Government of the People's Republic of Bangladesh
Ministry of Communications
Roads and Highways Department

BRIDGE CONDITION SURVEY MANUAL

September 2005

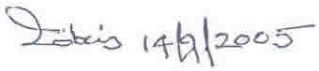
FOREWORD

The first computerized bridge/culvert database of Roads and Highways Department (RHD) was developed by the nationwide bridge/culvert condition survey in 1997 by RHD Staff in each Sub-Division. There was limited instruction to the field division to conduct that survey.

This manual describes detail procedures for carrying out the surveys and inspections necessary to update the bridge database, also assign specific responsibilities of RHD field officials to ensure correct and up-to-date information for effective management of the RHD bridge stock.

The Sub-Divisional Staff are involved in carrying out the survey by using standard forms and instructions. Three forms BCS-1, BCS-2 & BCS-3 are developed for proper bridge condition survey. These are used to determine and monitor routine and periodic maintenance, budgets and programs. BCS-3 is used to estimate the rehabilitation costs for the national bridge stock and to prepare budgets and prioritized works plans. Also bridges having span length 100m or above will be undertaken by suitably qualified bridge engineers, which has no prescribed format.

It is expected that this manual will guide the field officials to conduct regular bridge/culvert inspection and update the bridge database periodically so that it can help RHD, Bridge Management Wing to prioritize future bridge construction, reconstruction and maintenance program.



Md. Idris Miah
Additional Chief Engineer
Bridge Management Wing
Roads and Highways Department
Sarak Bhaban, Ramna, Dhaka.

September 2005

CONTENTS

1. BACKGROUND

The first nationwide Bridge Condition Surveys (on Form BCS-1) were carried out in 1997 by RHD staff in each Sub-Division. The data arising from the surveys was used to populate the first countrywide RHD computerised Bridge Database, and data for over 9,000 bridges and culverts was printed in the 1997-98 Annual Road and Bridge Database Report. The third output from the original BCS-1 survey was the preparation of a separate Bridge Record for every structure, also held on the Bridge Database. These commendable achievements are the direct result of the efforts and hard work put in by the field staff involved, without whom there would be no database, report or record, and for which congratulations are again extended herewith.

Notwithstanding these achievements, the bridge database is not a fixed set of data and must be constantly updated with accurate and reliable condition information from the field in order to ensure that budgeting, planning and programming remain efficient and effective.

2. INTRODUCTION

Effective bridge management relies upon the operation of a powerful database, which must be regularly updated with the input of current information on the assets under management. For the Bridge Maintenance Management System (BMMS) this is achieved through the implementation of a three-stage survey/inspection procedure, which is designed to collect different types of data at frequencies appropriate to the staff resources available within the Department. The procedure ensures that only data that is specifically required is collected at a particular time. It ensures that data is current and up-to-date for the purpose, and at the same time will not place unnecessary burdens of field and administrative work on limited staff resources.

Surveys are carried out by field-based staff from within the Sub-Division. Section Officers (Sub-Assistant Engineer) carry out annual condition surveys. Sub-Divisional Engineers undertake rehabilitation assessment surveys, typically on a three year cycle. Surveys are undertaken using standard forms, copies of which are included in **Appendices 1 and 2**, together with Instructions for their use, and sample completed forms.

Principal Bridge Inspections are undertaken by professionally trained and qualified bridge engineers from either the Bridge Management Wing or commissioned from the private sector.

The BMMS is the central bridge management system through which budgets, programmes, and eventually projects, are prioritised, co-ordinated and monitored.

This Manual describes the procedures for the carrying out the surveys and inspections necessary for the effective management of the RHD bridge stock. It is also accessible on the RHD Intranet.

3. ANNUAL CONDITION SURVEY – BCS-1 & BCS-2

Routine checking of all bridges is carried out in conjunction with the Road Condition Survey. This avoids duplication of effort and ensures that bridges are located correctly on the road in question. This is an assessment of the ‘surface’ or ‘external’ characteristics of the structure, and is undertaken by the **Sub-Assistant Engineer**. Annual Bridge Condition Surveys, on Form BCS-1, are undertaken in May, when water levels are at their lowest to allow inspection of the deck soffit and riverbed. No special equipment is required for this inspection, which should typically take 30-45 minutes to complete. It may be necessary to use a boat to carry out inspection of piers and bridge soffits where channels are still flowing.

Form BCS-2 contains a summary of all of the BCS-1 data, allowing the Sub-Divisional Engineer and Executive Engineer to make remarks on particular bridges and decide on appropriate action and give an indicative cost of repair. For example if they consider that the structure score does not adequately reflect the condition of the bridge this should be highlighted with suitable comments.

Data from the BCS-1 and BCS-2 survey is used to determine and monitor routine and periodic maintenance budgets and programmes.

4. PRELIMINARY REHABILITATION ASSESSMENT SURVEY – BCS-3

A second level, more detailed survey **(Engineering Condition)** of the 'structure' or 'internal' elements of the bridge requires a basic engineering judgement of the structural condition and is therefore undertaken by the **Sub-Divisional Engineer**. Frequency will depend upon type of bridge and overall condition, and the survey return period will be determined for each bridge individually. After all bridges have received the initial BCS-3 survey they will be prioritised for frequency of further survey. Any sudden deterioration will be picked up on BCS-1 survey as noted above, and if necessary an earlier BCS-3 survey may be called ahead of schedule. Additional equipment may be required to allow access for closer inspection of deck soffits, underside of bridge deck & girders, bearing shelves, seats, etc. The survey may take from 45 minutes for a simple structure up to perhaps 1 days for a larger more complex bridge.

Data from the BCS-3 survey is used to estimate the rehabilitation costs for the national bridge stock and to prepare budgets and prioritised works plans.

5. PRINCIPAL BRIDGE INSPECTION (PBI)

Principal Bridge Inspections are undertaken by suitably qualified bridge engineers, who have received training in advanced inspection techniques, and have been approved by the Bridge Management Wing. Given the limited resources in BMW the PBIs will normally be undertaken by consultants commissioned for either single bridges or for a specific programme.

There is no prescribed format for the PBI. It will be left to the discretion of the consultant, or BMW, to agree the format prior to the inspection(s). It must be made clear however, that the inspection must be made at no more than arms length from every structural element, including bearings, joints, hinges, etc, and also include an inspection below water level to identify any actual damage, or latent defects[1]. The PBI will also include recommendations on future maintenance, both corrective and preventative, together with a plan of action, for refurbishment (strengthening) or replacement. When specialist surveys are deemed necessary these must be arranged by the Planning and Data Circle (BMW) with reference to the concerned division.

Arrangements must be made for safe access to all parts of the structure. On fast flowing rivers in particular it may be necessary to extend detail inspection below water level. This may involve the need for specialists and specialist equipment (eg certified divers, underwater cameras and inspection tools).

All PBIs should make extensive use of photography to ensure any deterioration is adequately recorded from one PBI to another. The PBI report reference should be included on the BMMS, and the original report filed by the Planning and Data Circle for follow up.

[1] In some cases specialist firms should be used with specialist equipment and manpower.

6. FREQUENCY OF SURVEYS AND INSPECTIONS

Frequency of survey/inspection of bridges is generally related to the physical condition of the structure. It is essential that field managers adopt a systematic approach to the survey/inspection programme, and it is important that uniform criteria are applied consistently throughout the department. All structures must be surveyed/inspected according to a mandatory frequency, and may also have additional discretionary visits, which may be called for by either the field manager or the Bridge Management Wing.

The frequencies for mandatory survey/inspection are shown in Table 1.

Table 1 Mandatory Survey & Inspection Periods (in years) for All Bridges

Condition Category	Score	Description	BCS-1&2 Frequency	BCS-3 Frequency	PBI Size of Structure	PBI Frequency
A	0	No Damage	1	1	All structure >100m total span	5
B	1 to 29	Minor Damage	1	2	All structures >100m total tpan	5
C	30 to 499	Major Elemental damage	6 months	6 months	All structures	**2 ?**
D	Over 500	Major Structural Damage	6 months	6 months	All structures	1

7. BRIDGE CONDITION SURVEY PROGRAMME

Sub-Divisional Engineers are responsible for the compilation of the Survey/Inspection Programme, and for ensuring that the programme is implemented on time. The programme must be based upon the mandatory frequencies specified in Table 1, and may be adjusted or supplemented according to the number and condition of bridges in the particular Sub-Division.

The purpose of the Sub-Divisional Inspection Programme is to assess and allocate workload in order to meet survey inspection requirements, and also monitor progress by simply ticking off surveys and/or re-scheduling to suit ongoing commitments on staff time. BCS-1 surveys are carried out in May each year, as part of the annual Road Condition Survey (RCS). BCS-3 surveys are undertaken at a frequency described above, during October-November. In addition to the programmed surveys, other bridges may be added if the BCS-1 survey in May identifies a sudden deterioration, which warrants the BCS-3 earlier than the scheduled programme.

All surveys will be programmed to fit in with the Sub-Division Annual Maintenance Programme, which will be prepared each year by each Sub-Division according to assets under management and resources available.

8. PRINCIPAL BRIDGE INSPECTION (PBI) PROGRAMME

Inspections by Consultants are carried out throughout the dry season when floodwater has abated sufficiently to allow full access to substructures. The PBI programme will be carefully compiled jointly by the Sub-Division and Division offices in consultation with BMW. In the event that a PBI is required urgently, due to rapid unforeseen deterioration or structural

damage to a structure, the field office must notify BMW immediately to arrange inspection by in-house staff.

Overall management of PBIs is the responsibility of the **Planning and Data Circle**, BMW. It is therefore essential that the proposed PBI programme for each Division is submitted before 31 March for budget allocation.

9. PRIORITISING PERIODIC MAINTENANACE, REHABILITATION AND REPLACEMENT OF BRIDGES AND CULVERTS

The draft annual Bridge Periodic Maintenance, Rehabilitation and Replacement Programme will be produced by the Planning & Data Circle of the Bridge Management Wing using the BMMS. A prioritised list will be prepared up to a ceiling of twice the anticipated budget allocation. The draft programme will be sent to each Zonal Office for comment and final selection of works for the year. The original ranking of schemes will remain unchanged unless the Zone can provide satisfactory justification to the Planning & Data Circle for a change in priorities. Similarly, if the Zone can give a compelling reason why any other bridge not already on the long list should be included, this should be considered after inspection by the Planning and Data Circle.

APPENDIX 1

FORM BCS-1

and INSTRUCTIONS

RHD **BRIDGE/CULVERT INSPECTION REPORT FORM** **BCS-1**

1 Location

Zone		Circle		Division		Sub-Division	
Road No		Road Name		LRP Name		GPS	Lat. / Lon.
Structure Name		LRP + Offset (m)		Chainage (km)			

2 Structure Type √ X

Box Culvert		RCC Bridge		Truss with RCC Slab		Bailey with Steel Deck	
Slab Culvert		RCC Girder Bridge		Truss with Steel Deck		Bailey with Timber Deck	
Arch Masonry		Steel Beam & RCC Slab		Truss with Timber Deck			
		PC Girder Bridge					
		PC Box					

3 Superstructure Details *specify*

No of Spans/Boxes	*3*	Span Lengths(m) →	*6.50 + 6.70 + 7.15*						Total Length →		*20.40*
No of Beams	*9*	Year of Construction →	1962	E	A				Load Restriction (Tons) →		
Width (m)	*4.65*	Carriageway →	3.80	Sidewalk 1 →					Sidewalk 2 →		
Wearing Surface √		Bitumen		Concrete		Nil					
Railing Type √		RCC Post & Rail		RCC Solid		Masonry		Steel		Nil	

4 Substructure Details

Material √ X					Type √ X							Weep Holes
	RCC	Steel	Earth	Masonry	Solid	Spill through	Column	Trestle	Pipe	Free	Fixed	
Abutment				√	√							
Pier/Box Wall				√	√							
Wing Wall				√								

5 Foundation Type √ X

Abutment	Open		Piled		Well		Not Known	
Pier	Open		Piled		Well		Not Known	

6 Abutment Protection Existing √ X | | **Approach Drainage Existing** √ X

7

Observation		Element								
o	X	Road Approaches	Channel	Railing	Truss	Deck	RCC Girder	Abutments	Piers / Box Walls	Wing Walls
Scouring	Major							500	500	500
	Minor							1	1	1
Leaning / Tilting	Major							500	500	500
	Minor							1	1	1
Settlement	Major	30						500	500	500
	Minor	1						1	1	1
Obstruction	Major		30							
	Minor		1							
Cracks	Major				500	500	500	30	30	30
	Minor				1	1	1	1	1	1
Concrete Spalling	Major					30	30	30	30	
	Minor					1	1	1	1	
Damaged or Missing Sections	Major			30	500	30	500			30
	Minor			1	1	1	1			1
Missing Bolts	Major				30				30	
	Minor				1				1	
Element Total Score										

8 Structure Total Score

Note All tick boxes to be completed as indicated with ✓ *(yes)* or ✗ *(no)* or ○ or ✗ *(score)*

All specify boxes to be completed with required details or dimensions in metres

Additional Information and/or Sketch to be placed on back of this page if required yes no

Inspected by _____ Date _____

(full name / designation)

RHD Bridge/Culvert Inspection Report Summary **BCS-2**

Zone _____ **Circle** _____ **Division** _____ **Sub-Division** _____

Bridge / Culvert No	Approaches	Channel	Railing	Truss	RCC Slab	RCC Girder	Abutments	Piers / Box Walls	Wing Walls	Total Score	Action Recommended	Estimated Cost (Lac Taka)

Prepared by _____ **SAE** **Recommended by** _____ **SDE** **Approved by** _____ **EE**

full name *full name* *full name*

Date _____ **Date** _____ **Date** _____

INSTRUCTIONS FOR COMPLETING THE FORMS BCS-1 & BCS-2

1. FORM BCS-1

A separate Form BCS-1 is to be completed for each bridge and box culvert structure, **excluding circular pipe culverts**, along the length of the road being inspected.

For the purpose of this inspection a **box culvert** is defined as a structure which is a box form (single or multiple cell) in cross section, which contains a ground slab, and where the floor, walls and deck are of monolithic construction, ie there are no joints or bearings. A **slab culvert** is defined as a structure comprising a slab without girder(s) supported on abutments. Any other structure will be classed as a **bridge**.

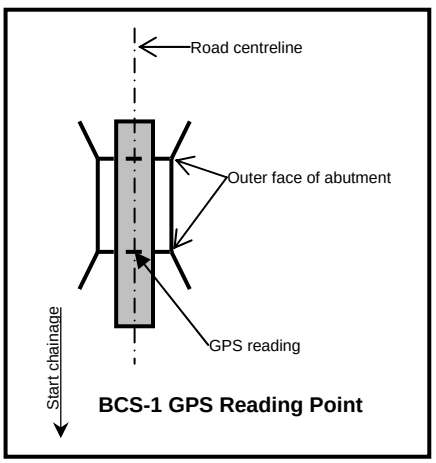
Form BCS-1 records the following details of the structure:

- Section 1 Location
- Section 2 Structure Type
- Section 3 Superstructure Details
- Section 4 Substructure Details
- Section 5 Foundation Type
- Section 6 Abutment Protection & Approach Drainage
- Section 7 Observations (Condition Report)
- Section 8 Structure Total Score

There are three types of entry required on Form BCS-1 and it is **essential** that all answer boxes are clearly filled in **on site at the time of the inspection**. The types of data are as follows:

1.1 SECTION 1

Bridge locations are included in the RHD Road and Pavement Inventory Manual and checked using GPS. The reading should be taken at the intersection of the centreline of the road with the outer face of the abutment nearest the starting chainage of the road. Readings should be taken at every structure during the BCS-1 survey to ensure that the structure and location are correctly recorded.



BCS-1 GPS Reading Point

1.2 SECTIONS 2 TO 6

Where specific dimensions or numerical information is required, the box is clearly marked with the word ***'specify'*** and an arrow ➔. Dimensions should be in metres to an accuracy of one centimetre (ie two decimal places), eg 9.77.

The remainder of the information required is either **'yes'** or **'no'**, where the inspector must insert the appropriate symbol ✓ or ✗**.**

The **actual** Year of Construction may be obtained from a marking on the bridge/culvert or from office records. If no information is available the inspector should estimate the year. The inspector must then tick ✓ the box marked *E* for **estimated** date or *A* for **actual** date, and cross ✗ the box, which is not applicable.

If there is a Load Restriction on the bridge/culvert then the figure should be entered in the appropriate box marked with an arrow ➔. If no restriction is found the box should be entered with the symbol ✗.

1.3 SECTION 7

The Condition Observations section of Form BCS-1 should be completed **for one element (column) at a time** working from the top of the sheet to the bottom. **During** the inspection of each element the inspector must 'circle' (with the symbol ❍) the number corresponding to the degree of the condition observation (major or minor) and **'cross through'** (with the symbol ✘) the remainder. If no problem exists for the observation then both numbers should be crossed through (✘).

Guidelines for assessing the degree of deterioration (Major/Minor) of each element are included on Page 4 of these Instructions.

1.4 SECTION 8

After the full inspection of the structure is complete the inspector must add up the **'circled'** numbers in each column and enter the figure as the **Element Total Score**. The total of all the **elements** is then calculated by adding up the numbers in the **row** and the result is entered in the final box in section 8 to give the **Structure Total Score**.

1.5 GENERAL

Where boxes are not applicable they have been blocked out to indicate that no entry is required. **All un-blocked boxes must be filled in** to avoid confusion when data is taken from the Form at the Zone Office for entry onto the computer database.

Any important additional notes and/or sketches should be placed on the back of Form BCS-1.

Examples might include the approximate skew angle of the channel under the deck if this is found to be excessive (greater than 20 degrees), the number of holes in the deck, the location of serious cracking or localised concrete failures. **At the end of the inspection the inspector must indicate if additional information has been added on the back of the Form by ticking the yes or no box accordingly and crossing the one which does not apply.**

When Form BCS-1 has been completed on site it must be signed and dated by the inspector, and his designation should be clearly indicated.

When Form BCS-1 is filled out completely it will provide the BMMS with precisely the information required, without having to ask questions to seek clarification.

2. PHOTOGRAPHS

Two photographs should be taken of each structure, one from each end, diagonally opposite and facing the bridge obliquely, ensuring that the full length of the bridge is within the photograph. Photographs may be digital where the facility is available, otherwise conventional film type will suffice. In this case the Bridge Number and Name, together with the date of the photograph, should be written on the back of each photograph and they should then be **stapled** to the corresponding Form BCS-1. The photographs will be computer scanned and stored on the BMMS at Sarak Bhaban in due course.

It is important that photographs to be taken at the same time as the survey, and it will be helpful for later identification if a separate record is maintained of photographs taken, together with the date of each.

3. FORM BCS-2

When all site work is complete the inspector should complete the Bridge/Culvert Report Summary Sheet Form BCS-2. The purpose of this sheet is to present a summary of the condition of all bridges and culverts inspected, together with the Bridge/Culvert Total Scores, and to allow the Sub-Divisional Engineer and Executive Engineer to make remarks on particular structures if required.

The Bridge/Culvert No. is entered as follows:

Road No. / LRPNo. + Offset (m)

An example would be **N5 / LRP022c + 337**

4. SUMMARY

Examples of the completed Forms BCS-1 and BCS-2 are attached to these Instructions, together with illustrations of Bridge/Culvert types for identification purposes.

Additional guidance may be found in Overseas Road Note 7, Volume 2, Bridge Inspector's Handbook, published by the Transport Research Laboratory (TRL), UK. This may be viewed online at -

http://www.transport-links.org/transport_links/filearea/publications/1_704_ORN%207%20Vol%202.pdf

As a general guideline, it should take approximately 30 minutes to inspect a single span bridge, and proportionately longer for multiple spanned structures.

5. GUIDELINES FOR ASSESSING THE DEGREE OF DETERIORATION

All observations of deterioration must be recorded as either **Major** or **Minor** in extent. It is very important to ensure that assessments of extent are uniformly recorded in all Divisions. The general criteria for **Major** deterioration are as follows :

Observation	Major Deterioration
Scouring	Underside of pile cap is exposed Visible depth of scour exceeds 1m Volume of scour exc bnnneeds $15m^3$
Leaning/Tilting	There is evidence of backfill material having been washed out Horizontal displacement at top measured with stringline exceeds 1 in 30 or maximum 150mm
Settlement	Bridge Approaches are average 100mm lower than the deck at a distance of 1m Vertical displacement of superstructure is clearly visible by eye. Vertical differential displacement of structure measured on a horizontal stringline exceeds 1 in 60, or 50mm over a length of 3.0m.
Obstruction	Obstruction cannot be removed by hand by local labour, and has to be carried out by contract or requires other special attention
Cracks	Cracks in concrete are clearly visible from a distance of 3m Maximum crack width in concrete exceeds 1mm Cracks in concrete occur in critical areas, e.g. under bearings, at beam mid-span. Any cracks in steelwork
Concrete Spalling	Soffit reinforcement is fully exposed over a single area exceeding $1m^2$ of deck or half width of beams
Damaged or Missing Sections	All structural members in concrete and steel All holes in concrete decks – All railing members
Missing Bolts	Structural joints

Any observations, which have been, made which do not meet the above criteria and conditions should be recorded as **Minor**.

6. STAFF & EQUIPMENT CHECKLIST FOR BRIDGE/CULVERT SURVEY

The Survey Team Leader will be the SDE or a nominated SAE, who will be assisted by at least one W/A. The team will be supported and assisted by a minimum of two flagmen to warn and control traffic.

For safety purposes all staff involved in the survey must wear coloured reflective jackets **at all times**.

The following equipment must be carried during the Bridge/Culvert survey:

- Bridge Condition Survey Forms (BCS-1) for the days work plus spares (Original Prints)
- Clipboard
- Pens
- Measuring Tape 30m
- Measuring Tape 3m
- String Line 30m
- Plumb Line 10m
- Straight Edge 3m
- Inspection Warning Signs 2 No.
- Flags 2 No.
- Reflective Safety Jackets 4 No.
- Camera (including spare film)

The Survey Team Leader will be responsible for checking that the equipment inventory is complete and that all items are in full working order prior to departure from the office.

RHD **BRIDGE/CULVERT INSPECTION REPORT FORM** | **BCS-1** | *2004*

1 Location

Zone	*Raishahi*	Circle	*Rajshahi*	Division	*Naogaon*	Sub-Division	*Naogaon*
Road No	*R-548*	Road Name	*Naogaon - Atrai Road*	LRP Name	*06 (a)*	GPS Lat. / Lon.	*24°45'37"* / *88°57'43"*
Structure Name	*Elsha Bari Bridge*	LRP + Offset (m)	*6 + 123*	Chainage (km)	*5.224*		

2 Structure Type (√ / X)

Box Culvert	X	RCC Bridge	X	Truss with RCC Slab	X	Bailey with Steel Deck	X
Slab Culvert	X	RCC Girder Bridge	√	Truss with Steel Deck	X	Bailey with Timber Deck	X
Arch Masonry	X	Steel Beam & RCC Slab	X	Truss with Timber Deck	X		
		PC Girder Bridge	X				
		PC Box	X				

3 Superstructure Details (specify)

No of Spans/Boxes	*3*	Span Lengths(m) →	*6.50 + 6.70 + 7.15*					Total Length →	*20.40*		
No of Beams	*9*	Year of Construction →	1962	E √	A X			Load Restriction (Tons) →	X		
Width (m)	*4.65*	Carriageway →	*3.80*	Sidewalk 1 →				Sidewalk 2 →	X		
Wearing Surface	√	X	Bitumen	X	Concrete	√	Nil	X			
Railing Type	√	X	RCC Post & Rail	√	RCC Solid	X	Masonry	X	Steel	X	Nil X

4 Substructure Details

Material (√ / X)				Type (√ / X)							Weep Holes
RCC	Steel	Earth	Masonry	Solid	Spill through	Column	Trestle	Pipe	Free	Fixed	
Abutment	X		X	√	√	X						√
Pier/Box Wall	X	X		√	√		X	X	X			
Wing Wall	X			√						X	√	√

5 Foundation Type (√ / X)

Abutment	Open	X	Piled	X	Well	X	Not Known	√
Pier	Open	X	Piled	X	Well	X	Not Known	√

6 Abutment Protection Existing (√ / X) X — **Approach Drainage Existing** (√ / X) X

7 Observation / Element

O X		Road Approaches	Channel	Railing	Truss	Deck	RCC Girder	Abutments	Piers / Box Walls	Wing Walls
Scouring	Major							~~500~~ X	~~300~~ X	~~300~~ X
	Minor							~~1~~ X	~~1~~ X	~~1~~ X
Leaning / Tilting	Major							~~500~~ X	~~300~~ X	~~300~~ X
	Minor							~~1~~ X	~~1~~ X	~~1~~ X
Settlement	Major	~~50~~ X						~~500~~ X	~~300~~ X	~~500~~ X
	Minor	~~1~~ X						~~1~~ X	~~1~~ X	~~1~~ X
Obstruction	Major		~~30~~ X							
	Minor		~~1~~ X							
Cracks	Major				~~500~~ X	500	500	30	30	30
	Minor				~~1~~ X	1	1	1	1	1
Concrete Spalling	Major					30	30	~~30~~ X	~~30~~ X	
	Minor					1	1	1	1	
Damaged or Missing Sections	Major			30	~~500~~ X	30	500			30
	Minor			1	~~1~~ X	1	1			1
Missing Bolts	Major				~~30~~ X				~~30~~ X	
	Minor				~~1~~ X				1	
Element Total Score		*0*	*0*	*30*	*0*	*560*	*1030*	*30*	*30*	*60*

8 Structure Total Score *1740*

Note All tick boxes to be completed as indicated with ✓ (yes) or ✗ (no) or ○ or ✗ (score)

All specify boxes to be completed with required details or dimensions in metres

Additional Information and/or Sketch to be placed on back of this page if required ~~yes~~ ✓ no

Inspected by *Md. Kamruzzaman / A. E (DDC)* (full name / designation) Date *20. 07. 04*

RHD **Bridge/Culvert Inspection Report Summary** **BCS-2**

Zone	Rajshahi	Circle	Rajshahi	Division	Naogaon	Sub-Division	Naogaon

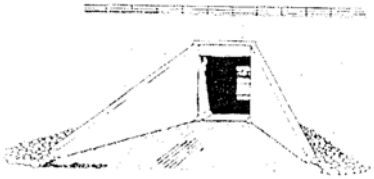
Bridge / Culvert No	Approaches	Channel	Railing	Truss	RCC Slab	RCC Girder	Abutments	Piers / Box Walls	Wing Walls	Total Score	Action Recommended	Estimated Cost (Lac Taka)
N5 / LRP022c +	0	0	30	0	560	1030	30	30	60	1740	Railing replace	246
											D/S replace	
											Girder replace	
											Abutment replace	
											Pier replace	
											Wingwall replace	

Prepared by Md Kamruzzaman (DDC) *full name*
Date 24.07.04

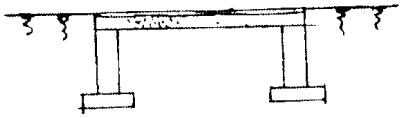
Recommended by Md Rezaul Karim (DDC) *full name*
Date 26.07.04

Approved by Shahidul Islam EE *full name*
Date 15.08.04

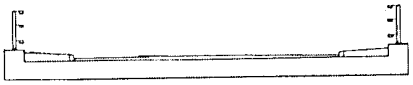
Identification of Bridge and Culvert Types for BCS-1 Survey



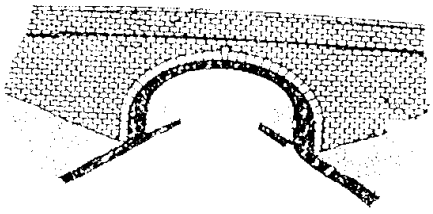
Box Culvert



Slab Culvert



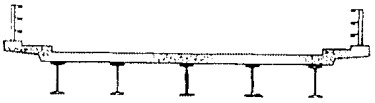
RCC Bridge



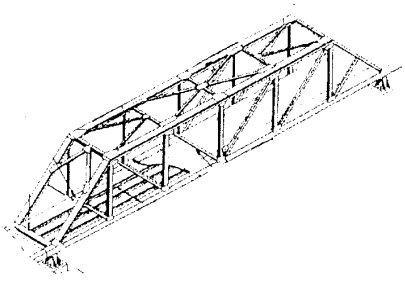
Arch Masonry

RCC Girder Bridge (small spans)

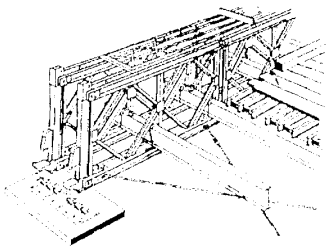
PCC Girder Bridge (large spans)



Steel Beam & RCC Slab



Truss (with steel deck or RCC slab)



Bailey (with steel or timber deck)

APPENDIX 2

FORM BCS-3

and INSTRUCTIONS

PRELIMINARY BRIDGE/CULVERT REHABILITATION ASSESSMENT

BCS-3 _____

1 LOCATION

Zone		Circle		Division		Sub-Division	
Road No		Road Name		LRP Name		GPS	N / E
Structure Name		LRP + Offset (m)		Chainage(km)			

2 SUMMARY OF PROPOSED REHABILITATION WORKS

Element	Repair			Replace/New			Remarks
	No	m	m2	No	m	m2	
Approaches							
Guide Posts							
Slope Protection							
Toe Wall							
Railing							
Sidewalk							
Deck							
Concrete Beam							
Steel Beam							
Truss							
Bailey							
Abutment							
Pier							
Wing Wall							
Pier Cap							
Bearing Seat							
Bearing							
Expansion Joint							
Pile Cap							
Foundation Protection							

3 SUMMARY OF OVERALL BRIDGE CONDITION

Category	Condition	Recommended by Name & *signature*	Accepted by Name & *signature*
1	Structure is satisfactory		
2	Structure requires repair of some members		
3	Structure requires replacement of some members		
4	Structure requires total replacement		
5	Structure is in danger of imminent collapse		

4 ROUTINE & PERIODIC MAINTENANCE ASSESSMENT

Category	Condition	Recommended by Name & *signature*	Accepted by Name & *signature*
1	Satisfactory		
2	Not Satisfactory		
3	Has not been undertaken		

5 LENGTH OF SHORTEST DIVERSION

_____ km

6 ASSESSMENT COMPLETION

Report prepared by *full name* _____ Date _____

Report accepted by *full name* _____ Date _____

Additional Information and/or Sketch to be placed on back of this page if required yes no

INSTRUCTIONS FOR COMPLETING FORM BCS-3

1. FORM BCS-3

A separate Form BCS-3 is to be completed for each bridge and box culvert structure, **excluding circular pipe culverts**, along the length of the road being inspected.

The purpose of Form BCS-3 is to provide sufficient information to make a preliminary estimate of the cost of rehabilitation of the bridge in question. This information will be collected for all damaged structures, and will be used for budgetary purposes in future project formulation and to prioritise rehabilitation programmes. The objective of the BCS-3 surveys is to identify the overall budget cost for bringing the entire bridge network back to a state of serviceability and maintainability.

For the purpose of this inspection a **box culvert** is defined as a structure which is a box form (single or multiple cell) in cross section, which contains a ground slab, and where the floor, walls and deck are of monolithic construction, i.e. there are no joints or bearings. A **slab culvert** is defined as a structure comprising a slab without girder(s) supported on abutments. Any other structure will be classed as a **bridge**.

Form BCS-3 records the following details of the structure :

- Section 1 Location
- Section 2 Preliminary assessment of the overall scope of works necessary to bring the structure back to a state of serviceability and maintainability
- Section 3 Summary of the Overall Bridge Condition
- Section 4 Routine & Periodic Maintenance Assessment
- Section 5 Length of Shortest Diversion
- Section 6 Acceptance of the Assessment by the Executive Engineer

A completed Form BCS-3 is included at the end of these instructions.

1.1 SECTION 1

Road location details **must** be precisely the same as those on the corresponding Bridge Condition Survey Form BCS-1, a copy of which should be held on file at the Sub-Division and Division offices. The Sub-Divisional Engineer should arrange for Section 1 of Form BCS-3 to be completed from office records before starting out on the survey. (SDE should also carry sufficient spare BCS-3 forms in case of loss or damage on site of the prepared form).

1.2 SECTION 2

Section 2 information will enable RHD to determine the **order of cost** associated with each structure. **Estimated quantities** are to be entered in the **Repair** or **Replace/New** column for each **Element**, and these may be derived from actual measurement or alternatively by pacing or other method of approximation. If the element is in satisfactory condition then the box must be completed with a tick (✓).

Where boxes are not applicable they have been blocked out. **All un-blocked boxes must be filled in** to avoid confusion when data is taken from the Form at the Zone Office and later at Head Office for entry onto the computer Bridge Maintenance Management System (BMMS) and subsequent calculation of rehabilitation budget costs.

The remark column should be used to report specific observations and possible suggestions for the most appropriate type of repair.

1.3 SECTION 3

The purpose of Section 3 is for the Sub-Divisional Engineer to indicate by his signature the overall condition of the structure. The Executive Engineer must either accept the recommendation of the SDE or propose an alternative condition by signature in a different category.

1.4 SECTION 4

In Section 4 the Sub-Divisional Engineer should indicate his assessment of the condition of routine and periodic maintenance works at the time of the inspection. The Executive Engineer must either accept the recommendation of the SDE or propose an alternative condition by signature in a different category.

1.5 SECTION 5

In Section 5 the Sub-Divisional Engineer should enter the shortest diversion route by road for traffic if the structure was not passable. This does not include bypassing the structure when there is little or no water in the channel. The unit of measurement must be indicated by placing a circle over the appropriate unit, i.e. km or miles, and a cross through the other one.

1.6 SECTION 6

Section 6 should be completed and signed by SDE and EE on completion of the Form.

Any important additional notes and/or sketches should be placed on the back of Form BCS-3.

Examples might include the approximate skew angle of the channel under the deck if this is found to be excessive (greater than 20 degrees), the number of holes in the deck, the location of serious cracking or localised concrete failures. **At the end of the inspection the inspector must indicate if additional information has been added on the back of the Form by ticking the yes or no box accordingly and crossing the one which does not apply.**

Guidelines for assessing whether repair or replacement of each element is necessary are included at the end of these Instructions.

When Form BCS-3 is filled out completely it will provide the Bridge Unit with precisely the information required to prepare a Rolling Rehabilitation Programme, without having to ask further questions to seek clarification.

2. GUIDELINES FOR ASSESSING REPLACE OR REPAIR

Element	Unit	Rehabilitation Indicators	
		Repair	Replace / New
Approaches	m2	Approach ramp does not run smoothly onto the deck, causing shock/impact load onto the deck member. Observe three heavy trucks/buses passing the joint, and assess the severity of the impact.	
Guide Posts	No		Deck is narrower than embankment crest width. Minimum 4 No concrete posts required at each corner.
Slope Protection	m2	Any serious erosion of the embankment should be given suitable protection.	
Toe Wall	m	Cracking Spalling Honeycombing Open joints / Missing bricks	Scour/erosion of the embankment
Railing	m	Minor cracking Localised spalling Honeycombing	Post and/or rail is damaged or missing
Sidewalk	m	Minor cracking Localised spalling Honeycombing	Damaged or missing sections
Element	**Unit**	**Rehabilitation Indicators**	
		Repair	**Replace / New**
Deck	m2	Minor cracking Minor spalling - less than 1m wide Honeycombing	Missing sections Major spalling - exceeds 1m wide Extensive open cracking

Concrete Beam	m	Minor cracking Localised spalling Honeycombing	Loss of section due to spalling - reinforcement exposed
Steel Beam	m	Minor cracking	Excessive cracking Cross-section reduced by more than 20% due to corrosion
Truss Bailey	m	Minor rusting or corrosion	Damaged or missing sections / members Cross-section reduced by more than 20% due to corrosion
Abutment Pier Wing Wall	m2 No	Cracking Spalling Honeycombing Open joints / Missing bricks	Leaning in excess of 1 in 30 Differential settlement and rotation about foundation
Pier Cap	m2 No	Cracking Spalling Honeycombing	
Bearing Seat	No	Cracking or Spalling at bearing plinth or seat	
Bearing	No		Bearing is missing, has failed or is damaged
Expansion Joint	m	Edge Spalling Steel angles damaged, missing or loose	Missing components
Pile Cap	m2	Damaged sections Honeycombing	
Foundation Protection	m2	Scour exceeds 1m at pile cap or foundation	

PRELIMINARY BRIDGE/CULVERT REHABILITATION ASSESSMENT

BCS-3

1 LOCATION

Zone	Rajshahi	Circle	Rajshahi	Division	Naogaon	Sub-Division	Naogaon
Road No	R - 548	Road Name	Naogaon - Atrai Road	LRP Name	06 (a)	GPS	N 24°45'37" / E 88°57'43"
Structure Name	Elsha Bari Bridge	LRP + Offset (m)	6 + 123	Chainage(km)	5.224		

2 SUMMARY OF PROPOSED REHABILITATION WORKS

Element	Repair			Replace/New			Remarks
	No	m	m2	No	m	m2	
Approaches			X				
Guide Posts				16			For narrow width.
Slope Protection			X			X	
Toe Wall		X			X		
Railing		X			40.70		Railing damaged.
Sidewalk		X			X		
Deck			X			95.00	Deck Slab Damaged.
Concrete Beam		X			61.05		Major spalling, re-bar exposed
Steel Beam		X			X		
Truss		X			X		
Bailey		X			X		
Abutment			X	2			Major cracks.
Pier			X	2			Major cracks
Wing Wall			X	4			Major cracks
Pier Cap			X				
Bearing Seat	X						
Bearing				X			
Expansion Joint		X			X		
Pile Cap			X				
Foundation Protection			X			X	

3 SUMMARY OF OVERALL BRIDGE CONDITION

Category	Condition	Recommended by Name & *signature*	Accepted by Name & *signature*
1	Structure is satisfactory	X	
2	Structure requires repair of some members	X	
3	Structure requires replacement of some members	X	
4	Structure requires total replacement	✓	
5	Structure is in danger of imminent collapse	✓	

4 ROUTINE & PERIODIC MAINTENANCE ASSESSMENT

Category	Condition	Recommended by Name & *signature*	Accepted by Name & *signature*
1	Satisfactory	X	
2	Not Satisfactory	✓	
3	Has not been undertaken	X	

5 LENGTH OF SHORTEST DIVERSION

9.7 km

6 ASSESSMENT COMPLETION

Report prepared by *full name* Md. Kamruzzaman (DDC) Date 26.07.04

Report accepted by *full name* _____ Date _____

Additional Information and/or Sketch to be placed on back of this page if required yes ✓ no