



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

BRIDGE CONDITION SURVEY MANUAL



September 2005

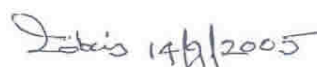
FOREWORD

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.



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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 defects¹. 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 span	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 MAINTENANCE, 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.