are implemented by RHD <p>Pre-Conditions</p> <ul style="list-style-type: none"> Skilled and appropriate engineers are allocated in RHD Policy priority on bridge maintenance is not drastically decreased <p><Issues and countermeasures></p>		

Project Design Matrix (Project Monitoring Sheet I)

Version 3

Dated 5th March, 2017

Project Title: Bridge Management Capacity Development Project

Implementing Agency: Organizations: Ministry of Road Transport and Bridges, Roads and Highways Department (RHD)

Target Group: Staff in RHD head office and zone offices

Period of Project: 10 July 2015 – 2 March 2018. 32 months

Project Site: RHD Head office

Model Site: Manikganj Division

Narrative Summary		Objectively Verifiable Indicators		Means of Verification		Important Assumption		Achievement		Remarks	
Overall Goal Bridge management under RHD is enhanced		1. Annual ratio of bridge inspection conducted by RHD is increased from XX% to XX% 2. Bridge maintenance cycle is conducted by RHD		• Record of bridge inspection • Input-output data of BMS							
Project Purpose Bridge maintenance capacity of RHD is improved		1. Bridge maintenance cycle is commenced by RHD 2. Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT)		• Record of bridge inspection • Input-output data of BMS • Report on training conducted by Master Trainers (MT)		• Budgets for bridge maintenance are secured • Staff for bridge management is continuously allocated		Each indicator will be measured during the 5th JCC (a couple of months before the project completion).			
Outputs 1. Bridge maintenance framework is developed 2. Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed 3. Bridge management system is developed 4. Necessary knowledge of bridge management is enhanced by RHD staff		1-1. Documents of Bridge maintenance procedure and staff deployment are approved by RHD 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared 2-1. Bridge inspection / evaluation manual is approved by RHD 2-2. Bridge rehabilitation / strengthening manual is approved by RHD 3-1. Data accessibility of BMS is improved 3-2. BMS manual is approved by RHD 4-1. 75 bridge inspection MT are trained 4-2. 75 bridge rehabilitation MT are trained 4-3. 75 BMS administrators are trained 4-4. Institutional capacity development plan is approved		• Documents of Bridge maintenance procedure and staff deployment • Bridge maintenance plan (annual budget and work plans) in model area(s) • Bridge inspection / evaluation manual • Bridge rehabilitation / strengthening manual • Access log of BMS • BMS manual • Training report • Institutional capacity development plan		Each indicator will be measured during the 4th JCC.					
Activities 1-1. Actual condition of bridge maintenance is reviewed 1-2. Problems / issues on bridge maintenance cycle are identified 1-3. Institutional framework of bridge maintenance is reviewed 1-4. Documents of bridge maintenance procedure and standard of staff deployment are prepared 2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed 2-2. Bridge inspection / evaluation manual is updated 2-2-1. Bridge inspection / evaluation manual (Inspection) is updated 2-2-2. Bridge inspection / evaluation manual (Evaluation) is prepared 2-3. Bridge rehabilitation / strengthening manual is prepared 2-3-1. Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared 2-3-2. Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared 2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT) 3-1. Existing BMMS is reviewed and analysed 3-2. Utilisation of BMS is examined together by RHD 3-3. Function of BMS is defined and developed 3-4. Data in existing BMMS is entered into BMS by RHD 3-5. BMS manual for administrators and users is prepared 3-6. BMS manual is explained to RHD staff by BMS administrators 4-1. On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge inspection / evaluation manual 4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS 4-3. OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual 4-4. Advices on supervision of bridge rehabilitation / strengthening works are given by Expert 4-5. Institutional capacity development plan is prepared		The Japanese Side 1. Experts 1) Team Leader/Bridge Maintenance Plan 2) Bridge Inspection 3) Bridge Evaluation 4) Bridge Maintenance Plan (2) 5) Detailed Survey 6) Bridge Rehabilitation Strengthening/Bridge Evaluation (2) 7) Cost Estimate 8) Bridge Management System 9) Asset Management 10) Project Monitoring 11) Coordinator/Bridge Maintenance Plan (Assistance) 2. Procurement of machinery and equipment 1) Computers for database with accessories 2) Concrete testing equipment • Ground penetrating radar (RC Rader) • Concrete core sampling apparatus • Electric drill 3. Training in Japan 2 times 4. Expenses 1) Operational expenses for workshop and seminars 2) Other expenses needed for the Project implementation		The Bangladesh Side 1. Personnel 1) Project Director 2) Additional Project Director 3) Project Manager 4) Deputy Project Manager 5) Counterpart (C/P) of RHD 6) Other relevant units 2. Facility and Equipment 1) Offices (inside RHD building) 3. Expenses for activities 1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs		Important Assumption • Bridge rehabilitation / strengthening works for advisory activity (Activity 4-4) are implemented by RHD Pre-Conditions • Skilled and appropriate engineers are allocated in RHD • Policy priority on bridge maintenance is not drastically decreased <Issues and countermeasures>					

Project Design Matrix (Project Monitoring Sheet I)

Version 4

Dated 5th March, 2017

Project Title: Bridge Management Capacity Development Project

Implementing Agency: Organizations: Ministry of Road Transport and Bridges, Roads and Highways Department (RHD)

Target Group: Staff in RHD head office and zone offices

Period of Project: 10 July 2015 – 2 March 2018. 32 months

Project Site: RHD Head office

Model Site: Manikganj Division

Narrative Summary		Objectively Verifiable Indicators		Means of Verification		Important Assumption		Achievement		Remarks	
Overall Goal Bridge management under RHD is enhanced		1. Annual ratio of bridge inspection conducted by RHD is increased to 50% 2. Bridge maintenance cycle is conducted by RHD		• Record of bridge inspection • Input-output data of BMS				XX will be replaced with numbers during the 4th JCC.			
Project Purpose Bridge maintenance capacity of RHD is improved		1. Bridge maintenance cycle is commenced by RHD 2. Master Trainers (MTs) are trained. 3. Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT)		• Record of bridge inspection • Input-output data of BMS • Report on training conducted by Master Trainers (MT)		• Budgets for bridge maintenance are secured • Staff for bridge management is continuously allocated		Each indicator will be measured during the 5th JCC (a couple of months before the project completion).			
Outputs 1. Bridge maintenance framework is developed 2. Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed 3. Bridge management system is developed 4. Necessary knowledge of bridge management is enhanced by RHD staff		1-1. Documents of Bridge maintenance procedure and staff deployment are approved by RHD 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared 2-1. Bridge inspection / evaluation manual is approved by RHD 2-2. Bridge rehabilitation / strengthening manual is approved by RHD 3-1. Data accessibility of BMS is improved 3-2. BMS manual is approved by RHD 4-1. 75 bridge inspection MT are trained 4-2. 75 bridge rehabilitation MT are trained 4-3. 75 BMS administrators are trained 4-4. Institutional capacity development plan is approved		• Documents of Bridge maintenance procedure and staff deployment • Bridge maintenance plan (annual budget and work plans) in model area(s) • Bridge inspection / evaluation manual • Bridge rehabilitation / strengthening manual • Access log of BMS • BMS manual • Training report • Institutional capacity development plan				Each indicator will be measured during the 4th JCC.			
Activities 1-1. Actual condition of bridge maintenance is reviewed 1-2. Problems / issues on bridge maintenance cycle are identified 1-3. Institutional framework of bridge maintenance is reviewed 1-4. Documents of bridge maintenance procedure and standard of staff deployment are prepared 2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed 2-2. Bridge inspection / evaluation manual is updated 2-2-1. Bridge inspection / evaluation manual (Inspection) is updated 2-2-2. Bridge inspection / evaluation manual (Evaluation) is prepared 2-3. Bridge rehabilitation / strengthening manual is prepared 2-3-1. Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared 2-3-2. Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared 2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT) 3-1. Existing BMMS is reviewed and analysed 3-2. Utilisation of BMS is examined together by RHD 3-3. Function of BMS is defined and developed 3-4. Data in existing BMMS is entered into BMS by RHD 3-5. BMS manual for administrators and users is prepared 3-6. BMS manual is explained to RHD staff by BMS administrators 4-1. On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge inspection / evaluation manual 4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS 4-3. OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual 4-4. Advices on supervision of bridge rehabilitation / strengthening works are given by Expert 4-5. Institutional capacity development plan is prepared		1. Experts 1) Team Leader/Bridge Maintenance Plan 2) Bridge Inspection 3) Bridge Evaluation 4) Bridge Maintenance Plan (2) 5) Detailed Survey 6) Bridge Rehabilitation Strengthening/Bridge Evaluation (2) 7) Cost Estimate 8) Bridge Management System 9) Asset Management 10) Project Monitoring 11) Coordinator/Bridge Maintenance Plan (Assistance) 2. Procurement of machinery and equipment 1) Computers for database with accessories 2) Concrete testing equipment • Ground penetrating radar (RC Rader) • Concrete core sampling apparatus • Electric drill 3. Training in Japan 2 times 4. Expenses 1) Operational expenses for workshop and seminars 2) Other expenses needed for the Project implementation		The Japanese Side 1. Personnel 1) Project Director 2) Additional Project Director 3) Project Manager 4) Deputy Project Manager 5) Counterpart (C/P) of RHD 6) Other relevant units 2. Facility and Equipment 1) Offices (inside RHD building) 2) Engineering Equipment/Inspection Equipment 3. Expenses for activities 1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs		The Bangladesh Side • Bridge rehabilitation / strengthening works for advisory activity (Activity 4-4) are implemented by RHD Pre-Conditions • Skilled and appropriate engineers are allocated in RHD • Policy priority on bridge maintenance is not drastically decreased <Issues and countermeasures>					

Project Design Matrix (Project Monitoring Sheet I)

Version 5

Dated 3rd December, 2017

Project Title: Bridge Management Capacity Development Project

Implementing Agency: Organizations: Ministry of Road Transport and Bridges, Roads and Highways Department (RHD)

Target Group: Staff in RHD head office and zone offices

Period of Project: 10 July 2015 – 2 November 2018, 40 months

Project Site: RHD Head office

Model Site: Manikganj Division

Narrative Summary		Objectively Verifiable Indicators		Means of Verification		Important Assumption		Achievement		Remarks	
Overall Goal Bridge management under RHD is enhanced		1. Annual ratio of bridge inspection conducted by RHD is increased to 50% 2. Bridge maintenance cycle is conducted by RHD		• Record of bridge inspection • Input-output data of BMS				The indicators of the Overall Goal will be measured during the ex-post evaluation.			
Project Purpose Bridge maintenance capacity of RHD is improved		1. Bridge maintenance cycle is commenced by RHD 2. Master Trainers (MTs) are trained. 3. Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT)		• Record of bridge inspection • Input-output data of BMS • Report on training conducted by Master Trainers (MT)		• Budgets for bridge maintenance are secured • Staff for bridge management is continuously allocated		Each indicator will be measured during the 5th JCC (a couple of months before the project completion).			
Outputs 1. Bridge maintenance framework is developed		1-1. Documents of Bridge maintenance procedure and staff deployment are approved by RHD 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared		• Documents of Bridge maintenance procedure and staff deployment • Bridge maintenance plan (annual budget and work plans) in model area(s)				Results of achievements measured of each indicator are described in the Monitoring Sheet version 5 and shared during the 4th JCC.			
2. Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed		2-1. Bridge inspection / evaluation manual is approved by RHD 2-2. Bridge rehabilitation / strengthening manual is approved by RHD		• Bridge inspection / evaluation manual • Bridge rehabilitation / strengthening manual • Access log of BMS • BMS manual							
3. Bridge management system is developed		3-1. Data accessibility of BMS is improved 3-2. BMS manual is approved by RHD									
4. Necessary knowledge of bridge management is enhanced by RHD staff		4-1. 75 bridge inspection MT are trained 4-2. 75 bridge rehabilitation MT are trained 4-3. 75 BMS administrators are trained 4-4. Institutional capacity development plan is approved		• Training report • Institutional capacity development plan							
Activities		The Japanese Side		The Bangladesh Side		Important Assumption					
1-1. Actual condition of bridge maintenance is reviewed		1. Experts		1. Personnel		• Bridge rehabilitation / strengthening works for advisory activity (Activity 4-4) are implemented by RHD					
1-2. Problems / issues on bridge maintenance cycle are identified		1) Team Leader/Bridge Maintenance Plan		1) Project Director							
1-3. Institutional framework of bridge maintenance is reviewed		2) Bridge Inspection		2) Additional Project Director							
1-4. Documents of bridge maintenance procedure and standard of staff deployment are prepared		3) Bridge Evaluation		3) Project Manager							
2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed		4) Bridge Maintenance Plan (2)		4) Deputy Project Manager							
2-2. Bridge inspection / evaluation manual is updated		5) Detailed Survey		5) Counterpart (C/P) of RHD							
2-2-1. Bridge inspection / evaluation manual (Inspection) is updated		6) Bridge Rehabilitation Strengthening/Bridge Evaluation (2)		6) Other relevant units							
2-2-2. Bridge inspection / evaluation manual (Evaluation) is prepared		7) Cost Estimate		2. Facility and Equipment							
2-3. Bridge rehabilitation / strengthening manual is prepared		8) Bridge Management System		1) Offices (inside RHD building)							
2-3-1. Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared		9) Asset Management		2) Engineering Equipment/Inspection Equipment							
2-3-2. Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared		10) Project Monitoring		3. Expenses for activities							
2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT)		11) Coordinator/Bridge Maintenance Plan (Assistance)		1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs							
3-1. Existing BMMS is reviewed and analysed		2. Procurement of machinery and equipment									
3-2. Utilisation of BMS is examined together by RHD		1) Computers for database with accessories									
3-3. Function of BMS is defined and developed		2) Concrete testing equipment									
3-4. Data in existing BMMS is entered into BMS by RHD		• Ground penetrating radar (RC Rader) • Concrete core sampling apparatus • Electric drill									
3-5. BMS manual for administrators and users is prepared		3. Training in Japan									
3-6. BMS manual is explained to RHD staff by BMS administrators		2 times									
4-1. On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge inspection / evaluation manual		4. Expenses									
4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS		1) Operational expenses for workshop and seminars									
4-3. OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual		2) Other expenses needed for the Project implementation									
4-4. Advices on supervision of bridge rehabilitation / strengthening works are given by Expert											
4-5. Institutional capacity development plan is prepared											

Project Design Matrix (Project Monitoring Sheet I)

Version 6

Dated 15th August, 2018

Project Title: Bridge Management Capacity Development Project

Implementing Agency: Organizations: Ministry of Road Transport and Bridges, Roads and Highways Department (RHD)

Target Group: Staff in RHD head office and zone offices

Period of Project: 10 July 2015 – 2 September 2018, 38 months

Project Site: RHD Head office

Model Site: Manikganj Division

Narrative Summary		Objectively Verifiable Indicators		Means of Verification		Important Assumption		Achievement		Remarks	
Overall Goal Bridge management under RHD is enhanced		1. Annual ratio of bridge inspection conducted by RHD is increased to 50% 2. Bridge maintenance cycle is conducted by RHD		• Record of bridge inspection • Input-output data of BMS				The indicators of the Overall Goal will be measured during the ex-post evaluation.			
Project Purpose Bridge maintenance capacity of RHD is improved		1. Bridge maintenance cycle is commenced by RHD 2. Master Trainers (MTs) are trained. 3. Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT)		• Record of bridge inspection • Input-output data of BMS • Report on training conducted by Master Trainers (MT)		• Budgets for bridge maintenance are secured • Staff for bridge management is continuously allocated		Each indicator will be measured during the 5th JCC (a couple of months before the project completion).			
Outputs 1. Bridge maintenance framework is developed		1-1. Documents of Bridge maintenance procedure and staff deployment are approved by RHD 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared		• Documents of Bridge maintenance procedure and staff deployment • Bridge maintenance plan (annual budget and work plans) in model area(s)				Results of achievements measured of each indicator are described in the Monitoring Sheet version 5 and shared during the 4th JCC.			
2. Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed		2-1. Bridge inspection / evaluation manual is approved by RHD 2-2. Bridge rehabilitation / strengthening manual is approved by RHD		• Bridge inspection / evaluation manual • Bridge rehabilitation / strengthening manual • Access log of BMS • BMS manual							
3. Bridge management system is developed		3-1. Data accessibility of BMS is improved 3-2. BMS manual is approved by RHD									
4. Necessary knowledge of bridge management is enhanced by RHD staff		4-1. 75 bridge inspection MT are trained 4-2. 75 bridge rehabilitation MT are trained 4-3. 75 BMS administrators are trained 4-4. Institutional capacity development plan is approved		• Training report • Institutional capacity development plan							
Activities		Inputs		Important Assumption							
1-1. Actual condition of bridge maintenance is reviewed		The Japanese Side		The Bangladesh Side							
1-2. Problems / issues on bridge maintenance cycle are identified		1. Experts 1) Team Leader/Bridge Maintenance Plan 2) Bridge Inspection 3) Bridge Evaluation 4) Bridge Maintenance Plan (2) 5) Detailed Survey 6) Bridge Rehabilitation Strengthening/Bridge Evaluation (2) 7) Cost Estimate 8) Bridge Management System 9) Asset Management 10) Project Monitoring 11) Coordinator/Bridge Maintenance Plan (Assistance)		1. Personnel 1) Project Director 2) Additional Project Director 3) Project Manager 4) Deputy Project Manager 5) Counterpart (C/P) of RHD 6) Other relevant units 2. Facility and Equipment 1) Offices (inside RHD building) 2) Engineering Equipment/Inspection Equipment 3. Expenses for activities 1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs		• Bridge rehabilitation / strengthening works for advisory activity (Activity 4-4) are implemented by RHD					
2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed		2. Procurement of machinery and equipment 1) Computers for database with accessories 2) Concrete testing equipment • Ground penetrating radar (RC Rader) • Concrete core sampling apparatus • Electric drill 3. Training in Japan 2 times				Pre-Conditions • Skilled and appropriate engineers are allocated in RHD • Policy priority on bridge maintenance is not drastically decreased					
2-2. Bridge inspection / evaluation manual is updated		4. Expenses 1) Operational expenses for workshop and seminars 2) Other expenses needed for the Project implementation									
2-2-1. Bridge inspection / evaluation manual (Inspection) is updated											
2-2-2. Bridge inspection / evaluation manual (Evaluation) is prepared											
2-3. Bridge rehabilitation / strengthening manual is prepared											
2-3-1. Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared											
2-3-2. Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared											
2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT)											
3-1. Existing BMMS is reviewed and analysed											
3-2. Utilisation of BMS is examined together by RHD											
3-3. Function of BMS is defined and developed											
3-4. Data in existing BMMS is entered into BMS by RHD											
3-5. BMS manual for administrators and users is prepared											
3-6. BMS manual is explained to RHD staff by BMS administrators											
4-1. On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge inspection / evaluation manual											
4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS											
4-3. OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual											
4-4. Advices on supervision of bridge rehabilitation / strengthening works are given by Expert											
4-5. Institutional capacity development plan is prepared											

付録4：R/D、M/M、JCC 議事録（写し）

R/D 2015年2月15日
 変更 R/D 2015年10月8日
 第1回 JCC 2015年8月30日
 第2回 JCC 2016年1月28日
 第3回 JCC 2017年3月5日
 第4回 JCC 2017年12月3日
 第5回 JCC 2018年8月29日


ワークショップ 番号	開催日時	ワークショップ 番号	開催日時
A1-WS1	2015年11月5日	A2-WS5	2016年3月13日
A1-WS2	2016年1月10日	A2-WS6	2016年4月10日
A1-WS3	2016年1月17日	A2-WS7	2016年4月10日
A1-WS4	2016年1月17日	A2-WS8	2016年5月22日
A1-WS5	2016年2月4日	A2-WS9	2016年5月22日
A1-WS6	2016年3月27日	A2-WS10	2016年6月19日
A1-WS7	2016年4月10日	A2-WS11	2016年6月19日
A1-WS8	2016年4月10日	A3-WS1	2016年2月4日
A2-WS1	2015年12月13日	A3-WS2	2016年3月27日
A2-WS2	2015年12月13日	A3-WS3	2016年3月29日
A2-WS3	2016年1月10日	A3-WS4	2017年1月29日
A2-WS4	2016年3月13日		

RECORD OF DISCUSSIONS
ON
BRIDGE MANAGEMENT CAPACITY DEVELOPMENT PROJECT
IN
PEOPLE'S REPUBLIC OF BANGLADESH
AGREED UPON BETWEEN
ROADS AND HIGHWAYS DEPARTMENT
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

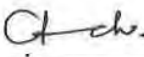
Dhaka
February 15, 2015




Kei TOYAMA
Senior Representative
Japan International Cooperation Agency



M.A.N. Siddique
Secretary
Road Transport and Highways Division
Ministry of Road Transport and Bridges



Mohammed Abu Taher
Additional Secretary
Wing-1, Economic Relations Division
Ministry of Finance



Md. Feroz Iqbal
Chief Engineer
Roads and Highways Department

Based on the minutes of meetings on the Detailed Planning Survey on the "Bridge Management Capacity Development Project" (hereinafter referred to as "the Project") signed on June 12, 2014 between Roads and Highways Department (hereinafter referred to as "RHD") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA held a series of discussions with RHD and relevant organizations to develop a detailed plan of the Project.

Both parties agreed the details of the Project and the main points discussed as described in the Appendix 1 and the Appendix 2 respectively.

Both parties also agreed that RHD, the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA, coordinate with other relevant organizations and ensure that the self-reliant operation of the Project is sustained during and after the implementation period in order to contribute toward social and economic development of People's Republic of Bangladesh recipient country (hereinafter referred to as "Bangladesh").

The Project will be implemented within the framework of the Agreement on Technical Cooperation signed on December 8th, 2002 (hereinafter referred to as "the Agreement") and the Note Verbales to be exchanged between the Government of Japan (hereinafter referred to as "GOJ") and the Government of People's Republic of Bangladesh (hereinafter referred to as "GOB").

The effectiveness of the record of discussions is subject to the exchange of the Note Verbales.

Appendix 1: Project Description

Appendix 2: Main Points Discussed

Appendix 3: Minutes of Meetings on the detailed planning survey for the Project signed on June 12, 2014

PROJECT DESCRIPTION

Both parties confirmed that there is no change in the Project Description agreed on in the minutes of meetings on the concerning Preparatory Survey on the Project signed on June 12, 2014 (Appendix 3).

I. BACKGROUND

Bangladesh has experienced a firm economic growth in recent years maintaining the annual GDP growth rate of about 6 percent. Along with that, freight volume has increased by approximately 8 times in the 30 years between 1975 and 2005, and the freight volume and the number of passengers has maintained an upward trend at a pace of 6-7 percent. Among the major means of transportation in Bangladesh such as inland waterway, railway and road, the rate relying on road use in both passenger and freight has exceeded 80 percent in 2005. However, newly road construction is not adequately implemented against an increase of the traffic volume, and condition of existing road is deteriorating due to incompetent capacity on roads/bridges maintenance and budgetary deficit. These obstacles are hindering smooth transportation of passenger and freight.

According to the "Sixth Five Year Plan (2011-2015)", GOB defines that efficient and modern road transportation system plays an important role in the road sector for achieving "Sixth Five Year Plan" and "Vision 2021" which is the mid-term aim of Bangladesh. Furthermore, appropriate maintenance on existing roads is placed as an important issue in order to reduce costs for road users. "National Land Transport Policy (2004)" describes that enhancing maintenance capacity, securing budgets and formulating a long-term development plan are prioritized as an important policy. "Road Master Plan (2009)" formulated based on the "National Land Transport Policy" mentions that maintaining asset value of roads and bridges is one of the aims to be focused.

Construction of bridges in Bangladesh has been accelerated drastically after its independence in 1971, and the number of bridges and culverts increased from 1,112 to 18,356 in 2013. Meanwhile, the rapid increase of bridges has caused frequent falls of baily bridges (emergency bridges) and road condition has seriously deteriorated due to inadequate maintenance. Though GOB is aware of the necessity of the capacity development on bridge management, it is yet to be implemented. This results in bridges falls before the arrival of the end of their durable years.

Under above background, GOB requested GOJ to implement "Technical Cooperation for Bridge Management and Maintenance System under Roads and Highways Department" with aiming to introduce preventive bridge maintenance utilizing the bridge management system. In response to this



request, JICA determined to transfer the technology in order to facilitate the bridge maintenance cycle and held series of discussion with RHD and related authorities concerned of Bangladesh. Based on the agreements between JICA and the authorities concerned of Bangladesh, the Minutes of Meetings was signed on June 12, 2014, which leads both parties to conclude this Record of Discussions.

II. OUTLINE OF THE PROJECT

Details of the Project are described in the Logical Framework (Project Design Matrix: PDM) (Annex 1) and the tentative Plan of Operation (PO) (Annex 2).

1. Input

(1) Input by RHD

RHD will take necessary measures to provide at its own expense:

- (a) Services of RHD's counterpart personnel and administrative personnel as referred to in II-2;
- (b) Suitable office space with necessary equipment;
- (c) Supply or replacement of equipment and any other materials necessary for the implementation of the Project to be borne by RHD as described in PDM, if necessary;
- (d) Information as well as convenience for receiving medical care;
- (e) Credentials or identification cards;
- (f) Available data (including maps and photographs) and information related to the Project;
- (g) Expenses necessary for transportation within Bangladesh of the equipment referred to in PDM, if arise; and
- (h) Necessary facilities to the JICA experts for the remittance as well as utilization of the funds introduced into Bangladesh from Japan in connection with the implementation of the Project

2. Implementation Structure

The Project organization chart is given in the Annex 3. The roles and assignments of relevant organizations are as follows:

(1) RHD

- (a) Project Director
Additional Chief Engineer, Bridge Management Wing will be responsible for overall administration and implementation of the Project.
- (b) Additional Project Director
Superintendent Engineer, Planning & Data Circle will be responsible for administration of the Project.
- (c) Project Manager
Executive Engineer, BMMS Division will be responsible for the implementation of the Project
- (d) Deputy Project Manager
Sub-Divisional Engineer, BMMS Division will be responsible for deputy to the Project Manager

(e) Counterparts

Relevant officers in RHD will be responsible for the managerial and technical matters of the Project.

(2) JICA Experts

The JICA experts will give necessary technical guidance, advice and recommendations to RHD on any matters pertaining to the implementation of the Project.

(3) Joint Coordination Committee

Joint Coordination Committee (hereinafter referred to as "JCC") will be established in order to facilitate inter-organizational coordination. JCC meeting will be held at least once a year and whenever deems it necessary. JCC will approve an annual work plan, review overall progress, conduct evaluation of the Project, and exchange opinions on major issues that arise during the implementation of the Project. A list of proposed members of JCC is shown in the Annex 4.

3. Project Site(s) and Beneficiaries

(1) Project Site

The main activities of the Project will be implemented at RHD's headquarters.

(2) Direct beneficiaries

Direct beneficiaries of the Project will be the staff of RHD.

(3) Indirect beneficiaries

Indirect beneficiaries are road users.

4. Duration

The duration of the Project will be thirty (30) months from the commencement. The tentative Plan of Operation is shown in Annex 2.

5. Reports

At the commencement of the Project, JICA will prepare and submit the Inception Report including the Monitoring Sheet ver. 1 based on PDM and PO to RHD in English.

In addition, RHD and JICA experts will jointly prepare the following reports in English.

(1) The Monitoring Sheets based on PDM and PO on semiannual basis until the project completion

(2) Project Completion Report at the time of completion.

6. Environmental and Social Considerations

RHD agreed to abide by 'JICA Guidelines for Environmental and Social Considerations' in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

III. UNDERTAKINGS OF RHD and GOB

1. RHD and GOB will take necessary measures to:

- (1) ensure that the technologies and knowledge acquired by Bangladesh nationals as a result of Japanese technical cooperation contributes to the economic and social development of Bangladesh, and that the knowledge and experience acquired by the personnel of Bangladesh from technical training as well as the equipment provided by JICA will be utilized effectively in the implementation of the Project; and
 - (2) grant privileges, exemptions and benefits to the JICA experts referred to in PDM and their families, which are no less favorable than those granted to experts and members of the missions and their families of third countries or international organizations performing similar missions in Bangladesh.
 - (3) provide tax exemption for construction materials and equipment for the Project.
 - (a) The Bangladesh side agreed that customs duties, internal taxes and other fiscal levies which may be imposed in Bangladesh are exempted under mutual agreement of the Agreement on Technical Cooperation signed on December 8th, 2002 between GOB and GOJ.
 - (b) If any expenses stated above are caused by some reasons such as the delay of execution of tax exemption, the Bangladesh side shall pay for it.
2. Other privileges, exemptions and benefits will be provided in accordance with the Agreement on Technical Cooperation signed on December 8th, 2002 between GOB and GOJ and/or the Note Verbales to be exchanged between GOB and GOJ.

IV. MONITORING AND EVALUATION

JICA and the RHD will jointly and regularly monitor the progress of the Project through the Monitoring Sheets based on PDM and PO. The Monitoring Sheets shall be reviewed every six (6) months.

Also, Project Completion Report shall be drawn up one (1) month before the termination of the Project.

JICA will conduct the following evaluations and surveys to mainly verify sustainability and impact of the Project and draw lessons. RHD is required to provide necessary support for them.

1. Ex-post evaluation three (3) years after the project completion, in principle
2. Follow-up surveys on necessity basis

V. PROMOTION OF PUBLIC SUPPORT

For the purpose of promoting support for the Project, RHD will take appropriate measures to make the Project widely known to the people of Bangladesh.

VI. Misconduct

If JICA receives information related to suspected corrupt or fraudulent practices in the implementation of the Project, RHD and relevant organizations shall provide JICA with such information as JICA may reasonably request, including information related to any concerned official of the government and/or public organizations of the Bangladesh.

RHD and relevant organizations shall not, unfairly or unfavorably treat the person and/or company which provided the information related to suspected corrupt or fraudulent practices in the implementation of the Project.

VII. MUTUAL CONSULTATION

JICA and RHD will consult each other whenever any major issues arise in the course of Project implementation.

VIII. AMENDMENTS

The record of discussions may be amended by the minutes of meetings between JICA and RHD.

The minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the record of discussions.

- Annex 1 Logical Framework (Project Design Matrix:PDM)
- Annex 2 Tentative Plan of Operation
- Annex 3 Project Organization Chart
- Annex 4 A List of Proposed Members of Joint Coordinating Committee

Project Design Matrix

Version 0

Dated ●●, ●●, 2014

Project Title: Bridge Management Capacity Development Project

Implementing Agency: Organizations: Ministry of Communication, Roads and Highways Department (RHD)

Target Group: Staff in RHD head office and zone offices

Period of Project: XX 2014 – XX 2016, 30 months

Project Site: RHD Head office

Model Site: XX district

	Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal Bridge management under RHD is enhanced		1. Annual ratio of bridge inspection conducted by RHD is increased from XX% to XX% 2. Bridge maintenance cycle is conducted by RHD	<ul style="list-style-type: none"> • Record of bridge inspection • Input-output data of BMS 			
Project Purpose Bridge maintenance capacity of RHD is improved		1. Bridge maintenance cycle is commenced by RHD 2. Necessary training based on the human resource development plan is conducted by Master Trainers (MTs)	<ul style="list-style-type: none"> • Record of bridge inspection • Input-output data of BMS • Report on training conducted by Master Trainers (MTs) 	<ul style="list-style-type: none"> • Budgets for bridge maintenance are secured • Staff for bridge management is continuously allocated 		
Outputs 1. Bridge maintenance framework is developed		1-1. Documents of Bridge maintenance procedure and staff deployment are approved by XX 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared 2-1. Bridge inspection / diagnosis manual is approved by XX 2-2. Bridge rehabilitation / retrofitting manual is approved by XX 3-1. Data accessibility of BMS is improved 3-2. BMS manual is approved by XX 4-1. XX bridge inspection MTs are trained 4-2. XX bridge rehabilitation MTs are trained 4-3. XX BMS administrators are trained 4-4. The human resource development plan is approved	<ul style="list-style-type: none"> • Documents of Bridge maintenance procedure and staff deployment • Bridge maintenance plan (annual budget and work plans) in model area(s) • Bridge inspection / diagnosis manual • Bridge rehabilitation / retrofitting manual • Access log of BMS • BMS manual • Report on training conducted by Experts • Human resource development plan 			
2. Bridge inspection / diagnose manual and bridge rehabilitation / retrofitting manual are developed						
3. Bridge management system is developed						
4. Necessary knowledge of bridge management is enhanced by RHD staff						

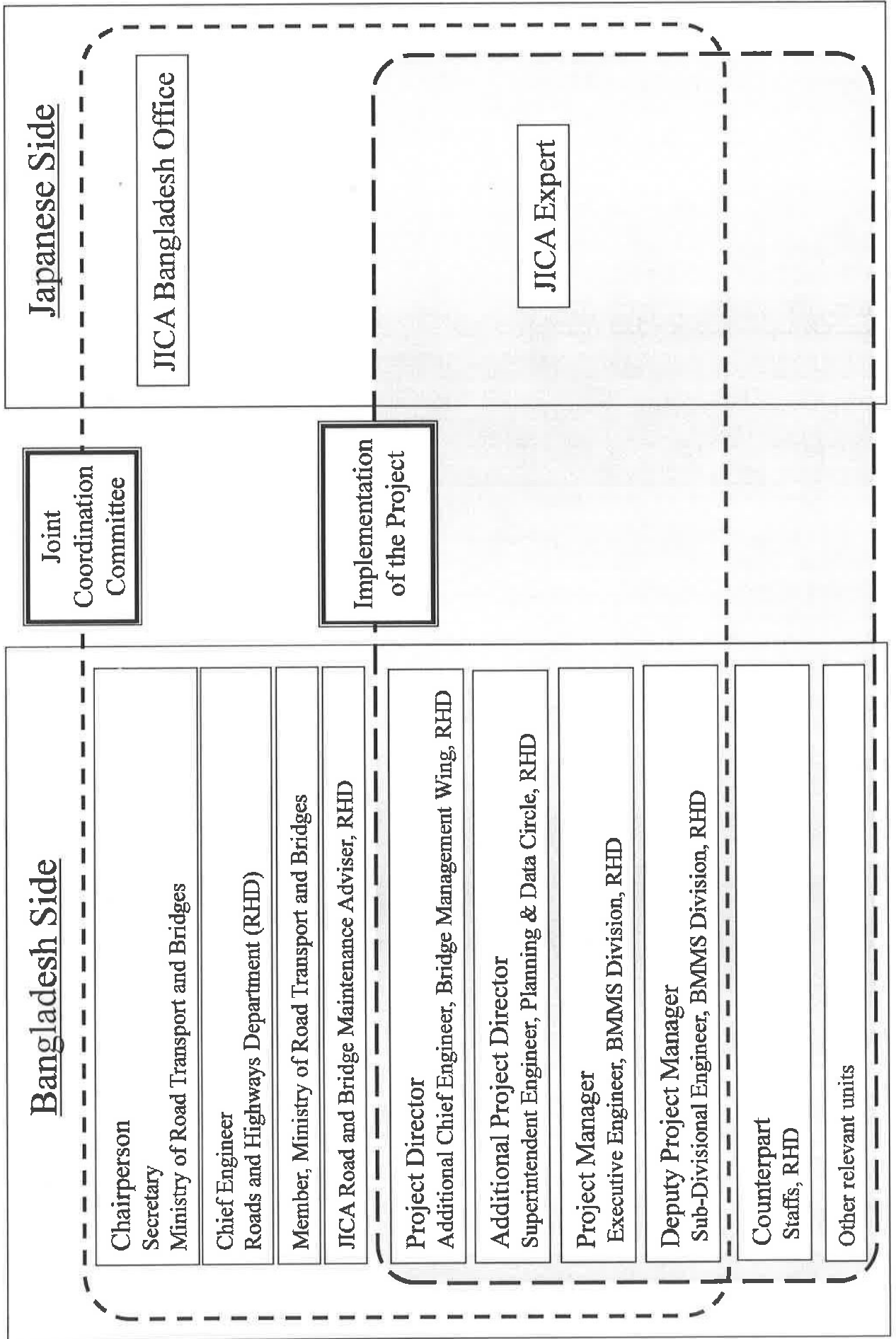
Activities	Inputs	Important Assumption
<p>1-1. Actual condition of bridge maintenance is reviewed</p> <p>1-2. Problems / issues on bridge maintenance cycle are identified</p> <p>1-3. Institutional framework of bridge maintenance is reviewed</p> <p>1-4. Documents of bridge maintenance procedure and standard of staff deployment are prepared</p> <p>2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed</p> <p>2-2. Bridge inspection / diagnosis manual is updated</p> <p>2-3. Bridge rehabilitation / retrofitting manual is prepared</p> <p>2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MTs)</p> <p>3-1. Existing BMMS is reviewed and analysed</p> <p>3-2. Utilisation of BMS is examined together by RHD</p> <p>3-3. Function of BMS is defined and developed</p> <p>3-4. Data in existing BMMS is entered into BMS by RHD</p> <p>3-5. BMS manual for administrators and users is prepared</p> <p>3-6. BMS manual is explained to RHD staff by BMS administrators</p> <p>4-1. On the job trainings (OJTs) on bridge inspection / diagnosis in model area(s) are conducted with bridge inspection / diagnosis manual</p> <p>4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS</p> <p>4-3. OJTs on selection of bridge rehabilitation / retrofitting measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / retrofitting manual</p> <p>4-4. Advices on supervision of bridge rehabilitation / retrofitting works are given by Expert</p> <p>4-5. Human resource development plan is prepared</p>	<p>The Japanese Side</p> <p>1. Experts</p> <p>1) Bridge Maintenance Plan</p> <p>2) Bridge Inspection</p> <p>3) Bridge Soundness Evaluation</p> <p>4) Bridge rehabilitation / retrofitting</p> <p>5) Bridge Management System</p> <p>6) Cost Estimation (Bridge Maintenance)</p> <p>7) Project Coordinator</p> <p>2. Procurement of machinery and equipment</p> <p>1) Computers for database with accessories</p> <p>2) Concrete testing equipment</p> <p>- Ground penetrating radar (RC Rader)</p> <p>- Concrete core sampling apparatus</p> <p>- Electric drill</p> <p>3. Training in Japan</p> <p>2 times</p> <p>4. Expenses</p> <p>1) Operational expenses for workshop and seminars</p> <p>2) Other expenses needed for the Project implementation</p>	<p>The Bangladesh Side</p> <p>1. Personnel</p> <p>1) Project Director</p> <p>2) Additional Project Director</p> <p>3) Project Manager</p> <p>4) Deputy Project Manager</p> <p>5) Counterpart (C/P) of RHD</p> <p>6) Other staffs</p> <p>2. Facility and Equipment</p> <p>1) Offices (inside RHD building)</p> <p>3. Expenses for activities</p> <p>1) Personal and travel expenses and daily allowances for C/P</p> <p>2) Other necessary costs</p>
		<p>Pre-Conditions</p> <p>- Skilled and appropriate engineers are allocated in RHD</p> <p>- Policy priority on bridge maintenance is not drastically decreased</p>
		<p><Issues and countermeasures></p>

Tentative Plan of Operation

Project Title: Bridge Management Capacity Development Project

Activities		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					
Output 1: Bridge maintenance framework is developed																																				
1-1	Actual condition of bridge maintenance is reviewed																																			
1-2	Problems / issues on bridge maintenance cycle are identified																																			
1-3	Institutional framework of bridge maintenance is reviewed																																			
1-4	Documents of bridge maintenance procedure and standard of staff deployment are prepared																																			
Output 2: Bridge inspection / diagnose manual and bridge rehabilitation / retrofitting manual are developed																																				
2-1	Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed																																			
2-2	Bridge inspection / diagnosis manual is updated																																			
2-3	Bridge rehabilitation / retrofitting manual is prepared																																			
2-4	Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MTs)																																			
Output 3: Bridge management system is developed																																				
3-1	Existing BMMS is reviewed and analysed																																			
3-2	Utilisation of BMS is examined together by RHD																																			
3-3	Function of BMS is defined and developed																																			
3-4	Data in existing BMMS are entered into BMS by RHD																																			
3-5	BMS manual for administrators and users is prepared																																			
3-6	BMS manual is explained to RHD staff by BMS administrators																																			
Output 4: Necessary knowledge of bridge management is enhanced by RHD staff																																				
4-1	On the job trainings (OJTs) on bridge inspection/diagnosis in model area(s) are conducted with bridge inspection/diagnosis manual																																			
4-2	OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS with BMS manual																																			
4-3	OJTs on selection of bridge rehabilitation / retrofitting measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / retrofitting manual																																			
4-4	Giving advice on supervision of bridge rehabilitation / retrofitting works implemented by RHD																																			
4-5	Human resource development plan is prepared																																			
Administrative Activities																																				
Joint Coordination Committee																																				
Set-up the Detailed Plan of Operation																																				
Project Completion Report																																				
Submission of Monitoring Sheet																																				
Joint Monitoring																																				

Organization chart of the Project



LIST OF PROPOSED MEMBERS OF JOINT COORDINATION COMMITTEE

Chairperson: Secretary, Road Transport and Highways Division, Ministry of Road Transport and Bridges

Members:

(1) Bangladesh Side

- 1) Roads and Highways Department (RHD)
 - Chief Engineer
 - Project Director: Additional Chief Engineer, Bridge Management Wing
 - Additional Project Director: Superintendent Engineer, Planning & Data Circle
 - Project Manager: Executive Engineer, BMMS Division
 - Deputy Project Manager: Sub-Divisional Engineer, BMMS Division
- 2) Ministry of Road Transport and Bridges
- 3) JICA Road and Bridge Maintenance Adviser
- 4) Relevant personnel accepted by the Chairperson, if necessary

(2) Japanese Side

- 1) JICA Bangladesh Office
 - Senior Representative
 - Representative
 - Program Officers in charge of the Project
- 2) JICA Experts
 - Chief adviser / Bridge Maintenance plan
 - Bridge Inspection
 - Bridge Soundness Evaluation
 - Bridge Rehabilitation / retrofitting
 - Bridge Management System
 - Cost Estimation (Bridge Maintenance)
 - Project Coordinator
- 3) Other personnel accepted by JICA, if necessary

JCC will be scheduled based on the maximum availability of the members listed above.

MAIN POINTS DISCUSSED

I. PROJECT DESIGN MATRIX (PDM) AND PLAN OF OPERATIONS (PO)

Both sides agreed on the contents of the draft Logical Framework (Project Design Matrix: PDM) and draft Plan of Operations (PO) as shown in Annex-1 and Annex-2 of R/D. The PDM and PO are to be flexibly revised according to the progress and achievement of the Project, upon mutual agreement between RHD and JICA by signing a Minutes of Meetings, according to the R/D.

II. COUNTERPART

Both sides agreed that necessary counterparts of Bridge Management Wing as described in II.2 (1) and Annex-1 (PDM) of the draft R/D shall be assigned and informed JICA (before the signing of R/D).

III. MASTER TRAINERS

Both sides agreed that the target officials of OJTs are "Master Trainers (MTs)" who will act with a role of dissemination of their trained knowledge and skill to other RHD officials widely and the assignment plan of MTs shall be submitted to JICA (before the signing of R/D). In addition the number of MTs are planned to be approximately 75 RHD officials in total.

IV. MODEL AREA

Both sides agreed that Model Area(s) for OJTs will be determined the division(s) of Dhaka zone in the Project and the number of bridges and culverts in the Model Area(s) are approximately 300 in total.

V. TECHNICAL TRANSFER DURING THE PROJECT

Both sides agreed that technical transfer on bridge maintenance cycle will be done at OJT basis.

Workshops / Seminars will be held in Bangladesh.

Approximately 2 weeks Training in Japan will be held twice during the Project with the number of total 12 trainees from RHD.

VI. ON-SITE ACTIVITY

Both sides agreed that the on-site activities such as inspection, rehabilitation work shall be conducted with the full responsibility of RHD while advisory or relevant assistance will be provided by Japanese Experts

VII. BRIDGE REHABILITATION / RETROFITTING WORKS

Both sides agreed that the bridge rehabilitation / retrofitting works (2 or 3 works) for Activity 4-4 in PDM shall be implemented by RHD.

VIII. PROJECT OFFICE

Both sides agreed necessary work space(s) including office equipment (furniture) and basic utilities (electricity, air-conditioning etc.) will be prepared by RHD before commencement of the Project and it will be informed JICA before the signing of R/D.

IX. EQUIPMENT

Both sides agreed that personal equipment for Inspection MT (for example, Safety equipment, Testing hammer, Tape measure / Leveling staff, Crack scale sheet and Camera) are prepared by RHD.

X. TAX OR LEVY

Both sides confirmed that in case any tax or levy is imposed for equipment, RHD will provide the budget equivalent to the amount of the tax or levy for JICA on import.

XI. OTHERS

Japanese side emphasized that RHD should keep their eyes on the capacity building for self-governance and sustainability by securing the bridge maintenance cycle after completing the Project, and Bangladesh side expressed their full understanding.

**MINUTES OF MEETINGS
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
ROADS AND HIGHWAYS DEPARTMENT
FOR AMENDMENT OF THE RECORD OF DISCUSSIONS
ON
BRIDGE MANAGEMENT CAPACITY DEVELOPMENT PROJECT**

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and Roads and Highways Department (hereinafter referred to as "RHD") hereby agree that the Record of Discussions on "Bridge Management Capacity Development Project" (hereinafter referred to as "the Project") signed on February 15, 2015 will be amended as per the attached document;

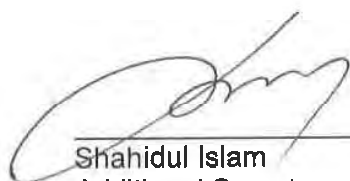
⁰⁸
Dhaka, 29, October 2017



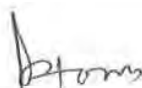
Taku Yamabe
Senior Representative
Japan International Cooperation Agency



M.A.N Siddique
Secretary
Road Transport and Highways Division
Ministry of Road Transport and Bridges



Shahidul Islam
Additional Secretary
Economic Relations Division
Ministry of Finance



Ebne Alam Hassan
Chief Engineer
Roads and Highways Department

Attached Document

1. Duration (Record of Discussions Appendix 1)

Before	Amended Version
The duration of the Project will be thirty (30) months from the commencement. The tentative Plan of Operation is shown in Annex 2.	The duration of the Project will be thirty eight (38) months from the commencement. The tentative Plan of Operation is shown in Annex 2.
Reason: JICA expert team had not been to Dhaka city for about 6 months due to security issues. It is necessary to extend the project duration because it will secure enough activities length of bridge rehabilitation/strengthening and improve bridge maintenance capacity of RHD.	

2. Activity (PDM)

Before	Amended Version
Activity 4-4: Advices on supervision of bridge rehabilitation / strengthening works are given by Expert	Activity 4-4: Advices on remote supervision of bridge rehabilitation / strengthening works are given by Expert
Reason: Under the current contexts, the field activity in Manikganj Road Division will be implemented through remote supervision by the JICA experts.	

Annex 1 : Record of Discussions signed on February 15, 2015

Annex 2 : PDM (Version.5)

Annex 3 : PO (Version.5)




Project Design Matrix (Project Monitoring Sheet 1)

Version 5

Dated 8th June, 2017

Project Title: Bridge Management Capacity Development Project

Implementing Agency: Organizations: Ministry of Road Transport and Bridges, Roads and Highways Department (RHD)

Target Group: Staff in RHD head office and zone offices

Period of Project: 10 July 2015 – 2 September, 2018, 38 months

Project Site: RHD Head office

Model Site: Manikganj Division

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal Bridge management under RHD is enhanced	1 Annual ratio of bridge inspection conducted by RHD is increased to 60% 2 Bridge maintenance cycle is conducted by RHD	• Record of bridge inspection • Input-output data of BMS		XX will be replaced with numbers during the 4th JCC	
Project Purpose Bridge maintenance capacity of RHD is improved	1 Bridge maintenance cycle is commenced by RHD 2 Master Trainers (MTs) are trained 3 Necessary training based on the Institutional capacity development plan is conducted by Master Trainers (MT)	• Record of bridge inspection • Input-output data of BMS • Report on training conducted by Master Trainers (MT)	• Budgets for bridge maintenance are secured • Staff for bridge management is continuously allocated	Each indicator will be measured during the 5th JCC (a couple of months before the project completion)	
Outputs 1 Bridge maintenance framework is developed 2 Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed 3 Bridge management system is developed 4 Necessary knowledge of bridge management is enhanced by RHD staff	1-1 Documents of Bridge maintenance procedure and staff deployment are approved by RHD 1-2 Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3 Data management by utilization of BMS is commenced by RHD 1-4 Bridge maintenance plan (annual budget and work plans) in model area(s) 2-1 Bridge inspection / evaluation manual is approved by RHD 2-2 Bridge rehabilitation / strengthening manual is approved by RHD 3-1 Data accessibility of BMS is improved 3-2 BMS manual is approved by RHD 4-1 75 bridge inspection MT are trained 4-2 75 bridge rehabilitation MT are trained 4-3 75 BMS administrators are trained 4-4 Institutional capacity development plan is approved	• Documents of Bridge maintenance procedure and staff deployment • Bridge maintenance plan (annual budget and work plans) in model area(s) • Bridge inspection / evaluation manual • Bridge rehabilitation / strengthening manual • Access log of BMS • BMS manual • Training report • Institutional capacity development plan		Each indicator will be measured during the 4th JCC.	
Activities	Inputs	Important Assumption			
1-1 Actual condition of bridge maintenance is reviewed 1-2 Problems / issues on bridge maintenance cycle are identified 1-3 Institutional framework of bridge maintenance is reviewed 1-4 Documents of bridge maintenance procedure and standard of staff deployment are prepared 2-1 Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed 2-2 Bridge inspection / evaluation manual is updated 2-2-1 Bridge inspection / evaluation manual (inspection) is updated 2-2-2 Bridge inspection / evaluation manual (Evaluation) is prepared 2-3 Bridge rehabilitation / strengthening manual is prepared 2-3-1 Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared 2-3-2 Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared 2-4 Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT) 3-1 Existing BMMS is reviewed and analyzed 3-2 Utilisation of BMS is examined together by RHD 3-3 Function of BMS is defined and developed 3-4 Data in existing BMMS is entered into BMS by RHD 3-5 BMS manual for administrators and users is prepared 3-6 BMS manual is explained to RHD staff by BMS administrators 4-1 On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge Inspection / evaluation manual 4-2 OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS 4-3 OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual 4-4 Advices on remote supervision of bridge rehabilitation / strengthening works are given by Expert 4-5 Institutional capacity development plan is prepared	The Japanese Side 1 Experts 1) Team Leader/Bridge Maintenance Plan 2) Bridge Inspection 3) Bridge Evaluation 4) Bridge Maintenance Plan (2) 5) Detailed Survey 6) Bridge Rehabilitation-Strengthening/Bridge Evaluation (2) 7) Cost Estimate 8) Bridge Management System 9) Asset Management 10) Project Monitoring 11) Coordinator/Bridge Maintenance Plan (Assistance) 2. Procurement of machinery and equipment 1) Computers for database with accessories 2) Concrete testing equipment • Ground penetrating radar (RC Rader) • Concrete core sampling apparatus • Electric drill 3 Training in Japan 2 times 4 Expenses 1) Operational expenses for workshop and seminars 2) Other expenses needed for the Project implementation	The Bangladesh Side 1 Personnel 1) Project Director 2) Additional Project Director 3) Project Manager 4) Deputy Project Manager 5) Counterpart (C/P) of RHD 6) Other relevant units 2 Facility and Equipment 1) Offices (inside RHD building) 2) Engineering Equipment/Inspection Equipment 3 Expenses for activities 1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs	• Bridge rehabilitation / strengthening works for advisory activity (Activity 4-4) are implemented by RHD Pre-Conditions • Skilled and appropriate engineers are allocated in RHD • Policy priority on bridge maintenance is not drastically decreased		
					<Issues and countermeasures>

