THE HIGHWAYS AGENCY BD 34/90

THE SCOTTISH OFFICE DEVELOPMENT DEPARTMENT

THE WELSH OFFICE
Y SWYDDFA GYMREIG

THE DEPARTMENT OF THE ENVIRONMENT FOR
NORTHERN IRELAND

Technical Requirements for the Assessment and Strengthening Programme for Highway Structures

Stage 1 - Older Short Span Bridges and Retaining Structures

Summary: This Departmental Standard supersedes Departmental Standard BD 34/88. It sets out the technical requirements for a programme of assessment and strengthening of certain older short span bridges and retaining structures on motorways and other trunk roads.

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VOLUME 3 HIGHWAY STRUCTURES: INSPECTION AND MAINTENANCE

SECTION 4 ASSESSMENT

PART

BD 34/90

TECHNICAL REQUIREMENTS FOR THE ASSESSMENT AND STRENGTHENING PROGRAMME FOR HIGHWAY STRUCTURES

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September 1990

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1. INTRODUCTION

1.1 The Department is undertaking a comprehensive programme of assessment and strengthening* of its highway structures on motorways and other trunk roads to ensure that they are adequate for present day and future traffic needs. This Departmental Standard deals with the first stage of the programme which is mostly concerned with the older short span bridges and retaining structures. It is intended as an up-to-date revision of BD 34/88, which is hereby superseded. The main purpose of the present revision is to clarify the procedures to be adopted during assessment and prior to undertaking strengthening work. It also introduces specific requirements with regard to assessing structures for abnormal loads and effects minor amendments to the data collection requirements.

1.2 The structures shall be assessed in accordance with Departmental Standard BD 21/84, together with Advice Note BA 16/84 and Amendment No 1: 1989 to both documents, to determine their ability to carry vehicles of up to 40 tonnes gross vehicle weight (40 tonnes Assessment Live Loading). Any structure which is found to be sub-standard when assessed for the 40 tonnes Assessment Live Loading shall be strengthened.

1.3 In addition, structures which can carry the 40 tonnes Assessment Live Loading shall be assessed for specific abnormal vehicle loads and/or Type HB loading in accordance with the requirements of 3.1g.

1.4 Further advice on this Departmental standard is available in Advice Note BA 34/90.

* The term strengthening in this document covers both strengthening and reconstruction.

2. PURPOSE

The purpose of this Departmental Standard is to identify the structures to be included in the programme, to set out the procedures to be followed for their assessment, strengthening and Technical Approval and to introduce the associated technical report forms to be used.

3. SCOPE

3.1 The following structures owned by the Department of Transport shall be assessed in stage 1 (subject to the exceptions given in 3.2):

a. Structures not known to have been designed to carry at least 30 units of HB loading or its equivalent.

b. Retaining walls providing structural support to a road, and not designed for Type HA surcharge or its equivalent.

c. Dry-stone retaining walls providing structural support to a road or supporting material above road level.

d. Structures which are at present subject to weight and/or traffic restrictions for loading reasons.

e. Structures which are thought to have a reduced load carrying capacity as a result of serious deterioration, foundation deficiency, inadequacy of back-filling materials or damage. (Note: Reduced capacity is deemed to be capacity of less than Type HA surcharge for retaining walls and less than 30 units of HB for other structures.)

f. Any structure not known to be designed to the strength-related criteria of Memorandum No 577 or subsequent MOT/DTp standards.

g. Structures which can carry the 40 tonnes Assessment Live Loading shall be additionally assessed for the following categories of abnormal loading with the agreement of the Technical Approval Authority (TAA):

i) General: Type HB

ii) Specific: particular abnormal vehicle configurations

The first category shall apply to all trunk road structures in the assessment programme for which an HB rating derived from recent design calculations using current standards is not already available. The second category of assessment is to be carried out only if it is known at the time of the assessment that a structure will be required to carry specific abnormal vehicles (eg when it is on a heavy load route) and that such an assessment has not already been carried out for that structure using current standards.

3.2 The following structures shall not be assessed:

a. Bridges, culverts, buried structures used as under-passes, pedestrian subways and cattle creeps of less than 1.8 metres span, multi-cell culverts where the cumulative span is 5 metres or less and retaining walls of 1.5 metres height or less from finished ground level in front of the wall to the top of the wall.

b. Long span bridges (ie over 50 metres loaded length). For simply-supported spans the loaded length is the effective span. For bridges of continuous construction consideration should be given to loading on a number of adjacent or alternate spans when calculating the loaded length. The longest loaded length shall govern.

c. Culverts and buried structures of 3 metres span or less with cover of 1 metre or more.

d. Non-masonry culverts and structures which are buried to an extent that highway loading is only of marginal significance when compared with the magnitude of earth pressure acting on the structure.

e. Structures carrying accommodation roads and other non-public roads.

f. Structures that have been certified in accordance with either Technical Memorandum (Bridges) BE 4/73 or Departmental Standard BD 2/79 as designed to carry at least 30 units of HB, or in the case of walls Type HA surcharge or equivalent, unless suffering from a reduction in capacity as described in 3.1e.

3.3 Notes on the significant developments in the history of loading as a background to the scope given in 3.1 are given in Appendix A. The notes are intended as a guide only to assist in determining which structures fall within the scope, as structures built after the introduction of any given loading standard may still have been designed to previous criteria. Those responsible for selecting structures for inclusion in the programme shall satisfy themselves that the structures comply with the scope.

4. INSPECTIONS FOR ASSESSMENT

4.1 Inspections for assessment shall be carried out in accordance with Section 4 of BD 21/84. Where a General or Principal Inspection, (see TRMM 2/88), is due the opportunity may be taken to combine that inspection with the inspection needed for assessment.

4.2 Whilst carrying out such inspections the opportunity shall be taken to up-date structure records, including Form ROADS 277 and Form BE 13/86.

5. ASSESSMENTS

5.1 The assessment methods adopted shall be in accordance with Departmental Standard BD 21/84 with Advice Note BA 16/84 and Amendment No 1: 1989 to both documents. The simple methods of assessment given in Section 4 of BA 16/84 provide a quick and cost-effective method for determining whether structures can carry the 40 tonnes Assessment Live Loading. However, as these methods are conservative they are likely to under-estimate the carrying capacity of structures. Therefore where such methods indicate that a structure may be sub-standard, more refined methods of assessment, including computer techniques when appropriate, shall be applied in accordance with Section 8 of BD 21/84. The TAA will stipulate the appropriate level of accuracy required in a particular case.

5.2 When carrying out a more rigorous analysis of a structure, particularly for one which appears to be only marginally sub-standard, the assumptions about material properties and the dimensions of structural elements etc used in the analysis shall be thoroughly verified. In the case of metal structures the positions of the worst corroded sections may not necessarily correspond with the positions of maximum load effect. In the case of concrete structures tests may indicate that the strength of the concrete is considerably higher than assumed initially.

5.3 During the assessment stage, it will be for the appropriate Director (T), on advice from the TAA, to determine what initial action, if any, is appropriate to safeguide public safety and the integrity of the structure. If, on completion of the assessment, strengthening measures are shown to be necessary, the Regional Offices will determine what interim measures will be appropriate until such time as these can be carried out.

5.4 Assessments for abnormal indivisible loads shall be carried out for structures which can carry the 40 tonnes Assessment Live Loading, in Accordance with 3.1(g). The assessment loading to be applied shall be as specified by the TAA.

6. INTERIM MEASURES

6.1 Structures which are assessed as being unable to carry the 40 tonnes Assessment Live Loading shall be strengthened. However, as it will not usually be possible to commence strengthening immediately it will be necessary, except on structures which can carry the 38 tonnes Assessment Live Loading, (ie vehicles for the current Construction and Use regulations), to undertake some interim measures such as the imposition of a temporary weight/lane restriction, or emergency action such as propping. The appropriate courses of action are described in 1.3 of Departmental Standard BD 21/84. Section 11 of BD 21/84 specifies levels of restricted loading for sub-standard structures which are related to the maximum gross weights of certain vehicle types.

6.2 The restriction signs shall comply with the requirements of 11.7 of Departmental Standard BD 21.84.

6.3 Interim measures shall not be applied until the necessary technical approval procedures referred to in Section 8 have been carried out.

7. STRENGTHENING

7.1 Strenghthening works shall be designed for Type HA and HB loading in accordance with the standards given in the Technical Approval Schedule (TAS) current at the time of design.

8. TECHNICAL APPROVAL PROCEDURES

8.1 Technical approval procedures shall be carried out in accordance with Departmental Standard BD 2/89 Part 1. The Advice Note associated with that Standard is BA 32/89.

9. DOCUMENTATION

9.1 Structural assessment reports are to be completed and submitted on forms AHS/2i and AHS/2ii as described below.

9.2 Form AHS/2i - Structure Assessment Report Part One shall be completed in respect of every assessment to record the results together with details of any previous assessments and any existing restrictions on the structure.

9.3 Form AHS/2ii - Structure Assessment Report Part Two shall be completed, wherever strengthening works are required, to record the proposed measures.

9.4 The forms shall be signed by the team leader responsible for the assessment and also by the following person or their deputy: the Chief Officer (Agent Authority), or Partner (Consulting Engineer). The forms shall then be submitted to the appropriate Regional Office of the Department of Transport. After checking at the Regional Office and signature by Director (DTp) or deputy the forms shall be forwarded to HM Division.

9.5 Forms AHS/2i shall be submitted as soon as possible after the completion of each assessment. They should not be forwarded to HM Division until the appropriate technical approval procedures have been carried out. Forms AHS/2ii shall be submitted as soon as the proposed measures have been decided. They should not be forwarded to HM Division until the proposed measures have been agreed by Regional Office.

9.6 General notes on the completion of forms AHS/2i and AHS/2ii are given in Appendix B. Specific notes on the completion of each form, AHS/2i and AHS/2ii, together with a completed example of each are given in Appendix C and Appendix D respectively.

9.7 On completion of the strengthening works revised Form ROADS 277 and Form BE 13/86 shall be submitted in accordance with TRMM 2/88.

10. REFERENCES

1. BD 21/84 & BA 16/84 - The Assessment of Highway Bridges and Structures: DTp: 1984 and Amendments No 1: DTp: 1989.

2. BA 34/90. Technical Requirements for the Assessment and Strengthening Programme for Highway Structures Stage 1 - Older Short Span Bridges and Retaining Structures: DTp:1990.

3. BD 2/79 (Superseded) - Technical Approval of Highway Structures on Trunk Roads (including Motorways) Part 1: General Procedures: DTp: 1979 and Amendment No 1: DTp: 1984 and Amendment No 2: DTp: 1988.

4. BD 2/89 - Technical Approval of Highway Structures on Motorways and Other Trunk Roads Part 1. General Procedures : DTp : 1989.

5. BA 32/89 - Technical Approval of Highway Structures on Motorways and Other Trunk Roads Part 1 : General Procedures : DTp : 1989.

6. BE 4/73 (Superseded) - Technical Approval of DOE Highway Structures on Trunk Roads and Motorways: DTp: 1973.

7. Memo No 577 (Superseded)- MOWT Memorandum on Bridge Design and Construction: HMSO: 1945.

8. Memo No 771 (Superseded) MOT Standard Highway Loading: HMSO: 1961.

9. Trunk Road Management and Maintenance Notice (TRMM) 2/88 - Trunk Road and Motorway structures - Records and Inspection: DTp: 1988.

10. MOT-Report on Administration of the Road Fund for Year 1921-2: HMSO: 1922.

11. BS 153 Part 3: Loads and stresses: BSI: 1923.

12. BS 153: Appendix 1 to Part 3: BSI: 1925.

13. MOT - Standard Loading for Highway Bridges: HMSO: 1931.

14. BS 153: Part 3 (1st Revision): BSI: 1937.

15. BS 153: Part 3A (2nd Revision): BSI: 1954.

16. Interim Memorandum (Bridges) IM10 (Superseded) MOT Standard Highway Loading: MOT: 1970.

17. Joint Committee: ICE, ISE - CP for Simply Supported Steel Bridges: ICE, ISE: 1949.

18. BE 5/73 (Superseded) - Standard Highway Loadings: DOE: 1973.

11. ENQUIRIES

Technical enquiries arising from the application of this document to a particular structure should be addressed to the appropriate Technical Approval Authority.

All other enquiries or comments about this Departmental Standard should be sent in writing to:

Head of Division
Bridges Engineering Division
Department of Transport
St Christopher House
Southwark Street
LONDON
SE1 0TE

Quoting reference:
BE 21/16/014

Orders for further copies of this Departmental Standard should be accompanied by the remittance shown on the cover and addressed to:

DOE/DTp Publications Sales Unit
Building One
Victoria Road
South Ruislip
Middlesex HA4 0NZ

Telephone No: 01- 841 3425

BACKGROUND NOTES ON THE SIGNIFICANT DEVELOPMENTS IN LOADING 1922-1973

A1.1 A summary of the key publications on loading in the period 1922-1973 is given in Table 1.

A1.2 In relation to the scope given in 3.1 the most significant developments in loading are as follows:

a. 1945 - Introduction of the equivalent of Type HA surcharge. (See Table 1 No 6.)

b. 1961 - Universal requirement for Type HB loading for bridges on roads then designated as follows (see Table 1 No. 9):

Motorways and Trunk Roads: 45 units
Class I and Class II Roads: 37½ units
Class III Roads, (ie mostly unclassified or unnumbered classified roads):

Type HA loading with a check made on the number of HB units which could be carried.

c. 1973 - Revision of the application of HB loading introducing the requirement that bridges on all public roads be designed for at least 30 units of HB. (See Table 1 No 11.) Details, for the then designated roads, are as follows:

Motorways, Trunk Roads, and associated Principal Roads	: 45 units
Principal Roads	: 37½ units
Other Public Roads	: 30 units

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Table 1 - Summary of Key Publications on Loading 1922 - 1973

NO.	DATE	PUBLICATION	CONTENT
1	June 1922	MOT "Report on Administration of the Road Fund for Year 1921-2", HMSO	First standard load for highway bridges: standard train including 50% allowance for impact. Recognised need for greater loading in certain localities to be determined by Local Authority.
2	Aug 1923	BS 153 Part 3: Loads and stresses, BSI	Traffic live loading to be specified by the Engineer. Impact factor inversely proportional to span.
3	May 1925	BS 153 Appendix 1 to Part 3, BSI	Unit loading train for highway girder bridges. Recommends 15 units for main roads in Great Britain.
4	Sept 1931	MOT "Standard Loading for Highway Bridges", HMSO	Introduced equivalent loading curve and knife edge loading including allowance for impact. This loading simulated the MOT standard train.
5	Sept 1937	BS 153 Part 3 (1st Revision), BSI	
6	1945	MOWT "Memorandum on Bridge Design and Construction" Memo No 577, HMSO	Loading identical with 1931 requirement.
7	1949	Joint Committee: ICE, ISE "CP for Simply Supported Steel Bridges", ICE, ISE	Appendix B reviews loadings in use: BS unit loadings (Types A and B); MOT equivalent loading. It also proposes abnormal loading (Type C).
8	Dec 1954	BS 153: Part 3A (2nd Revision), BSI	Appendix A specifies Types HA and HB loading.
9	1961	MOT "Standard Highway Loadings" Memo No 771, HMSO	Formal adoption of BS 153: 1954 by MOT with additional requirements.
10	Sept 1970	MOT Interim Memorandum (Bridges) IM10, "Standard Highway Loadings", MOT	Supplement to Memo No 771.
11	Aug 1973	Technical Memorandum (Bridges) BE 5/73, "Standard Highway Loadings", DOE.	Required a minimum of 30 units of HB loading for Public Roads

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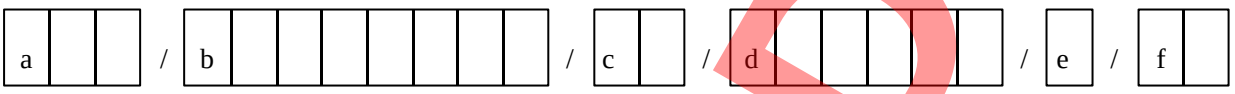
GENERAL NOTES ON COMPLETION OF ASSESSMENT OF HIGHWAY STRUCTURES FORMS AHS/2i AND AHS/2ii

B1.1 Structure Key: enter Structures Database unique reference number for the structure.

B1.2 Structure Number: enter agreed Department of Transport number for the structure. The structure number is comprised of the following components which shall be entered in the boxes, left justified, as shown:



a. Junction number: motorway junction number if appropriate - eg 19.

b. Road: road title eg M55, M4(S) A48, A1(M).

c. Link/Slip Road Designator: for structures at interchanges which are not on either interchange road.

d. Kilometrage: preceding kilometrage marker post for motorways with prefix ‘M’, or the Department of Transport reference number for other motorways and trunk roads.

e. Spur Letter: eg ‘Q’ for culverts or ‘R’ for retaining walls or A, B, C etc as appropriate.

f. Spur Reference: to distinguish structures within the same marker posts or within 0.1 kilometre of each other if appropriate.

B1.3 Structure Name: enter agreed DTp structure name.

B1.4 Region, Agent, and Consultant Code and Name: enter agreed codes and names. (See TRMM 2/88.)

B1.5 All forms shall be signed at the level indicated by the Department. (See 9.3.)

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NOTES ON COMPLETION AND EXAMPLE OF ASSESSMENT OF HIGHWAY STRUCTURES FORM AHS/2i - STRUCTURE ASSESSMENT REPORT PART ONE

C1 **Purpose**

C1.1 This form shall be completed to record the results of a structure assessment.

C2 **Completion**

C2.1 This form shall be completed as follows:

a. Date Assessment Completed: enter date on which Structure Assessment Report (Part One) completed. Date shall be in form of: 19-JUN-1990.

B. Structure Key, Name and Number; Region, Agent, Consultant Code and Name: enter as appropriate. (See Appendix B.). Where a Maintenance Agent carries out the assessment work the Agent code should be entered in the Consultant Code field.

c. Previous assessments (Questions 1-4)

This section shall be completed to show which assessments, if any, the structure has been subject to as follows:

i. Questions 1-4: enter Y or N.

ii. Question 3: where Y is entered details should be given on the back of the form.

d. Existing Restrictions on Structure (Questions 5-11)

This section shall be completed in respect of any restrictions in effect at the time of the assessment to BD 21/84 as follows:

i. Question 5: enter Y or N.

ii. Question 6: The basis of the restrictions shall be entered as follows:

None - 0
For BE 4 - 1
For BE 3/73 - 2
For Other - 3.

Where '3' is entered an explanation shall be given on the back of the form.

iii. Questions 7 & 8: enter appropriate restriction in tons or where no restriction enter 0.

iv. Questions 9-11: enter Y or N.

e. Assessed capacity of structure to assessment code (Questions 12 & 13)

Details of the capacity of the structure as assessed by application of Departmental Standard BD 21/84 shall be given in

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this section as follows:

i. Question 12: enter Assessment Live Loading capacity in tonnes in accordance with 7.4 of BD 21/84 or where less than 3 tonnes enter 2.9. For masonry arches, values from Table 5.6 of BA 16/84 should be entered.

ii. Question 13: enter as follows:

1: Assessed capacity to carry Group 1

2: Assessed capacity to carry Group 2

0: Assessed capacity unable to carry Group 1 or 2.

f. Assessed capacity to carry exceptional loads (Questions 14-16)

Details of assessments for exceptional loads shall be given in this section as follows:

i. Question 14: enter Y or N.

ii. Question 15: enter loading in HB units.

iii. Question 16: enter Y or N. Where Y give details on the back of the form.

g. Major factors governing load capacity (Question 17)

Where structures are not capable of carrying the 40 tonnes Assessment Live Loading this section shall be completed to show the element(s) governing capacity and the factor(s) affecting their strength.

i. The boxes shall be completed working from top to bottom and left to right.

ii. E - Element. For each element governing capacity enter appropriate code from Table 1.

iii. IF - Inspection Factor(s). Enter the code for the factor(s) affecting the element's strength as revealed on inspection from Table 2. The purpose of IF codes is to identify defects observed on the element and not to attribute causes. A summary of the acceptable/unacceptable IF code entries by element is given in Table 4.

iv. AF - Analysis Factor(s). Enter the code for the factor(s) affecting the element's strength as revealed by analysis from Table 3. A summary of the acceptable/unacceptable AF code entries by element is given in Table 5.

v. For each element code (E) entry there must be at least one IF and AF entry.

vi. If necessary continuation sheets should be attached.

vii. If the required element or factor does not appear in Tables 1-3 insert an asterisk where appropriate in the boxes and give details on the back of the form.

Table 1 - Structural Elements Governing Capacity

Superstructure Elements		Substructure or Retaining Wall Elements	
Element	Code	Element	Code
Main Beams	10	Foundations	01
Transverse Beams	11	Piers/Columns	04
Diaphragms/Bracings	12	Abutments	05
Concrete Slab	13	Wing Walls	06
Metal Deck Plates	14	Retaining Walls - other than 32	07
Jack Arch	15	Bearings	09
Arch Ring	16	Dry stone Retaining Walls	32
Spandrel Walls	17		
Tie Rods	18		
Troughing	33		

Table 2 - Major Factors Affecting Strength - Inspection

Factors affecting Strength	Code
defects not significant	01
loss of section	02
cracking	03
weathering	04
buckling	05
fracture	06
excessive deflexion	07
excessive rotation	08
inadequate pointing	09
bulging	10
distortion	11
tilting	12
settlement	13
subsidence	14
rocking	15
sliding	16
scour	17

Table 3 - Major Factors Affecting Strength - Analysis

Factor	Code
analysis not carried out	01
inadequate moment of resistance	02
inadequate shear resistance	03
inadequate torsional resistance	04
inadequate compressive strength	05
inadequate tensile strength	06
inadequate factor of safety for sliding	07
inadequate factor of safety for overturning	08
inadequate bearing capacity	09
inadequate vertical load capacity	10
inadequate horizontal load capacity	11

INSPECTION FACTOR/CODE		MAIN BEAMS 10	TRANS BEAMS 11	DIAPH/ BRAC 12	CONCR SLAB 13	METAL DK PL 14	JACK ARCH 15	ARCH RING 16	SPAND WALLS 17	TIE RODS 18	TROU- GHING 33	FOUND 01	PIERS /COLS 04	ABUT 05	WING WALLS 06	RET WALLS 07	BEAR- INGS 09	DRY STONE 32
DEFECTS NOT SIGNIFICANT	01	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
LOSS OF SECTION	02	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
CRACKING	03	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
WEATHERING	04	N	N	N	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	Y
BUCKLING	05	Y	Y	Y	N	Y	Y	Y	N	N	Y	N	Y	N	N	N	N	N
FRACTURE	06	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
EXCESSIVE DEFLEXION	07	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y	N
EXCESSIVE ROTATION	08	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N
INADEQUATE POINTING	09	N	N	N	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	N
BULGING	10	N	N	N	N	N	N	N	Y	N	N	N	N	Y	Y	Y	N	Y
DISTORTION	11	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
TILTING	12	N	N	N	N	N	N	N	Y	N	N	N	N	Y	Y	Y	N	N
SETTLEMENT	13	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N
SUBSIDENCE	14	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N
ROCKING	15	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N
SLIDING	16	N	N	N	N	N	N	N	Y	N	N	Y	Y	Y	Y	Y	Y	Y
SCOUR	17	N`	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N

KEY: Y = ACCEPTABLE N = UNACCEPTABLE

Table 4 - Summary of Acceptable/Unacceptable Inspection Factor Codes by Element

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ANALYSIS FACTOR/CODE		MAIN BEAMS 10	TRANS BEAMS 11	DIAPH/ BRAC 12	CONCR SLAB 13	METAL DK PL 14	JACK ARCH 15	ARCH RING 16	SPAND WALLS 17	TIE RODS 18	TROU-GHING 33	FOUND 01	PIERS /COLS 04	ABUT 05	WING WALLS 06	RET WALLS 07	BEAR-INGS 09	DRY STONE 32
ANALYSIS NOT CARRIED OUT	01	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
INADEQUATE MOMENT OF RESISTANCE	02	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
INADEQUATE SHEAR RESISTANCE	03	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N
INADEQUATE TORSIONAL RESISTANCE	04	Y	Y	Y	Y	Y	N	Y	N	N	N	Y	Y	Y	Y	N	N	N
INADEQUATE COMPRESSIVE STRENGTH	05	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
INADEQUATE TENSILE STRENGTH	06	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
INADQUATE FOS FOR SLIDING	07	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N
INADEQUATE FOS FOR OVERTURNING	08	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N
INADEQUATE BEARING CAPACITY	09	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N
INADEQUATE VERTICAL LOAD CAPACITY	10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N
INADEQUATE HORIZONTAL LOAD CAPACITY	11	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N

KEY: Y = ACCEPTABLE N = UNACCEPTABLE

Table 5 - Summary of Acceptable/Unacceptable Analysis Factor Codes by Element

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Department of Transport

Structure Assessment Report (Part One)

AHS/2i

Date Assessment Completed: 21-JUN-1990

Structure Key: 54321

Structure Number: 19A/M5G/WS/134•50/Q/1

Structure Name: NEW RIVER VIADUCT

Region Code: 9900 Region: NSRO

Agent Code: 4900 Agent Name: BARSETSHIRE

Consultant Code: 7900 Consultant Name: K.M. SNAVE & PARTNERS

Previous Assessments

1. BE4: Y
2. BE3/73: N
3. Other: N
4. None: N

Existing Restrictions on Structure

5. Restricted: N
6. Basis of Restriction: 0
7. Vehicle Weight (tons): 00•0
8. Axle Weight (tons): 00•0
9. Lane Width: N
10. Single Lane Working: N
11. Structure Being Monitored: N

Assessed Capacity of Structure to Assessment Code

12. Assessment Live Loading (tonnes): 25•0
13. FE Group: 1

Assessed Capacity to Carry Exceptional Loads

14. Structure assessed for HB: N
15. Level of HB Loading which can be carried (units): 00•0
16. Structure assessed for AIL: N

Major Factors Governing Load Capacity

17.

E	IF	E	IF	E	IF	E	AF	E	AF	E	AF
10	02	09	08			10	02	01	07		
10	05	09	15			10	03	01	09		
10	07	01	02			10	04				
13	03	01	03			13	02				
13	07	01	13			13	03				
13	06	01	17			09	10				
09	07					09	11				

Signature of Team Leader: T. Leader
Date: 2-JUL-1990

Signature of Chief Officer or Partner: A. Partner
Date: 5-JUL-1990

Signature of Director (DTp): D. Rector
Date: 31-JUL-1990

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NOTES ON COMPLETION AND EXAMPLE OF ASSESSMENT OF HIGHWAY STRUCTURES FORM AHS/2ii - STRUCTURE ASSESSMENT REPORT PART TWO

D1 **Purpose**

D1.1 This form shall be completed to record details of any measures required as a consequence of the assessment.

D2 **Completion**

D2.1 The form shall be completed as follows:

a. Structure Key, Name and Number; Region, Agent, Consultant Code and Name: enter as appropriate.(See Appendix B.). Where a Maintenance Agent carries out the work the Agent Code should be entered in the Consultant Code field.

b. Proposed remedial measures (Questions 1-7)

This section shall be completed to show the remedial measures proposed in respect of permanent works to ensure that the structure can carry the 40 tonnes Assessment Live Loading given in BD 21/84, as follows:

i. Questions 1-6: enter Y or N. Questions 5 and 6 apply only to structures which are classified as Retaining Walls in the Structures Database, for other structures enter N.

c. Affected Spans (Questions 7 & 8)

This section shall be completed to show the number of spans of the superstructure to be strengthened or reconstructed, as follows:

i. Questions 7 & 8: enter number of spans.

d. Interim Measures (Questions 9-16)

This section shall be completed to show what measures such as weight or lane restrictions are proposed as temporary expedients as follows:

i. Questions 9 and 11-16: enter Y or N.

ii. Question 10: enter weight restriction in tonnes.

e. Estimated cost of proposed remedial measures (Question 17)

This section shall be completed to give an estimate of the costs involved to execute the proposed remedial measures as follows:

i Question 17: enter estimated cost.

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Depart[illegible] of Transport

Structure Assessment Report (Part Two)

...1S/2ii

Structure Key 54321

Structure Number 19A / M5G / WS / 134·50 / Q / 1

Structure Name NEW RIVER VIADUCT

Region Code 9900 Region NSR

Agent Code 4900 Agent Name BARSETSHIRE

Consultant Code 7900 Consultant Name K.M. SNAVE & PARTNERS

Proposed Remedial Measures

1.	Strengthen Superstructure	Y
2.	Reconstruct Superstructure	N
3.	Strengthen Substructure	Y
4.	Reconstruct Substructure	N
5.	Strengthen Independent Retaining Wall	N
6.	Reconstruct Independent Retaining Wall	N

Affected Spans

7.	Number of Spans to be Strengthened	05
8.	Number of Spans to be Reconstructed	00

Interim Measures

9.	Required	Y
10.	Impose Weight Restriction (tonnes)	25·0
11.	Impose Lane Width Restriction	N
12.	Impose One Way Working	N
13.	Prop Structure	N
14.	Close Structure	N
15.	Provide Temporary Alternative	N
16.	Monitor Structure	N

Estimated Resources for Proposed Remedial Measures

17. Estimated Cost of Remedial Measures £ 500000

Signature of Team Leader: T. Leader
Date: 13-AUG-1990

Signature of Chief Officer or Partner: J. Partner
Date: 27-AUG-1990

Signature of Director (DTp): Di Rector
Date: 13-SEP-1990

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