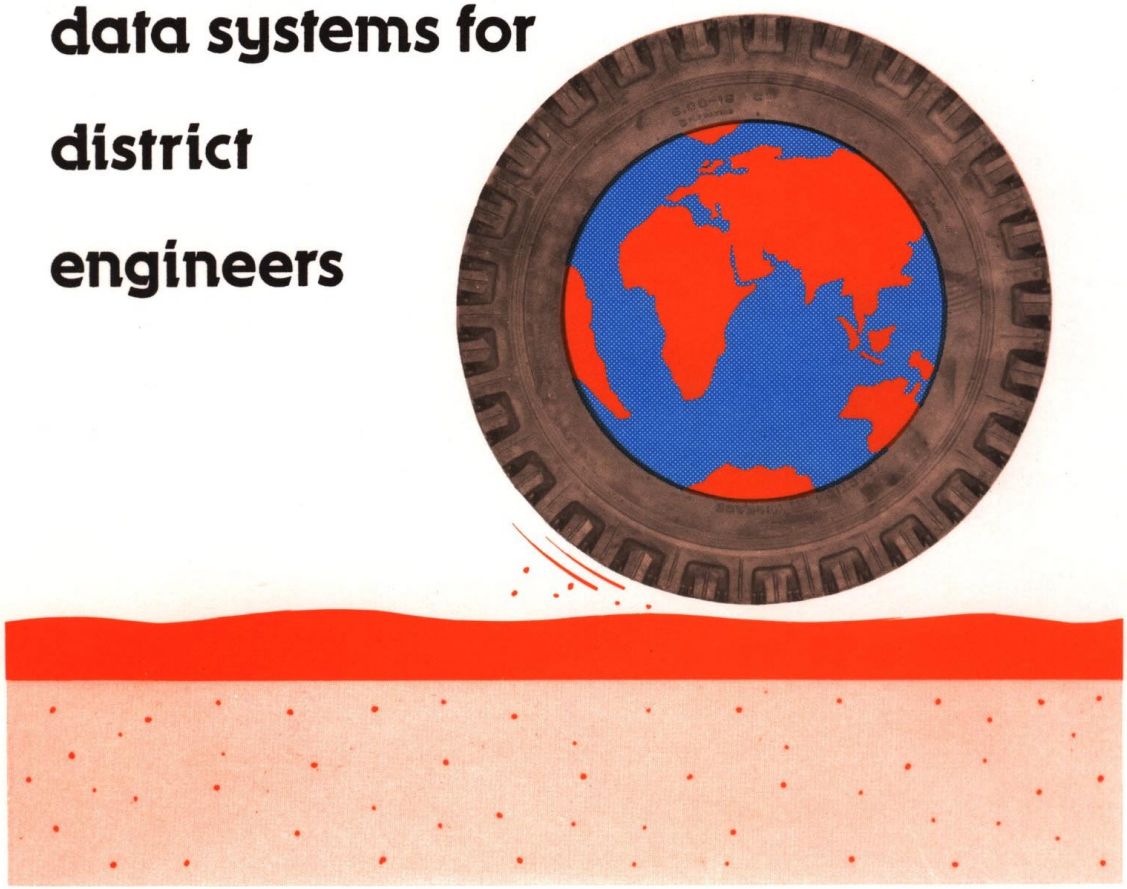
OVERSEAS ROAD NOTE 7

Vol 1

A guide to bridge inspection and data systems for district engineers



Overseas Unit
Transport and Road Research Laboratory · Crowthorne Berkshire United Kingdom

Transport and Road Research Laboratory Overseas Unit

Department of Transport
Overseas Development Administration

Overseas Road Note 7- Volume 1

A guide to bridge inspection and data systems for district engineers

Overseas Unit
Transport and Road Research Laboratory
Crowthorne Berkshire United Kingdom
1988

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OVERSEAS ROAD NOTES

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1 INTRODUCTION

1.1 The purpose of this note is to provide a district engineer with guidance on the establishment and operation of an effective bridge and culvert record system.

1.2 The two main elements of this programme are:
- the bridge data and recording methods.
- bridge inspection.

THE PURPOSE AND USES OF BRIDGE RECORDS

1.3 Effective management of bridges requires the regular collection and recording of accurate bridge condition data. These data, together with design and construction records, are used to:

- prepare maintenance and replacement programmes.
- identify design weaknesses.
- prepare itineraries for unusual vehicles.
- maintain a current road inventory.

1.4 A district engineer may be required to prepare a bridge replacement or upgrading programme, taking into account industrial and agricultural development projects planned for the near or mid-term future. To do this, accurate data are required on the current condition of each bridge and the rate of deterioration.

1.5 Design weaknesses can be very costly. Information from district engineers to the authority's bridge designers, detailing faults or material failures, etc is the only way of preventing the continuation of design faults in new bridges

1.6 Current bridge data are also required for the preparation of suitable routes for unusually high, wide, or heavy loads. There is pressure in some countries to increase the size or weight of vehicles generally permitted on the highway, or on certain routes. The effect of such changes in legislation can only be predicted using accurate, current bridge data

1.7 As part of the road inventory, bridge data are important to local and national government planners, police, armed forces, emergency services, transport operators and private developers of natural resources such as timber and minerals.

DATA GATHERING AND RECORDING

1.8 A complete and regularly updated record of all bridge data on computer, with appropriate programmes for different types of data retrieval may be a long-term aim, but this is not always suitable or desirable. A simple card based system can be very effective, even when it is not yet complete.

1.9 Chapter two of this note describes permanent and changing bridge records and recording systems. Chapter three describes the inspection of bridges, both where engineering staff levels are adequate and the alternative found in many countries, where there is a shortage of qualified bridge engineers. Under the latter circumstance it is recommended that less qualified employees should be trained to carry out routine inspections, using the pro-forma provided in Appendix C.

1.10 The companion volume to this note, the Bridge Inspector's Handbook, (TRRL Overseas Unit 1988), has been compiled specifically for the instruction of these inspectors, and to be used for reference by them during the inspection.

2. BRIDGE RECORDS

2.1 A record system must suit the specific requirements of the authority it is intended to serve. For this reason the system outlined here should be considered as a source of ideas, rather than as a set of rules. It is recognised that the existing records may not be complete and it may be impossible for the district engineer, because of the limited resources available to him, to assemble an ideal operational system within a short period of time. Appendix A is a guide intended to assist in establishing a new inventory, or modifying an existing one.

TYPES OF RECORD

2.2 There are four primary elements in the bridge record system:

Bridge inventory	One record card per bridge containing all basic information about the bridge.
Drawings and calculations	Construction and as-built drawings together with design calculations.
Inspection reports	All inspection reports are retained to record the changes in each bridge over time.
Maintenance records	Estimates, drawings of repairs, cost records and details of routine maintenance, such as painting etc.

2.3 In addition to these primary elements, it is appropriate to include some of the bridge data on the road inventory as described in Overseas Road Note I (TRRL Overseas Unit 1987). The type of details to be included on the road inventory are.

Chainage along the road (kilometres)
Bridge name.
Bridge number.
Over/under (name of obstacles, eg stream, road crossed).
Load restriction.
Width restriction.
Height restriction.
Total bridge length.
Number of spans.
Type of superstructure.
Alternative crossing (name, number, location, type, capacity), where available

THE BRIDGE INVENTORY

2.4 This is the basis of the record system and frequently takes the form of a series of cards, each of which records the data for a particular bridge which does not change over time. The originals of the cards are held at the headquarters bridge department, and each district office has copies of the bridge cards for the area which it covers.

2.5 Most district engineering offices will have an established format for the bridge record card. They will need only to ensure that they cover adequately all the aspects mentioned here. Those setting up a new system will find useful notes on the preparation of a bridge inventory and the sample record card, in Appendix A.

2.6 Although the data on the bridge inventory have been referred to as unchanging, the bridge record cards will require updating if:

- major maintenance is carried out which modifies the structure, when drawings must also be modified to show changes.
- an analysis for the passage of an abnormal vehicle is carried out.
- following an inspection, it is decided that a bridge has deteriorated to a point where its capacity must be reduced.
- a bridge is widened or strengthened, when drawings must also be modified and the bridge record card may need renewing.
- a new or replacement bridge is built, when new drawings and a new bridge record card must be produced.

2.7 It must be remembered that some of the data on the bridge record card are copied onto the road inventory If the bridge record card is updated, the matching data on the road inventory should be updated at the district office and at headquarters.

DRAWINGS AND CALCULATIONS

2.8 The authority's bridge department usually stores bridge drawings and calculations at headquarters. When they are needed, copies are sent to the district offices. Unfortunately, the original drawings and calculations of many older bridges may no longer exist. It should also be borne in mind that the reliability of drawings and calculations is variable. The different types of drawings, and their potential shortcomings are as follows:

Standard drawings.

Where a bridge is built to a standard' design it is very likely that the structure as-built will vary considerably from the drawings. Unrecorded alterations on site are likely in order to accommodate site conditions.

Drawings known to be original design drawings but not marked 'as-built'. Some changes during construction are possible.

'As-built' drawings.

These will show the bridge as originally built, but may not show modifications since completion.

'As-built' drawings with all changes since completion shown and dated. These are the most reliable.

Drawings based purely on a site inspection. (Where no original drawings exist). These should be dimensionally accurate, but are likely to be incomplete Reinforcement details, for example, will almost certainly be missing.

INSPECTION REPORTS

2.9 A recommended form of inspection report is provided in Appendix C. When a report has been completed in the field, it should be used to provide a record of defects over a period of time.

MAINTENANCE RECORDS

2.10 In most maintenance organisations, bridge maintenance records are kept using a simple chronological filing system with one file per bridge. This is perfectly adequate, as working through the file will tell the history of all work carried out on the bridge.

2.11 The maintenance record should include routine correspondence and, for each repair, should include:

Estimates of work proposed.
Details of work carried out.
Date of completion of repair.
Supervisors' quality control reports.
Actual cost of repairs.

2.12 Where significant repairs are carried out, the drawings and calculations used for the repair work should be copied to the bridges department records and both sets of bridge record cards (headquarters and district) amended to show the repair.

2.13 Some authorities keep bridge maintenance records on files which cover more than one bridge, and perhaps all the bridges on a long section of road. This is Rot recommended, since it makes it difficult to follow the history of any one bridge. Although the one-file-per-bridge system involves more files, mistakes are less likely to occur.

COMPUTERS

2.14 A bridge inventory may contain a large amount of data, and a variety of organisations may need information derived from it. Computers are a powerful tool for assisting in the handling of data. Proprietary database systems exist for most modern computers. Such a system could form the basis of a bridge record system but would still require additional software development. It must be stressed that all software development is both expensive and difficult.

2.15 The costs and benefits of implementing a computer based system should be evaluated before its introduction. Proprietary systems, if available, are likely to provide the cheapest solution, but the assistance and advice of professional consultants should always be sought at a very early stage.

2.16 In planning such a bridge record system, it is necessary to decide which bridge data are to be included. Possible alternatives are:
The inventory only (bridge record cards)
The inventory and inspection reports.
The inventory, inspection reports and maintenance records.

2.17 The ultimate file sizes and software required should be estimated initially, to enable decisions concerning appropriate development and or equipment to be made.

2.18 Two principal systems exist for computer equipment:

A central computer with links to district offices.
A microcomputer at headquarters and in each district office.

2.19 A central computer is the best option in terms of general access to one central file. It resolves the problem of ensuring that all users are dealing with current and consistent data. Microcomputers, however, may be cheaper, and are less vulnerable to unreliable electricity supplies, telecommunications problems, and hardware failure.

THE INVENTORY (BRIDGE RECORD CARDS)

2.20 This is the simplest and possibly the most useful element of the bridge records to record on computer. An inventory data base has a wide variety of potential users with widely different requirements. Some examples of queries received from users might be:

'List all bridges with load limits less than lOT.'
'List all bridges on the N23 road which are too narrow for a 4.5 metre wide load.'
'List all bridges in the National Park.'
'List all bridges under the control of the '11am' maintenance authority.'
List all bridges built by 'Barton Construction' between 1970 and 1976.'
'List all bridges in an area bounded by the following map references.

INSPECTION REPORTS AND MAINTENANCE RECORDS

2.21 If inspection and maintenance data are computerised, it will still be necessary to keep copies of inspection and maintenance reports. Some of the data on these reports cannot readily be computerised (sketch maps, references etc.). These systems have a narrower application than the basic bridge record system, as the data are concerned mostly with maintenance. The system could provide the basis for a series of regularly updated reports, which would be a valuable management tool for the district engineer. Reports could include:

Regular summaries of urgent work highlighted by inspections.

Summaries, defect by defect, which may highlight incorrect maintenance techniques, inappropriate materials, etc.
A maintenance diary of work needed and work carried out, listing for example, bridges inspected this month, bridges to be inspected next month, etc.

Work schedules for different gangs, provided either on an area by area basis, or a work type by work type basis.

COMPUTER FIELD RECORDING

2.22 Microcomputer-based loggers are not recommended for bridge inspection. When an inventory is very well established and all inspectors are familiar with its operation, it is possible that such a system could be considered, provided suitable training is available and equipment can be maintained. Even then, such a system could not fully replace the manual one recommended here.

3 BRIDGE INSPECTION

3.1 In some districts there will be few bridges and die district engineer may be able to carry out the inspection work himself, or he may have other qualified staff to do the inspection on his behalf. In this case, the organisational aspects covered in this chapter will be of interest, but not those parts referring to unqualified inspectors. However, the inspection report form presented in Appendix C is a comprehensive list of items to check, and can be used by all inspectors, whatever their experience.

THE BRIDGE INSPECTOR

3.2 Where there are many bridges and few bridge engineers, the district engineer has the choice of either:

- making infrequent inspections himself, or
- entrusting routine general inspections to others, and concentrating his own time on larger difficult bridges, and where die routine reports suggest that there are problems.

3.3 Staff suitable for routine bridge inspection are likely to be already in the employ of the district engineer. They may be junior engineers, technicians, or road foremen. Both older, experienced road men and younger, better qualified technicians have performed well in field trials of the procedures advocated here.

THE BRIDGE INSPECTOR'S HANDBOOK

3.4 Volume two of this note, the Bridge Inspector's Handbook, has been compiled specifically for inspectors who are not engineers, and who may not have English as their first language. It has been written in simple terms to teach the basic information needed to understand the task, and to guide the inspector through his work.

3.5 Part [1] of the handbook gives instruction on bridges. It can be used for formal, classroom instruction or private reading.

3.6 Part [2] guides the inspector through the report form presented in Appendix C of this note, item by item, explaining how relevant measurements or observations are made. it can be carried and used for reference, if required, during an inspection

THE ROLE OF THE ENGINEER

3.7 The purpose of the general inspection is to provide the engineer with detailed information about the condition of each bridge to enable him to:

- assess maintenance requirements.
- determine if a more detailed inspection is required.

3.8 He should therefore:

- ensure that each inspector fully understands his duties and responsibilities.
- ensure that each inspector has access to all necessary equipment, including safety equipment.
- ensure that prior to an inspection, the inspector is given the necessary documents. (see paragraph 3.30).
- occasionally carry out inspections with each inspector; this will help ensure consistent marking by inspectors.
- read each inspection report carefully so that the significance and possible inter-dependence of isolated defects can be assessed. For example, the inspector may have noted cracking in the road approaches, and elsewhere he may have noted damage to the abutment ballast wall. These maybe unconnected faults, but together they may indicate forward movement of the abutment, the damage to the ballast wall having been caused by thrust against the deck.
- be prepared to seek expert advice, particularly if the report indicates that the bridge may have potentially serious defects. District engineers will rarely have sufficient knowledge or experience to assess me importance of all defects reported
- ensure that the records are updated.
- determine what maintenance is required, categorise priorities, and prepare work schedules.

THE ROLE OF THE INSPECTOR

3.9 The inspector must record as clearly as possible any defects found at a bridge so that the district engineer may decide on the appropriate action

3.10 The inspector should *not,* in general, have to take decisions beyond giving his view of the severity and extent of problems he finds, if he is not a qualified engineer. Leaving any significant decisions to the inspector could lead to serious mistakes and places an unfair responsibility on him.

3.11 The inspector should be given specific responsibilities according to the discretion of the engineer.

If the inspector finds a defect which he believes is so serious that the bridge may collapse, he should be empowered to close the bridge immediately. The inspector may of course be wrong, but closing a bridge unnecessarily is better than allowing it to collapse and possibly cause injury or loss of life.

The inspector may be empowered to order or undertake specific maintenance tasks. Typically these tasks could include clearance of blocked drains or movement joints; minor repairs to parapets; repairs or replacement of signs; removal of debris in the river; and repairs to damaged gabions, rip-rap or stone pitching, etc. The defects should still be recorded on the report form, and noted as rectified.

SELECTING INSPECTORS

3.12 In selecting suitable personnel for training as bridge inspectors, me district engineer should look for the following qualities:

RELIABILITY

3.13 The engineer must be able to depend on his inspectors to carry out a task according to instructions given, and to inform the engineer promptly ofany unusual circumstances.

TECHNICAL SKILLS

3.14 Although inspectors may not necessarily have any formal technical training, they should possess practical experience of construction. They must be able to observe and measure accurately and to draw simple sketches of any deficiencies found.

LANGUAGE SKILLS

3.15 Inspectors must be able to read the simple technical English, or other language, used on the inspection report; they must also be able to write clearly in the same language.

HEALTH

3.16 Inspectors should be physically fit, so they are able to inspect difficult places without taking unnecessary risks; it is advisable to check that the inspector has good eyesight, as he will be required to detect small defects in conditions of varying light and shade.

ATTITUDE

3.17 Good inspectors are methodical in their work and must be willing to inspect items thoroughly and critically; they must also be continually aware of safety so that they do not take risks and do not endanger the safety of others.

TRAINING INSPECTORS

3.18 Training of inspectors is crucial to the successful operation of a bridge inspection system and should be tailored to the ability and experience of the trainees. Training should, ideally, be carried out initially by a skilled instructor from the authority's training school. The Bridge Inspector's Handbook can be used as a textbook for formal classroom instruction of inspectors.

3.19 The next step in training an inspector is for the district engineer or an instructor to go to several different bridges with the trainee inspector, or a group of trainee inspectors, and to go through the inspection step by step. When completing the inspection report form, an inspector must make decisions about How bad?" and “How much?", and on-site training periods are needed to teach the inspector how the engineer would answer these questions and to develop his note-taking and sketching skills. As the inspector will probably be dealing with several different types of bridge, he should inspect at least one of each type with an engineer before working on his own.

INSPECTION FREQUENCY

3.20 The district engineer is responsible for establishing the frequency of inspection of bridges under his management, although his highway authority may issue guidance. No fixed rules can be given, but if the bridge inspection is carried out by a road maintenance foreman, the engineer should consider the benefits of coordinating the inspection of roads and bridges.

3.21 How often a particular bridge should be inspected depends on a number of factors. These include: age, type of construction, traffic volume and type, structural condition, climate, and availability of resources for carrying out inspections. For example, an old timber bridge now carrying heavy traffic and known to be in a poor condition should be inspected much more frequently than a new short span concrete slab bridge. In an area known to suffer extremely heavy seasonal rainfall, it may be sensible to carry out an inspection both before and towards the end of each wet season, even if only those parts of the bridge likely to be affected by flood are inspected.

3.22 Limited human resources are likely to be a serious constraint on how often bridges can be inspected. However, an appropriate frequency can be based on the use of different types of inspection, as described in paragraphs 3.23 to 3.29.

TYPES OF INSPECTION

3.23 Inspections can be divided into four basic types:

Informal
General
Major
Special

INFORMAL INSPECTIONS

3.24 All personnel involved with bridge maintenance (particularly the inspectors) should be encouraged to 'keep their eyes open' whilst travelling around, and to report anything unusual about any bridge. Telling inspectors and engineers to 'stop and have a general look when crossing a bridge' is the best way to obtain progress reports on potentially serious defects, such as a river changing its path and undermining an abutment in the interval between routine inspections.

GENERAL INSPECTIONS

3.25 This is the type of inspection that can be accomplished by a less experienced inspector using the pro forma in Appendix C. General inspections should be carried out on a routine bases at least once a year, preferable at a time of low water to permit inspection of the substructures, the river bed and any bed protection. In areas where there is a very pronounced wet and dry season it is recommended that, as well as the inspection during the dry season, an inspection for flood damage is carried out at the end of the wet season.

MAJOR INSPECTIONS

3.26 Major inspections should also be carried out on a regular basis, although less frequently than the general inspections, to provide more detailed reports on the structures than the general inspections. For example, at a major inspection all bolts on a steel structure might be checked for tightness, whereas at a general inspection, the engineer may ask the inspector to check bolts only at selected joints. If possible, the district engineer should arrange for a qualified engineer to visit the bridge during a major inspection, or go himself, to ensure that the inspector's assessment of problems is the same as his own. Parts of Appendix C may also be used for major inspections.

3.27 The time interval between major inspections for a particular bridge should be established initially by an engineer, based on the age, condition and construction materials employed. From the rate of deterioration which he subsequently observes, an optimum time interval can then be determined. If there are a number of bridges of one type and age, a common time interval for the group can be used.

SPECIAL INSPECTIONS

3.28 Special inspections may be needed either when a bridge is at risk, or when there is a problem which requires further investigation. Additional risk may derive from the bridge being in poor condition, or from a series
of unusual loading events. The frequency of special inspections can vary from daily to six-monthly, and the inspection report form can be used in all or in part. Some examples of when this type of special inspection may be required are: -

- A bridge in poor condition, but considered safe for a relatively short time, is due for reconstruction in 2 or 3years' time.

- A low capacity bridge on a minor road which is normally adequate, but has to carry diverted heavy traffic when a bridge on the main road is closed

- An old steel bridge which is believed to be at risk from fatigue due to increases in traffic volume and vehicle weight, in this case, the inspector concentrates on the fatigue risk areas.

- A bridge which has been damaged by a major flood, but immediate repair is prevented by a continuing high water level; inspection might need to be daily in this case.

- Low cost, temporary structures.

3.29 Sometimes, during a general or major inspection, a problem is discovered whose cause is not immediately obvious. It may then be necessary to carry out a further special inspection in order to investigate the cause of the problem. Often this will involve inspection by experts, and specialised materials sampling and testing. In this case, a special report.

will be prepared, not using the standard inspection report form. Examples of situations when this type of special inspection is required are:

Paint on a repainted steel structure is showing signs of premature deterioration.

'Pop-outs' and 'map-cracking' on a concrete structure.

Cracking of prestressed concrete beams.

ORGANISING THE INSPECTION

3.30 The district engineer should supply the inspector with the following documents prior to undertaking an inspection:

Appropriate parts of a blank: inspection report form (Appendix C).

A copy of the previous inspection if any.

A copy of the bridge record card.

A list of maintenance work that has been completed since the last inspection.

3.31 The district engineer uses the inspection report form to:
- instruct the inspector to inspect a particular bridge.
- transmit any special instructions to the inspector.
- receive and record inspection data.
- receive any urgent notes from the inspector.

3.32 When the inspection of a bridge is due, the district engineer, or a member of his staff, compiles sufficient copies of the appropriate pages of the form. The form page numbers and the required number of each page are recorded on the bridge record card. Any sections of a page which are not required should be crossed out.

3.33 The following sections of the first two pages should be filled in **before** the form is given to the Inspector.

Page 1

The identification and location details, abstracted from the bridge record card.

Any special instructions to the inspector.

Page 2

The construction details, abstracted from the bridge record card.

Details of services abstracted from the bridge record card.

Details of signs abstracted from the highway signs inventory, or the bridge record card.

3.34 The identification and construction details enable initial identification of the correct bridge. By checking each of the construction details at every inspection, the inspector reduces the risk of confusion between similar bridges. This risk cannot be overstated. It is very easy, even for experienced bridge engineers, to be confused between two similar bridges.

3.35 Re-reading the construction details will help the inspector understand the structural principles of the bridge:
this is particularly true of 'foundation type' and 'movement'. Such an understanding will greatly assist him in properly completing the inspection report.

3.36 The sketch on page one of the form is for two purposes:

It enables the inspector to mark points of particular interest, eg an area of scour.

It helps to establish a reference system if the inspector records adjacent town names.

3.37 It is vital that a clear reference system is used in reporting, if the district engineer is to understand which part of the bridge is referred to in each part of the report.
This point must be strongly emphasised to each inspector.

3.38 The inspector should be encouraged to make additional notes and sketches or take photographs. These should be referenced in the final column. Very brief notes may be written in this column.

3.39 The district engineer should review the inspection report as soon as possible after submission by the inspector. He should ensure that he understands any notes or sketches and that the form has been properly completed. Whenever a potentially serious problem has been reported, the district engineer should instigate the appropriate action without undue delay and inform the inspector that he has done so.

Inspectors' enthusiasm and commitment will be greatly improved if a quick response results from his efforts.

MAJOR OR UNUSUAL BRIDGES

3.40 Major bridges need special consideration for the following reasons:

They represent a large capital investment.

The collapse of a major bridge would cause an unacceptably long disruption to traffic since the design and reconstruction of a major bridge is a long process.

The inspection of a major bridge or a bridge of unusual construction, eg moving bridges, is beyond the technical

capability of an unqualified inspector. Such structures must be inspected by an engineer with sufficient relevant experience.

3.41 Major or unusual bridges are outside the scope of this Note. Inventory systems must, of course, cover bridges of all types, but a major or unusual bridge will need a special version of the bridge record card and the inspection report. The guidelines in this Note on bridge record cards and inspection reports may assist the engineer in preparing such special versions.

4. REFERENCES

Bridge Inspector's Handbook.
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Maintenance techniques for district engineers.
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Overseas Road Note 2.
Crowthorne, Berkshire, RG45 6AU, United Kingdom

APPENDIX A

PREPARING AN INVENTORY

A.1 It is strongly recommended that, prior to introducing an inventory, discussions take place with all potentially interested parties. As well as the maintenance staff, these should include the highway planning department and may include such bodies as government departments responsible for industrial and agricultural developments, the police, the armed forces, road haulage groups, etc. By soliciting the views of all potentially concerned parties, the inventory can be set up so that the maximum use may be made of the data obtained. Unless engineers recognise its usefulness, the necessary updating may not take place, and within a few years the inventory will be inaccurate.

THE BRIDGE RECORD CARD

A.2 A suggested format for the bridge record card is show in Figures Al and A2. The format shown here may require modifications to meet the specific needs of the authority. If changes are made, care should be taken to ensure that both the bridge record card and inspection report are changed so that they still match, and that suitable notes for guidance are prepared and issued to all inspectors.

A.3 In deciding a suitable size for the bridge record cards, available storage facilities must be considered. The card shown in Figures Al and A2 has been designed as A3 size, because it is large enough to carry the required data, sketches and photographs, and a copy will fold readily into the more common A4 size files. Notes on the individual entries on the bridge record card are given in paragraphs A.4 to A.41.

BRIDGE NUMBER

A.4 Some authorities use elaborate bridge numbering systems, which in themselves indicate information about the bridge, services carried, responsible authorities, etc. This is unnecessary except where there is a large number of bridges and an advanced computerised reporting system.

A.5 The following system is recommended.

For major roads or roads identified as specific routes:

> The road number followed by the distance from the road origin (to the nearest tenth of a kilometre) e.g. N3/31.5. A simple sequential system could be used, but if a new bridge is added, such a system becomes difficult to modify.

For minor roads which cannot easily be identified by route:

> Subdivide the area of the authority into small units, which may be local council or village areas or simply an area defined by map references. Use as the bridge number the designated area number followed by a simple sequential number e.g. A15/83.The most appropriate size of the selected sub-divisions will be determined by the road density and the total number of structures. Minor road networks often include numerous intersections. It is, therefore, not so critical that bridge reference numbers are sequential along any given road and the addition of a new bridge will not disrupt the system.

A.6 Identification in the field will be greatly eased if the bridge number is painted conspicuously on each bridge.

BRIDGE NAME

A.7 Often the names used for rivers and bridges on maps differ from the name used by the villagers in the area. A decision needs to be made as to whether 'map names' (easy to work with in the office) or 'local names' (easy to work with in the field) are to be used, or both.

MAINTENANCE AUTHORITY

A.8 This should be the name of the local department responsible for any remedial or maintenance work required.

ROAD

A.9 For minor roads. this should be specified by the names of the towns, villages, or road junctions nearest to the bridge. Major roads should be subdivided into convenient sections (between major towns). The entry on the card should be the road number, followed by the names of the towns or junctions at the ends of the section.

e.g. N3 - (MALAN TO GOROKAN section).

KILOMETRE (OR CHAINAGE)

A.10 The distance to the bridge from the start of the section. Note that this will be the same as the bridge number for the first section of each road, but not for subsequent sections.

A.11 This entry should identify the name or number of the map on which the bridge occurs. In some countries maps of several different scales may be available in complete series. In others, the choice may be limited. 1/100,000 or 1/50,000 are suitable scales for this purpose.

REFERENCE

A.12 This should be the map reference of the bridge location using the map referred to in A. 11.

ROAD CLASSIFICATION

A.13 Most countries have an established nomenclature for their road network and this should be strictly adhered to.

N3/125·3 BRIDGE NUMBER	BRIDGE NAME CLEANWATER CREEK	MAINTENANCE AUTHORITY P.W.D.
	ROAD N3 (MALAN - GOROKAN SECTION)	KILOMETRE 31·7

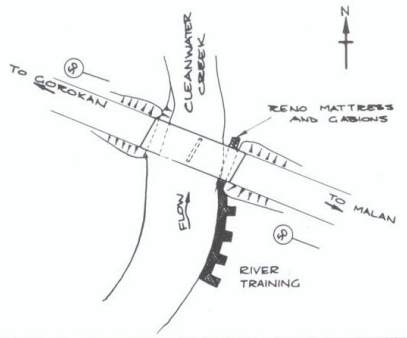
MAP GOROKAN	REFERENCE 653476/139419
ROAD CLASSIFICATION NATIONAL HIGHWAY	OVER/~~UNDER~~ CLEANWATER CREEK
LENGTH 28·7 m	NAVIGATION RESTRICTIONS NOT NAVIGABLE
WIDTH OF CARRIAGEWAY 7.5m	HEIGHT RESTRICTION NONE
LOAD RESTRICTION NONE	ABNORMAL VEHICLE A3 LOW LOADER + 68 TONNE

CONSTRUCTION DETAILS

SPAN(S)	14·0m, 14·0m
RUNNING SURFACE	CONCRETE
SUPERSTRUCTURE	COMPOSITE STEEL CONCRETE
PIER(S)	STEEL PILE, CONCRETE CAP
ABUTMENTS	CONCRETE BANK SEAT
FOUNDATION TYPE	PILED (PIER & ABUTMENTS)
MOVEMENT	FIXED AT ABUTMENTS, FREE AT PIER
SERVICES CARRIED	1 TELEPHONE CABLE
ROAD SIGNS	2 50 kph SIGNS

DESIGNED BY	
P.W.D.	
CONSTRUCTED BY	
BAKER CONSTRUCTION	
YEAR OF COMPLETION	1970

LOCATION PLAN



PHOTOGRAPHS

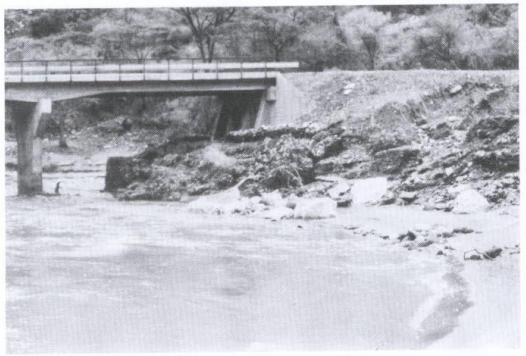


Fig. A1 Bridge record card (side 1)

DRAWING NUMBERS AND CALCULATION REFERENCES

CALCULATION FILE BE 45/74	
GENERAL ARRANGEMENT DRG. No.	B1/80712
ABUTMENT DETAILS Sheet 1	B1/80713
ABUTMENT DETAILS Sheet 2	B1/80714
PIER DETAILS	B1/80715
STEELWORK DETAILS	B1/80716
DECK DETAILS	B1/80717
WING WALL DETAILS	B1/80718
MISCELLANEOUS DETAILS	B1/80719

NOTES

INSPECTION REPORT PAGES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
NUMBER OF PAGES	1	1	1	1	1	1	2	0	2	2	0	0	2	0	2	1	1	1	0

PLAN, ELEVATION AND CROSS SECTION

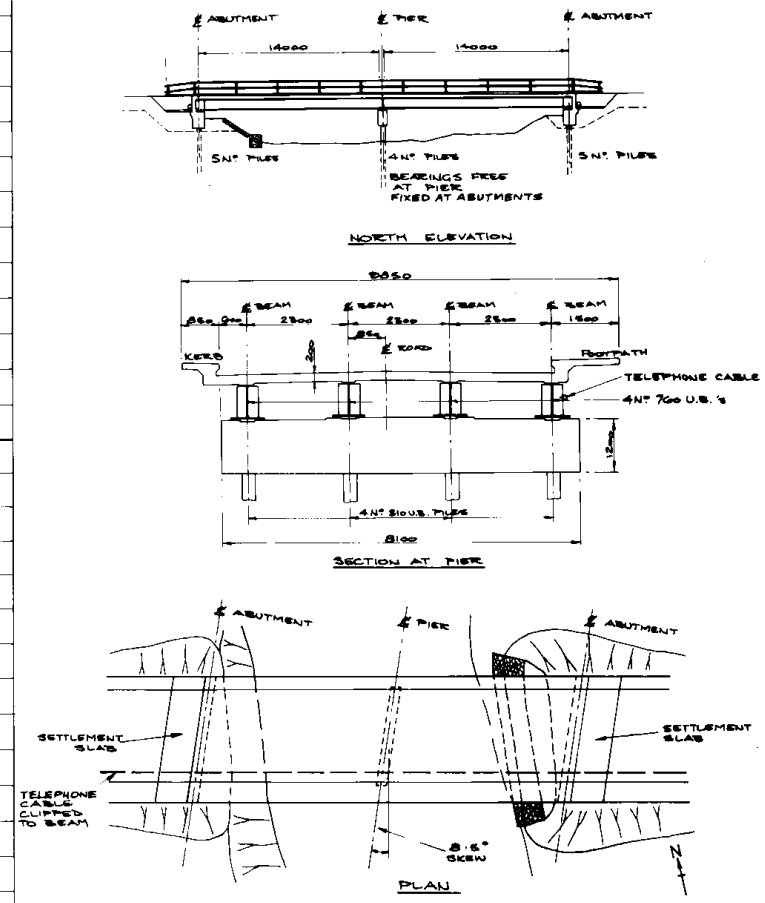


Fig. A2 Bridge record card (side 2)

OVER/UNDER

A.14 This identifies both the obstacle crossed and whether the bridge carries the road, or crosses the road.
e.g. OVER River Teem
or UNDER Tara-Kennan railway.

A.15 Road over road bridges are a special case. For the bridge record card, the bridge should be assigned to the road carried.

LENGTH

A.16 The total length of the bridge between abutment movement joints.

NAVIGATION RESTRICTIONS

A.17 For navigable rivers, a bridge may form an obstruction to shipping, both in terms of width of waterway and clearance to the underside of the bridge. The authority responsible for navigation should be consulted for advice regarding the water level from which heights should be measured. If the restriction involves lengthy descriptions it may be necessary to continue on the NOTES section on the back of the card.

WIDTH

A.18 This is the minimum width of the carriageway between the kerbs or parapets. For bridges over roads, the width of the road crossed should also be recorded.

HEIGHT RESTRICTION

A.19 This item is only applicable to bridges over roads and braced truss or braced arch bridges. In both cases, care must be taken that the height recorded is for the full carriageway width and, for road over road bridges, to which road the restriction applies. When it is considered useful to record a height over a reduced width of carriageway, this should be clearly marked on the elevation or cross section drawing and noted under 'height restriction'.

LOAD RESTRICTION

A.20 Where a bridge has a capacity below the legal limit this should be stated here.

ABNORMAL VEHICLE

A.21 Many bridges have a reserve of capacity beyond the normal maximum legal vehicle weight. Such capacity is

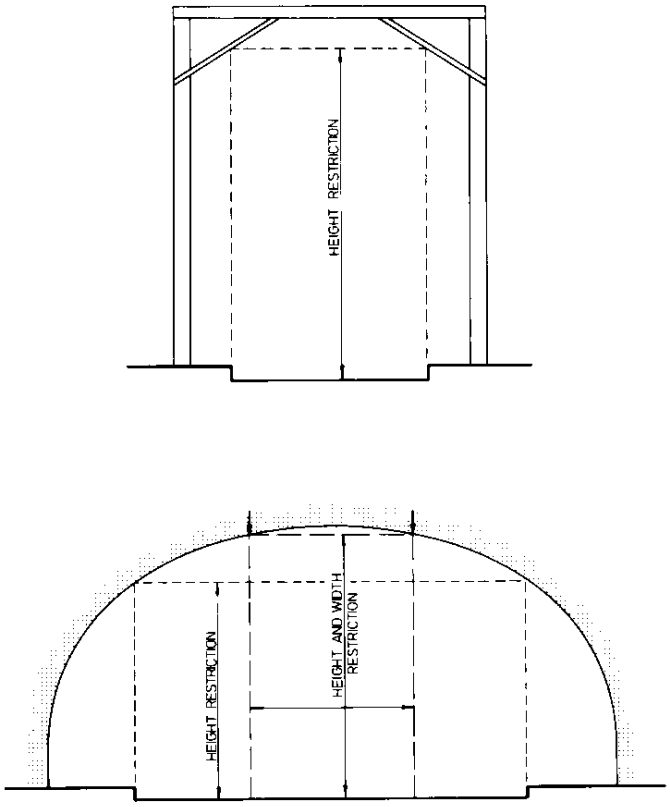


Fig. A3 Height restrictions

usually only determined when a specific heavy vehicle has need to cross the bridge. After such calculations, the special vehicle and the payload found to be acceptable should be noted on the card or reference made to a specific set of calculations.

CONSTRUCTION DETAILS

A.22 This section of the card is intended only to record general details of the type of construction, not full section sizes, etc. The details recorded help to identify the bridge and to explain how the bridge works.

SPAN(S)

A.23 Note here the individual span length (or lengths) measured between bearing centres. The total of the span lengths may be different from the bridge length.

RUNNING SURFACE

A.24 Concrete, mastic asphalt, galvanised steel plate, etc, are typical entries. If there is a waterproof membrane on the bridge, it should be noted here.

SUPERSTRUCTURE

A.25 This item is intended to identify the type of span construction. Typical entries would be:

Prestressed concrete beams, concrete deck.
Steel beams with concrete deck (note if composite action was assumed in the design).
Bailey bridge with timber deck, etc.

PIER(S)

A.26 The form of the pier, for example:

R.C. columns with cross head.
R.C. wall.
Steel trestle etc.

ABUTMENT

A.27 The form of the abutment, for example:

Masonry.
R.C. wall.
R.C. bank seat.
Gabions.

FOUNDATION TYPE

A.28 Typical entries would be:

Piled.
Spread footing.
Caisson.

MOVEMENT

A.29 This entry should state where the superstructure is 'fixed' to the substructure, and where it is 'free' to move. The fixed and free bearings should be noted on the sketches on the back of the card.

SERVICES CARRIED

A.30 Note here all services (electricity, water, sewer, etc.) known to be carried by the bridge.

ROAD SIGNS

A.31 List the number and type of road signs associated with the bridge.

LOCATION PLAN

A.32 This is not intended to give detail, but simply to assist in identifying the bridge. In some cases, it may be useful to show associated works such as river training, which cannot, at a reasonable scale, be included in the plans on the back of the card. All road signs relating to the bridge should be shown.

DESIGNED BY

A.33 The name of the organisation which designed the bridge (e.g. Bridge dept., Wigan & Partners consultants), if known.

CONSTRUCTED BY

A.34 The name of the department or contractor who built the bridge, if known.

YEAR OF COMPLETION

A.35 Both the date of original construction and the date of any major modification should be recorded.

PHOTOGRAPHS

A.36 Two photographs of the bridge should be fixed to the card, one view taken from the river and the other from the road.

A.37 If there is no sign containing the bridge name adjacent to the bridge, it will help identification if a board bearing the bridge number is included in the photograph taken from the road.

DRAWING NUMBERS AND CALCULATION REFERENCES

A.38 Record all drawing numbers, noting if they are 'as-built' drawings or not, and references to original calculations, plus any later calculations such as for heavy load movement

NOTES

A.39 Any special points of interest, modifications, problems, etc. should be recorded here.

INSPECTION REPORT PAGE NUMBERS

A.40 The inspection report form covers a wide variety of bridges. Only a limited number of its pages would be used on any bridge. To assist in preparing blank inspection forms before an inspection, the numbers of the pages to be used should be noted

PLAN, ELEVATION AND CROSS SECTION

A.41 Space is provided on the bridge record card for plan, elevation and cross-section sketches. Where there are thought to be useful (See Fig A2) Such drawings should not attempt to provide full details of the bridge, useful general details and principal dimensions are sufficient.

Such drawings can usefully indicate

The bridge skew, if any.
Bridge bearings. whether ‘fixed' or 'free'.
The location of services and their supports

CREATING NEW BRIDGE RECORDS

A.42 The preparation of the bridge record cards involves handling a lot of data from a number of different sources. It is very easy, even for experienced bridge engineers, to confuse one bridge with another, care must be taken to provide cross checks to ensure that the correct data are being recorded for each bridge This is particularly true when many similar bridges exist along a section of road. It is suggested that a system be utilised which involves *always* cross checking a few easily identifiable items of data such as:

Chainage along the road.
Note this can be prone to error due to an inaccurate zero setting at the survey start and because of vehicle odometer errors.
Span length(s)
Skew angle.
Number of beams or some other very obvious construction feature.

A.43 There are two ways of creating a complete set of bridge record cards:

(a) Form a survey team (or teams) to complete the work in one continuous programme
(b) Prepare the cards over a longer period. intermittently, with field inspections being fitted in with other necessary journeys.

A.44 Method a) has much to commend it, as the completed set of cards will be ready for use more quickly. Greater control of data is also possible as the work wilt proceed continuously. The disadvantage is that special teams need to be established and the extra cost may be high

A.45 Method b) will take longer and may be harder to control, but will certainly be cheaper. It may also eventually produce a better inventory. As ideas on systems can develop as work proceeds Method b) is likely to be the most practical for developing countries unless special resources and finance are made available.

A.46 The following sequence of operations is recommended in creating an inventory:

1) Determine from all available sources the number and location of all bridges believed to exist. Such sources include maintenance records. Information from maintenance personnel or others familiar with each road, drawings, maps and old inventories.

2) Set up a road numbering system, if one does not already exist, and a bridge numbering system (see paragraphs A.4 to A.6

3) Produce a preliminary card for each bridge containing all information which can be derived from existing sources

4) Carry out the initial general inspection and complete the preliminary bridge record cards, as follows:
a) Verify the data on the preliminary bridge record card.
b) Fill in the missing data from observations on and around the bridge.
c) Photograph the bridge and make sketches of river training works. services, etc.
d) Complete the inspection report form, paying particular attention to any deterioration which may influence the load carrying capacity of the structure.

5) In the office:
a) Resolve anomalies arising from differences in old and observed data
b) Carry out a load capacity evaluation for all bridges, except those where the capacity is clearly stated on the drawings and the condition survey revealed no serious deterioration.
c) Make out the final bridge record cards.

THE INITIAL GENERAL INSPECTION

A.47 Whereas data on the bridge record cards do not normally change with time, the data on the inspection report are changeable. However the two sets of data interrelate, so it is sensible to carry out the first bridge inspections at the same time as the bridge record cards are being finalised This is the initial general inspection.

A.48 If at all possible, this particular bridge inspection report should be completed by a bridge engineer working road by road, at the same time as the record cards are being finalised (step 4(d), para A 46). The reasons for this are:

a) Only an experienced bridge engineer can determine if the

nominal load capacity must be reduced because the bridge is in poor condition; thus a bridge engineer has to inspect each bridge before the load capacity can be finalised. Completing the initial general inspection report will not take much additional time

b) The inspector who carries out subsequent inspections may not be experienced in bridge inspections. If the initial general inspection report has been completed by an engineer, it will help the inspector considerably, and uniformity of approach will be more likely.

A.49 To provide useful training, potential inspectors should accompany the bridge engineer on these initial general inspections whenever possible.

APPENDIX B

SAFETY AND EQUIPMENT

B.I The safety of bridge inspectors and road users during the inspection is the responsibility of the district engineer. It is important that he trains the inspectors in safety procedures during the formal instruction period, and by example when lie accompanies them on the occasional joint inspection

B.2 Possibilities of injury arise mainly from:
Traffic on the deck or road approaches
A fall from the superstructure to the river or road below.
Insects, snakes, crocodiles, etc below the deck

B.3 All these dangers can be at least partly alleviated by the presence of an assistant, such as a driver. He can also help when measurements are required.

B.4 In addition, the inspector should:

- carry and use standard road signs and traffic cones Instruction in their use is detailed in Overseas Road Note 2. (TRRL Overseas Unit 1985).
- use a rope and harness whenever a fall could cause injury.
- beware of dangerous insects and reptiles.
- not enter an enclosed space without ensuring that fresh air can enter. and without keeping in constant contact with his companion

B.5 The inspector should be encouraged to exercise caution at all times When he finds that parts of a bridge are not safely accessible without special equipment, such as a boat, he must understand that he should not take risks to complete the report form and he should not guess at the answers required The responsible action is to record which parts of the report form were not possible to complete and return on another occasion with the required equipment to complete the inspection.

B.6 The inspector will assess the importance of the work he does by the interest paid by the engineer and the quality of the equipment issued to him The equipment should be inspected regularly, and kept up to complement.

B.7 The inspector should keep his equipment in good order and take care that potentially dangerous items, particularly chemical preservatives and paints. are kept away from children and are not discarded or spilled where they can harm animals or fish.

INSPECTION EQUIPMENT

B.8 The following equipment should be provided for all inspections:

First-aid box

Clipboard for inspection report forms protected from rain.
Waterproof marker, suitable for concrete, steel or timber.
Flashlight (torch).
Straight edge (at least 2m long).
String line.
Measuring Tapes (3m or 5m and 30m long).
Bush knife or similar tool to clear vegetation.
Small shovel or trowel.
Wire brush.
Small paintbrush and paint, for painting areas damaged during the inspection.
Hammer (350 - 450g).
Ranging rod or other similar long pole.
Set of spanners.
Crack measuring gauge.

B.9 The following additional equipment will be required when inspecting timber bridges

Square-ended spike.
Hand drill and 5mm diameter drill bits.
5mm wooden plugs.
Saw.
Wood preservative.

B.10 The following safety equipment should *always* be used.

Traffic warning signs and road cones.
High visibility, fluorescent waistcoat.
Safety helmet.

B.11 In certain circumstances it may also be necessary to provide:

About 20m of light rope.
A safety harness.
Ladders.
A small boat to examine river piers and abutments.

APPENDIX C

BLANK INSPECTION REPORT FORM

C.1 This appendix contains a complete blank inspection report form, listing all the items to be checked during a bridge inspection. For each bridge, only those pages corresponding to the construction type and materials used will be required. Some pages will be required more than once, e.g. for abutments and multi-span bridges.

BRIDGE INSPECTION REPORT FORM

Bridge Number..... Name.....

Crossing.....

Kilometre.....on the..... to .....road

Instructions from the engineer to the inspector:

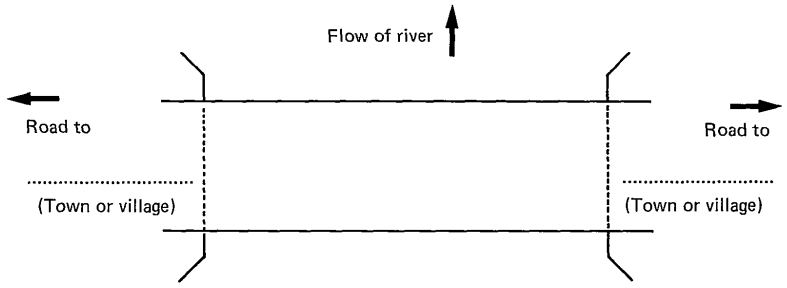
.....

.....

.....

.....

View of bridge looking from above.



Notes from the inspector to the engineer:

.....

.....

.....

.....

Inspected by.....Date.....

Number of pages in report
(Including sketches, notes, photos, etc.).....

Report accepted by.....Date.....

CONSTRUCTION DETAILS (from the Inventory)

	Correct ? Yes	No
Span		
Running surface		
Deck		
Pier(s)		
Abutments		
Foundation type		
Movement		

Services	Details of service on bridge card	Service still there ? Yes	No	Service damaged ? Yes	No
Telephone					
Electricity					
Gas					
Watermain					
Sewer drain					
Oil pipeline					

Notes.....
.....
.....

Signs Details of signs on bridge card	Sign still there ? Yes	No	Sign damaged ? Yes	No	Notes

Previous inspection

By.....Date.....

Comments.....
.....
.....

Handbook page (2)	ROAD APPROACHES AND DECK POSSIBLE PROBLEM	Problem: No	Problem: Yes	How bad ?: Not very bad	How bad ?: Bad	How bad ?: Very serious	How much ?: Not much	How much ?: Some	How much ?: A lot	Note or sketch reference
15	ROAD SURFACE NEAR BRIDGE									
	Bumpy road surface ?									
	All checked									Yes ☐ No ☐
16	DRAINAGE									
	Badly built road drainage near bridge ?									
	Blocked or damaged road drains ?									
	Water on the deck ?									
	Blocked or damaged deck drains ?									
	All checked									Yes ☐ No ☐
19	BITUMEN SURFACE — BRIDGE SURFACE AND FOOTPATHS									
	Surface breaking up or lifting off ?									
	Cracking above joints ?									
20	CONCRETE SURFACE									
	Cracking ?									
	Spalling ?									
	Reinforcement exposed ?									
	Poor concrete ?									
	Wear of surface due to small stones ?									
22	STEEL SURFACE									
	Fixings loose or damaged ?									
	Bends in panels ?									
	Corrosion ?									
	All checked									Yes ☐ No ☐

Handbook page (2)	DECK AND PARAPETS POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
	24 TIMBER SURFACE									
	Dirt or plants between boards ?									
	Decay ?									
	Insect attack ?									
	Splitting of timbers ?									
	Loose or damaged fixings ?									
	25 TIMBER RUNNING STRIPS									
	Damage to running strips ?									
	Loose or damaged fixings ?									
	26 RAILWAY OR TRAM RAILS									
	Loose rail fixings ?									
	26 KERBS									
	Damaged or loose kerbs ?									
	26 FOOTPATHS									
	Damaged footpaths ?									
									All checked	Yes / No
27	**PARAPETS, RAILINGS AND GUARD RAILS**									
	Impact damage ?									
	Loose or damaged fixings ?									
	Loose post base ?									
	28 STEEL OR ALUMINIUM PARAPETS									
	Damaged galvanising or paint ?									
	Corrosion ?									
									All checked	Yes / No

Handbook page (2)	PARAPETS AND JOINTS POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
	29 CONCRETE PARAPETS									
	Cracking ?									
	Spalling ?									
	Corrosion of reinforcement ?									
	Poor concrete ?									
	30 TIMBER PARAPETS									
	Decay ?									
	Insect attack ?									
	Splitting of timbers ?									
	31 MASONRY PARAPETS									
	Cracking ?									
	Movement or bending of parapet ?									
	Poor pointing ?									
	Deterioration of the bricks or stonework ?									
									All checked	Yes ☐ No ☐
	32 EXPANSION JOINT AT .....ABUTMENT OR PIER No..... (from above)									
	Damage to concrete of deck end or ballast wall near joint ?									
	Debris or vegetation in joint ?									
	Loose or damaged fixings ?									
	Damage or corrosion to metal parts ?									
	Damage to rubber waterbars ?									
									All checked	Yes ☐ No ☐

Handbook page (2)	THE RIVER POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
	THE RIVER									
	34 BLOCKAGES IN WATERWAY									
	Debris against piers or abutments ?									
	Remains of old bridges under or upstream of the bridge ?									
	Fencing or buildings under bridge ?									
	Trees or bushes growing under bridge ?									
	37 CHANGE OF RIVER PATH									
	River changing path upstream from bridge ?									
	New islands forming upstream of bridge ?									
	39 RIVER TRAINING WORKS									
	River attack beyond the upstream end of the river training works ?									
	Damage to sheet piled walls ?									
	Loss of rip-rap ?									
	Damage to gabions, timber, fencing etc. ?									
	Damage to trees ?									
							All checked	Yes		No

Handbook page (2)	SUPERSTRUCTURE SPAN No. ..... POSSIBLE PROBLEM	Problem: No	Problem: Yes	How bad ?: Not very bad	How bad ?: Bad	How bad ?: Very serious	How much ?: Not much	How much ?: Some	How much ?: A lot	Note or sketch reference
41	SUPERSTRUCTURE									
42	GENERAL (from below the deck — above and below for a through truss)									
	Impact damage to beams, girders, trusses or bracings ?									
	Debris or vegetation on beams, girders, trusses or bracings or in joints ?									
	Water coming through the deck ?									
	Water from the deck drainage flowing onto girders, trusses, beams or bracings ?									
	Not enough headroom for overbridge ?			If the road has been resurfaced						MIN HEADROOM = ...
									All checked	Yes / No
44	MAIN BEAMS, GIRDERS, TRUSSES AND BRACINGS									
44	CONCRETE BEAMS									
	Cracking ?									
	Spalling ?									
	Corrosion of reinforcement ?									
	Poor concrete ?									
47	STEEL GIRDERS AND BRACINGS									
	Deterioration of paint or galvanising ?									
	Corrosion ?									
	Bends in webs, flanges, stiffeners or bracings ?									
	Loose bolts or rivets ?									
	Cracking ?									
									All checked	Yes / No

Handbook page (2)	SUPERSTRUCTURE SPAN No. ..... POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
	50 STEEL TRUSSES									
	Deterioration of paint or galvanising ?									
	Corrosion ?									
	Bends in truss members ?									
	Bent or damaged joints ?									
	Bent or damaged bracings ?									
	Loose bolts or rivets ?									
	Cracking of steel members ?									
	53 TIMBER BEAMS									
	Decay ?									
	Insect attack ?									
	Splitting of timber ?									
	Separation of laminations on glue laminated beams ?									
	Loose or corroded nails, spikes or fixing wires ?									
	56 TIMBER TRUSSES									
	Decay ?									
	Insect attack ?									
	Splitting of timber ?									
	Loose deck to truss connection ?									
	Loose or corroded bolts or pins at joints ?									
	Bends in truss timbers ?									
	Damaged or corroded steel parts ?									
									All checked	Yes ☐ No ☐

Handbook page (2)	SUPERSTRUCTURE SPAN No. ..... POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
59	UNDERSIDE OF DECK									
59	CONCRETE									
	Cracking ?									
	Spalling ?									
	Corrosion of reinforcement ?									
	Poor concrete ?									
	Not enough cover to reinforcement ?									
60	STEEL									
	Deterioration of paint or galvanising ?									
	Corrosion ?									
	Bends in stringers or plates ?									
	Loose bolts or rivets ?									
	Cracking ?									
61	TIMBER									
	Decay ?									
	Insect attack ?									
	Split timbers ?									
	Loose or corroded bolts or pins ?									
63	MASONRY JACK ARCH DECKS									
	Change of shape of arch ?									
	Cracking or spalling ?									
	Poor pointing ?									
									All checked	Yes ☐ No ☐

Handbook page (2)	BEARINGS ABUTMENT NAME ..... PIER No. POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
64	BEARINGS									
64	ALL BEARINGS									
	Debris or vegetation around bearings ?									
	Bad drainage to bearing shelf ?									
	Not enough room for the bridge span to move ?									
	Bearing not seated properly ?									
	Bridge span not seated properly on bearing ?									
	Damaged bedding mortar ?									
66	RUBBER BEARINGS									
	Splitting, tearing or cracking of rubber ?									
	Damaged or loose bolts or pins at fixed bearings ?									
67	METAL BEARINGS									
	Parts not properly seated ?									
	Parts not free to move ?									
	Problem with the lubrication system ?									
	Sliding surfaces damaged ?									
	Cracks or bends in metal Parts ?									
	Corrosion of metal parts ?									
69	EARTHQUAKE RESTRAINTS									
	Damaged or loose earthquake restraints ?									
								All checked	Yes	No

Handbook page (2)	MASONRY ARCHES SPAN No. ..... POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	

Change of shape of arch ?									
Cracking of arch barrel ?									
Cracking or bulging of spandrel walls ?									
Spandrel walls separating from arch ?									
Spalling of stones or bricks ?									
Poor pointing ?									
Water leaking through arch ?									
Scour under arch foundations ?									

All checked | Yes | | No | |

Handbook page (2)	BAILEY BRIDGES SPAN No. ..... POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
75	BAILEY BRIDGES									
	Missing safety pins ?									
	Missing panel pins ?									
	Missing or loose bolts ?									
	Missing rakers or tie plates ?									
	Missing or loose sway braces ?									
	Missing, loose or damaged horizontal bracing frames ?									
	Missing or loose transom clamps ?									
	Wear at stringer to transom seating ?									
	Cracking ?									
	Bends in members ?									
	Deterioration of paint or galvanising ?									
	Corrosion ?									
	Settlement of bearings ?									
	Damage to bearings or base plates ?									
	Maximum vertical sag ?	Upstream side							Downstream side	
	Maximum horizontal bend ?	Upstream side							Downstream side	
							All checked	Yes		No

Handbook page (2)	ABUTMENT, WING WALLS AND RETAINING WALLS ABUTMENT NAME ..... POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
82	ABUTMENT, WING WALLS AND RETAINING WALLS									
82	GENERAL									
	Erosion or scour near abutment ?									
	Damage to caissons or piles ?									
	Movement of abutment ?									
	Debris against abutment ?									
	Vegetation growing on or in abutment ?									
	Scour near to retaining walls ?									
	Movement of retaining walls ?									
	Water leaking down through the expansion joint ?									
87	DRAINAGE SYSTEM									
	Not enough weepholes ?									
	Weepholes not working ?									
	Water leaking through the abutment ?									
89	CONCRETE ABUTMENTS, WING WALLS AND RETAINING WALLS									
	Cracking ?									
	Spalling ?									
	Corrosion of reinforcement ?									
	Poor concrete ?									

All checked | Yes | | No | |

Handbook page (2)	ABUTMENT, WING WALLS AND RETAINING WALLS ABUTMENT NAME ..... POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
91	MASONRY ABUTMENTS AND RETAINING WALLS									
	Cracking ?									
	Bulging ?									
	Poor pointing ?									
	Deterioration of bricks or stones ?									
93	GABION ABUTMENTS AND RETAINING WALLS									
	Settlement or bulging of gabions ?									
	Damage to gabion wires or ties ?									
94	TIMBER ABUTMENTS AND RETAINING WALLS									
	Decay ?									
	Insect attack ?									
	Splitting of timber ?									
	Loose or corroded binding cables ?									
	Loose or corroded fixing spikes ?									
							All checked	Yes		No

Handbook page (2)	EMBANKMENTS ABUTMENT NAME ..... POSSIBLE PROBLEM	Problem		How bad ?			How much?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
96	EMBANKMENTS AND FILL IN FRONT OF ABUTMENTS									
96	GENERAL									
	Scour at base of slopes ?									
	Slip of fill ?									
	Erosion of fill ?									
	Cracking of road or embankment edge ?									
	Piping failures of fill ?									
99	PILED WALLS									
	Forward movement ?									
	Deterioration of piles ?									
100	STONE PITCHING SLOPE PROTECTION									
	Cracking ?									
	Poor pointing ?									
	Scour or erosion at edge ?									
	Pieces broken off ?									
102	GABION SLOPE PROTECTION									
	Too much movement of gabions ?									
	Damage to gabion wires or ties ?									
104	RIP-RAP SLOPE PROTECTION									
	Rip-rap being washed away?									
	Bed settlement ?									

All checked | Yes | | No | |

Handbook page (2)	THE RIVER BED POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
105	BED PROTECTION									
	Large holes in the river bed ?									
106	STONE PITCHING OR CONCRETE BED PROTECTION AND APRONS									
	Scour at edge ?									
	Cracking ?									
	Spalling or stones missing ?									
	Erosion of surface ?									
	Corrosion of reinforcement ?									
108	GABION BED PROTECTION AND APRONS									
	Gabions broken away from pier or abutment ?									
	Damage to wires or ties ?									
109	RIP - RAP BED PROTECTION									
	Loss of rip-rap ?									

All checked | Yes | | No | |

Handbook page (2)	PIERS PIER No. ..... POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
	PIERS									
	110 GENERAL									
	Scour near base of pier ?									
	Damage to caissons or piles ?									
	Movement of pier ?									
	Impact damage ?									
	Debris against pier ?									
	Vegetation growing on pier ?									
	Water leaking past expansion joint ?									
	113 CONCRETE PIERS									
	Cracking ?									
	Spalling ?									
	Corrosion of reinforcement ?									
	Poor concrete ?									
	114 MASONRY PIERS									
	Cracking ?									
	Poor pointing ?									
	Deterioration of masonry ?									
									All checked	Yes ☐ No ☐

Handbook page (2)	PIERS PIER No. ..... POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	Alot	
116	STEEL PIERS									
	Debris in joints ?									
	Deterioration of paint or galvanising ?									
	Corrosion ?									
	Bends in steel members or at joints ?									
	Loose bolts or rivets ?									
	Cracking ?									
117	TIMBER PIERS									
	Debris in joints ?									
	Decay ?									
	Insect attack ?									
	Splitting of timber ?									
	Loose bolts or pins at joints ?									
	Bends in pier timbers ?									
	Damaged or corroded steel parts ?									
									All checked	Yes ☐ No ☐

Handbook page (2)	CULVERTS POSSIBLE PROBLEM	Problem		How bad ?			How much ?			Note or sketch reference
		No	Yes	Not very bad	Bad	Very serious	Not much	Some	A lot	
119	CULVERTS (also use page 1–5 of the bridge inspection forms as required)									
119	GENERAL									
	Debris, vegetation etc. in or near culvert ?									
	Settlement of parts of the culvert ?									
	Scour at ends of culvert or at edge of apron ?									
121	CONCRETE CULVERT BARRELS									
	Cracking ?									
	Spalling ?									
	Corrosion of reinforcement ?									
	Poor concrete ?									
122	CORRUGATED STEEL CULVERTS									
	Change of shape of culvert barrel ?									
	Damage or deterioration to paint or galvanising ?									
	Corrosion of steel ?									
	Loose or corroded bolts ?									
123	CULVERT APRONS									
	Cracking and damage to concrete or stone pitching ?									
	Damage to gabions ?									
124	HEADWALLS									
	Movement of headwall ?									
	Concrete: cracking, spalling, corrosion of reinforcement or poor concrete ?									
	Masonry: cracking, poor pointing or deterioration of bricks or stones ?									
								All checked	Yes	No

NOTES

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