VOLUME 3 HIGHWAY STRUCTURES: INSPECTION AND MAINTENANCE

SECTION 1 INSPECTION

PART 2

BD 54/93

POST-TENSIONED CONCRETE BRIDGES PRIORITISATION OF SPECIAL INSPECTIONS

INTRODUCTION

This Departmental Standard sets out citeria for prioritising special inspections for post-tensioned concrete bridges.

INSTRUCTIONS FOR USE

This is a new document to be incorporated into the Manual.

1. Insert BD 54/93 into Volume 3 Section 1.

2. Archive this sheet as appropriate.

Note: A new contents page for Volume 3 containing reference to this document are included in the set of contents pages at Annex F of HA 51/93.

BD 54/93

THE HIGHWAYS AGENCY

THE SCOTTISH OFFICE INDUSTRY DEPARTMENT

THE WELSH OFFICE
CYNULLIAD CENEDLAETHOL CYMRU

THE DEPARTMENT OF THE ENVIRONMENT FOR
NORTHERN IRELAND

Post-tensioned Concrete Bridges Prioritisation Of Special Inspections

Summary: This Standard sets out criteria for prioritising special inspections for post-tensioned concrete bridges.

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REGISTRATION OF AMENDMENTS

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Contents

Chapter

1. Introduction

2. Method for Determining Inspection Priorities

3. References

4. Enquiries

1. INTRODUCTION

Background

1.1 Existing post-tensioned bridges with grouted ducts are to be examined by way of a programme of Special Inspections over a five year period.

1.2 The purpose of this document is to provide a means of prioritising inspection of bridges which fall within its scope so that the programme can be prepared. It is expected that assessments will need to be undertaken in parallel with the inspections.

1.3 A Departmental Advice Note will advise on procedures for carrying out Special Inspections and such testing which may be carried out during the inspections. This will be available in draft form in time for the Transport Research Laboratory (TRL) training seminars.

1.4 A series of TRL Seminars are to be held commencing January, 1993, and engineering staff involved in the specialised process of inspection and testing of the Overseeing Department's post-tensioned bridges will be expected to have attended one of these seminars.

1.5 It is intended that a series of Standards and Advice Notes will be prepared to deal with the other aspects of the Special Inspection Programme, ie Methods of Inspection, Assessment, Strengthening, Repair, and Monitoring.

Scope

1.6 This document is intended to cover bridges, any parts of which have been constructed using post-tensioning techniques, ie tendons or bars in ducts which may or may not be grouted.

1.7 Chapter 2 of this document gives the ratings which are to be used in the assessment of priority. Difficulties with interpretation of any factors used in determining the rating of a particular bridge should be resolved by the Overseeing Department.

1.8 General requirements for inspection and records for use in England are described in TRMM 2/88. In Scotland advice on inspections is given in SB1/78 (DMRB 3.1). In Wales, WOTRMM 2/88 applies and in Northern Ireland BE 4/77 NIRS applies

Use in Northern Ireland

1.9 For use of this Standard in Northern Ireland the Overseeing Department shall be considered to be the Roads Service Headquarters and the Maintenance Agent shall be considered to be the Roads Service Divisional Offices.

Implementation

1.10 This Standard is to be implemented forthwith and shall be used by Maintenance Agents (MAs) as the basis for preparing a programme of Special Inspections of post-tensioned bridges to be carried out over the next five years (commencing 1993). The inspections are to be carried out in priority order and shall be integrated into the annual inspection programme.

1.11 To enable the Overseeing Departments to co-ordinate the overall programme, MAs in England, Wales and Northern Ireland (see 1.9 above) shall submit their preliminary programme for approval by 31 March 1993. In Scotland, because of the relatively small number of post-tensioned bridges, the MAs will be contacted by the Roads Directorate of The Scottish Office Industry Department to agree prioritisation within a two year programme of Special Inspections commencing in 1993.

2. METHOD FOR DETERMINING INSPECTION PRIORITIES

General

2.1 This Standard is intended as an aid to MA's in assigning priorities for the programme of Special Inspections. It is intended also to ensure a degree of uniformity of ranking throughout the network. Note, however, that engineering judgement will still be required, especially in respect of Tables 2 and 3, in order to give a speedy but reasonably reliable assessment of the variables.

Age of Bridge Rating

2.2 An age of bridge rating (R_a) between 1 and 5 shall be assigned to the bridge in accordance with Table 1.

Bridge Form Rating

2.3 A bridge form rating (R_f) shall be assigned to the structure in accordance with Table 2.

Vulnerable Detail Rating

2.4 A vulnerable detail rating (R_d) between 1 and 5 shall be assigned to the bridge in accordance with Table 3.

Traffic Volume Assessment Rating (A)

2.5 The traffic volume rating (R_v) shall be derived from AADT figures (24 hr Annual Average Daily Traffic) in accordance with Table 4. Where this information is not readily available from existing sources an estimate based on observations taken during an average weekday shall be used.

Traffic Volume Assessment Rating (B)

2.6 The traffic volume rating (R_u) shall be derived from the AADT figures, or feature type in accordance with Table 5.

Route Importance Rating

2.7 The importance of the route shall be assessed and assigned a rating (R_i), between 0 and 5, in accordance with Table 6.

Table 1 Age of Bridge Rating

Date Constructed	Assessment Rating R_a
Pre 1965	5
1965 to 1970	4
1971 to 1975	3
1976 to 1980	2
1981 to present	1

Table 2 Bridge Form Rating

Type	Assessment Rating R_f
Segmental i. Where precast segment joints extend through deck ie no deck slab, or where construction joints in slab coincide with segment joints. ii. All other segmental.	 5 4
Other Primary Types eg beams, composite construction, slabs, solid and voided, and transverse post-tensioning associated with longitudinal post-tensioning, or where transverse post-tensioning is the main means of support of longitudinal members.	3
Non-primary eg transverse post-tensioning where there is no longitudinal post-tensioning, pier crossheads, vertical post-tensioning in decks and holding down bearings.	1

Note: In the case of post-tensioned tie-down support types, which could lead to global failure, R_f shall be 5.

Table 3 Vulnerable Detail Rating

Details	Assessment Rating R_d
Many vulnerable details	5
↕	↕
Few vulnerable details	1

Examples of Vulnerable Details

The list below does not necessarily give any rating, it is up to the engineer to decide.

Segmental Joints
Segmental joints to be rated in order of decreasing vulnerability (in situ mortar narrow, mortar wide, match cast glued).

Types of Prestressing Systems
Those with a lack of redundancy eg a small number of large tendons where a severe local defect might have a serious effect on strength.

Those with tendons located in the upper part of a deck where failure of the deck waterproofing may lead to corrosion.

Types and Locations of Anchorages
Anchorages recessed into the upper surfaces of the deck or located within joints, that may have reduced protection against corrosion.

Joints Crossing Tendons
Where records indicate a lack of water tightness or vulnerability due to leaking deck drainage fittings or failure of deck waterproofing in the vicinity of joints.

Waterproofing Systems
Where records indicate poor performance of systems (current and previous).

Table 4 Traffic Volume Assessment Rating (A)

Traffic on/carried by the bridge

Range of Annual Average Daily Flow	Assessment Rating R_v
Over 80,000 vpd	5
Over 60,000 vpd to 80,000 vpd	4
Over 40,000 vpd to 60,000 vpd	3
Over 20,000 vpd to 40,000 vpd	2
Up to 20,000 vpd	1

Table 5 Traffic Volume Assessment Rating (B)

Feature below or adjacent to bridge

Feature	Assessment Rating R_u
Traffic Range of annual average daily flow: Over 80,000 vpd Over 60,000 vpd to 80,000 vpd Over 40,000 vpd to 60,000 vpd Over 20,000 vpd to 40,000 vpd Up to 20,000 vpd	 5 4 3 2 1
Railway	5
Other areas occupied by people, valuable installations, environmentally sensitive areas such as conservation areas, storage of hazardous materials etc.	1 to 5
Feature type other than indicated above	0

Table 6 Route Importance Assessment Rating

Route Type (carried by structure)	Assessment Rating R_i
Route of strategic importance linking major conurbations and industrial areas, routes to ports. No acceptable alternative route available.	5
Route of major regional importance linking large towns with industrial development. Major holiday route with saturation flows in summer months. No acceptable alternative route available.	4
Route of major regional importance linking large towns with industrial development. Major holiday route with saturation flows in summer months. Acceptable alternative route available.	3
Route linking medium size towns with industrial development. No acceptable alternative route available.	2
Route linking medium size towns with industrial development. Acceptable alternative route available.	1
Route type other than indicated above.	0

Total Assessment Rating

2.8 The total assessment rating (TA) which will have a value between 8 and 50, shall be calculated in accordance with the following expression:

$$TA = 4R_a + 2R_f + R_d + R_v + R_u + R_i$$

Priority Rating

2.9 The priority rating (PR) of the bridge, which will lie between 1 and 5 shall be determined from Table 7. Bridges with a priority rating of 1 shall be inspected first, those with a priority rating of 5 last.

Table 7 Structure Priority Rating

Total Assessment Rating TA	Priority Rating PR
43 to 50	1
36 to 42	2
29 to 35	3
22 to 28	4
8 to 21	5

Special Considerations

2.10 A bridge shall automatically be assigned a priority rating of 1 if any of the following apply:

(a) There is any immediate concern for the safety of the public. (NB other immediate action may need to be taken to ensure the safety of the public).

(b) Irrespective of the amount of traffic carried over or under, it is of a structural form which has little inbuilt redundancy, eg simply-supported segmental or post-tensioned tie-down support types of bridge. (Unless the bridge is judged to be of sufficiently young age taking into account its materials and condition etc, to justify placing it in a lower priority).

(c) Past assessments have indicated overstress in critical elements.

(d) The structure is currently weight restricted.

2.11 Consideration shall be given to including an inspection earlier in the programme than the priority rating would indicate if any of the following apply:

(a) The bridge is within a road improvement/widening scheme.

(b) The inspection can be carried out in conjunction with a highways maintenance scheme.

(c) The inspection has already been programmed.

2.12 If further sub-division of bridges within a particular priority is required to suit resource/programming needs, then this sub-division shall be based primarily on the age criterion.

3. REFERENCES

1. TRMM 2/88 Trunk Road and Motorway Structures - Records and Inspection
[for use in England]

2. Technical Memorandum (Bridges) SB 1/78 - The Inspection of Highway Structures (DMRB 3.1)
[for use in Scotland]

3. WOTRMM 2/88 Welsh Office Trunk Road and Motorway Structures - Records and Inspections
[for use in Wales]

4. Technical Memorandum (Bridges) BE 4/77 NIRS - The Inspection of Highway Structures
[for use in Northern Ireland]

4. ENQUIRIES

All technical enquiries or comments on this Standard should be sent in writing as appropriate to:-

Chief Highway Engineer The Department of Transport St Christopher House Southwark Street London SE1 OTE	T A ROCHESTER Chief Highway Engineer

The Deputy Chief Engineer Roads Directorate The Scottish Office Industry Department New St Andrew's House Edinburgh EH1 3TG	J INNES Deputy Chief Engineer

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