CONTENTS PAGE

BRIDGE REFERENCE

EDE25

BRITISH RAIL PROPERTY BOARD

BRIDGE ASSESSMENT TO BD21/97

B6259 – GREAT MUSGRAVE RAILWAY BRIDGE NO 25

CONSULTANCY & DESIGN

CUMBRIA COUNTY COUNCIL - CONSTRUCTION SERVICES BD 21/97 LOAD ASSESSMENT REPORT FOR: B6259 GREAT MUSGRAVE RAILWAY BRIDGE	PAGE No. 1 OF 38 PAGES REV No. 0 DATE: Nov. 98

REPORT COVER SHEET AND INDEX

CLIENT: BRITISH RAIL PROPERTY BOARD

SCHEME No.: As Quality Plan

ASSESSMENT LIST APPENDIX No.: 24 **DATED:** 27/08/96

FOR QUALITY PLAN REF: BG/96/97
(Note: Work is covered by Scheme Specific Instruction)

REPORT TITLE: AS HEADER

STATUS	DATE	AUTHOR	APPROVED
ISSUED FOR USE	Nov. 98	[redacted] (Assessor)	[redacted] (Team Leader)

CATEGORY B

SIGNED: ..... [redacted] ..... **Date:** 13 Nov. 98.
(Assessor)

APPROVED: ..... [redacted] ..... **Date:** 14 Nov. 98.
(Team Leader)

DATE SUBMITTED TO CLIENT: 19 Nov. 98.

DISTRIBUTION LIST:
ONE COPY PRODUCED FOR CCC STRUCTURES CLIENT AND BRPB.
ONE COPY RETAINED IN CCC RECORD SYSTEM

RECORD COPY RETAINED BY E+E.

The assessment was carried out in accordance with the standards stated in the Design Basis Statement/Approval in Principle Form TA1 countersigned by the Client on ....10 Nov 97.....(delete if non-applicable).

1. The results of the assessment are as follows:

Great Musgrave No 25 Railway Bridge has been assessed in accordance with BA16/97 and BD21/97 using the modified MEXE method.

The arch barrel has been found to be unsatisfactory for Full Construction and Use loading. A 17 Tonne weight restriction should be applied to the structure.

The allowable axle loads are: Max single axle load = 11.5T per axle
Max double axle load = 7.5T per axle
Max triple axle load = 6.5T per axle

The foundations, abutments, wingwalls, spandrels and parapets have been assessed qualitatively (visual inspection) in accordance with clause 8 of BD21/97 and are considered adequate to carry the present imposed loading.

The parapets do not comply with the requirements of BD52/93 in terms of impact resistance.

2. Recommendations to increase the assessed capacity are as follows:

Repoint arch barrel

ASSESSMENT TO BD 21/97
INSPECTION AND SURVEY INFORMATION

Explanatory Notes on Completion of Inspection Report Form

Severity:

1 - No significant defect.

2 - Minor defects of a non-urgent nature.

3 - Defects which should be included for attention within the next annual maintenance programme.

4 - Severe defects where urgent Client action is recommended for the protection of persons and property.

Extent:

A - No significant defect.

B - Slight, not more than 5% of length or area affected.

C - Moderate, 5% - 20% affected.

D - Extensive, more than 20% affected.

Boxes for all applicable elements are to be completed, i.e. Extent A Severity 1 represents a 'nil' report.

Boxes for non-applicable elements are to be dashed to indicate consideration.

A typical form is shown overleaf.

The comments section is to be used to list remedial works and estimated costs. The rear of the form or an extra sheet may be used for continuations.

C.C.C. BRIDGE INSPECTION REPORT — DEPARTMENT OF HIGHWAYS AND ENGINEERING

ROAD NO B6259 BRIDGE NO 25 BRIDGE NAME GREAT MUSGRAVE

TYPE OF BRIDGE MASONRY ARCH SPANS 1 N° 8·45 m (SKEW)

DATE OF INSPECTION 4/9/96 INSPECTED BY [redacted]

ITEM NO	ITEM DESCRIPTION	EXTENT	SEVERITY	COMMENTS/DESCRIPTION OF CONDITION
1	FOUNDATIONS	A	1	NOT INSPECTED BUT NO SIGNS OF MOVEMENT
2	INVERT OR APRONS	A	1	
3	FENDERS			
4	PIERS/COLUMNS			
5	ABUTMENTS	A	1	
6	WING WALLS	B	2	REPOINT OPEN/CRACKED JOINTS MONITOR CRACHING TO S·E WINGWALL
7	RETAINING WALLS OR REVETMENTS			
8	APPROACH EMBANKMENTS			
9	BEARINGS			
10	MAIN BEAMS			
11	TRANSVERSE BEAMS			
12	DIAPHRAGMS OR BRACING			
13	CONCRETE SLAB			
14	METAL DECK PLATES			
15	JACK ARCHES			
16	ARCH RING/~~ARMCO~~	B	2	REPAIR LOCAL SPALLED ELEMENTS, REPOINT OPEN JOINTS
17	SPANDRELS	D	3	REPOINT OPEN/CRACKED JOINTS; MONITOR NORTH SPANDRELS FOR FURTHER MOVEMENT
18	TIE RODS			
19	DRAINAGE SYSTEM			
20	WATERPROOFING			
21	SURFACING	A	1	
22	SERVICE DUCTS			
23	EXPANSION JOINTS			
24	PARAPETS	D	2	REPOINT OPEN JOINTS TO NORTH PARAPET REBED DISPLACED MASONRY TO N·E END
25	ACCESS GANTRIES OR WALKWAYS			
26	MACHINERY			

REMEDIAL WORK RECOMMENDED AT PREVIOUS INSPECTION SATISFACTORILY COMPLETED YES/NO

COMMENTS IF ANSWER IS NO.....

INSPECTION AND SURVEY INFORMATION

ACTION

GENERAL

Great Musgrave Railway No 25 consists of a 8.45m single skew span sandstone masonry arch structure carrying the B6259 over a disused railway line, 0.5km west of the village of Great Musgrave.

The structure can be located at Ordnance Survey Reference NY 765 136.

Inspection of the structure was carried out on 4 September 1996 using a 7.5m aluminium extension ladder for access.

The weather was warm, dry and sunny on the day of the inspection.

FOUNDATIONS (Item No. 1)

Inspection of the bridge did not reveal any undue signs of movement/settlement which would indicate any inadequacies in the foundations. It can therefore be assumed that the foundations are sound and that they are adequate to support the present imposed loading.

INVERT/TRACK BED (Item No. 2)

The original railway line and ballast has been recovered and the land returned to agricultural use.

ABUTMENTS (Item No. 5)

Both east and west abutments were constructed from large rectangular, course, rockfaced sandstone masonry blocks following a good uniform alignment (Photo No 5 & 6). The mortar joints to the abutments were generally intact and filled with reasonable quality. Inspection of the abutments did not reveal any defects which would reduce their ability to carry the current imposed loading.

A longstanding vertical crack 0.3mm wide was present through the full depth of the NW springing bedstone, visible on the north face.

Monitor

ARCH BARREL (Item No. 16)

Barrel constructed from coursed, dressed sandstone masonry (Fb = 0.95) with 6mm - 10mm wide mortar joints (Fw = 0.9). The faces of 4No barrel stones had spalled away to a depth of 30mm on the second and third courses above the west springing, 2No 500mm from the north edge and 2No 500mm from the south edge (Photo No 9). The face of 1 No number block has spalled away to a depth of 75mm over a 300 x 450mm area (Photo No 8), 2 No courses west of the crown 1.5m from the south edge. The mortar to the joints to this spalled barrel stone was missing for the full arch barrel depth. At the time of inspection the arch barrel was dry, however leachate deposits were present for a distance of 2m in from each edge indicating that water has or still is penetrating through the arch barrel construction. Random open joints were evident to 10% of the barrel soffit in the crown area.

Monitor

Local repair

INSPECTION AND SURVEY INFORMATION (CONT.)

ACTION

The length of open joints varied between 150 to 300mm to an average depth of 300mm.
(Fd = 0.8, Fmo = 0.9)

Repoint open joints

The voussiors to the north elevation were reasonably well pointed and followed a good alignment with no visible deterioration of the individual masonry elements.

The south voussiors also maintained a satisfactory profile, with no visible deterioration of the individual masonry elements. The voussior soffit joint was open for up to 60mm in the length at the bottom corner for 3No voussiors at the SW quarter point, the rest of the joints to the voussiors were reasonably well pointed.

Repoint open joints

SPANDREL WALLS (Item No. 17)

Spandrels constructed from coursed rockfaced sandstone masonry. The alignment of the south spandrel was satisfactory with no sign of any significant lateral displacement, bulging or movement. Random cracking was evident to a number of mortar joints over the south spandrel area. Cracking of the mortar pointing to the extrados joint has occurred for the full length of the joint with the mortar missing over the 8th and 9th voussoir above the SW springing (Photo No 10).

Repoint cracked/open joints

50% of the pointing to the north spandrel extrados joint was missing, where pointing was present cracking was evident together with evidence of 2-3mm spandrel displacement (possibly longstanding). 30% of the mortar joints to the north spandrel were cracked or the pointing was spalling away from the masonry. Apart from the lateral displacement the alignment of the spandrel wall was satisfactory with no significant bulging or deformation evident.

Repoint cracked/open joints
Monitor for further movement

Both stringcourses followed a satisfactory alignment with no significant deformation, the majority of the mortar pointing to the perp joints has been washed out leaving the joints open. Minor vegetation was evident along the stringcourse to the north elevation (Photo No 13).

Repoint open joints
remove vegetation

WING WALLS (Item No. 6)

Wing walls constructed from coursed, rockfaced sandstone masonry.

The SE wingwall followed a good alignment with no significant deformation rotation or movement. A small number of the mortar joints were cracked but overall the pointing to the wall was satisfactory. A longstanding predominately vertical crack 1-2mm wide ran the full height of the wall, in the mortar joints, 4m east of the east abutment (Photo No 14).

Monitor

The SW and NE wingwalls were reasonably well pointed with only the occasional cracked joint, both walls following a satisfactory alignment.

INSPECTION AND SURVEY INFORMATION (CONT.)

ACTION

The mortar was cracked or missing to 10% of the joints to the NW wingwall. 2 No masonry blocks were badly weathered with the faces spalled away adjacent to the spandrel, 1No 6 course above ground level for the full course height, 450mm in length for a depth of 100mm and 1No 3 course above ground level for the full course height, 300mm in length for a depth of 75mm (Photo No 15).

Repoint cracked/open joints
Local masonry repair

PARAPETS (Item No. 24)

The parapets are constructed of coursed dressed sandstone masonry with flat top sandstone copings. Accidental damage has resulted in 2No masonry blocks being displaced by up to 100mm at the east end of the north parapet, 2 courses above road level (Photo No 17). The pointing to the north parapet is at the end of its life with the majority of the joints open or cracked (Photo No 18) 30% of the mortar joints to the north parapet requiring repointing (Photo No 19). Apart from the minor accidental damage on the north parapet both parapets followed a satisfactory alignment.

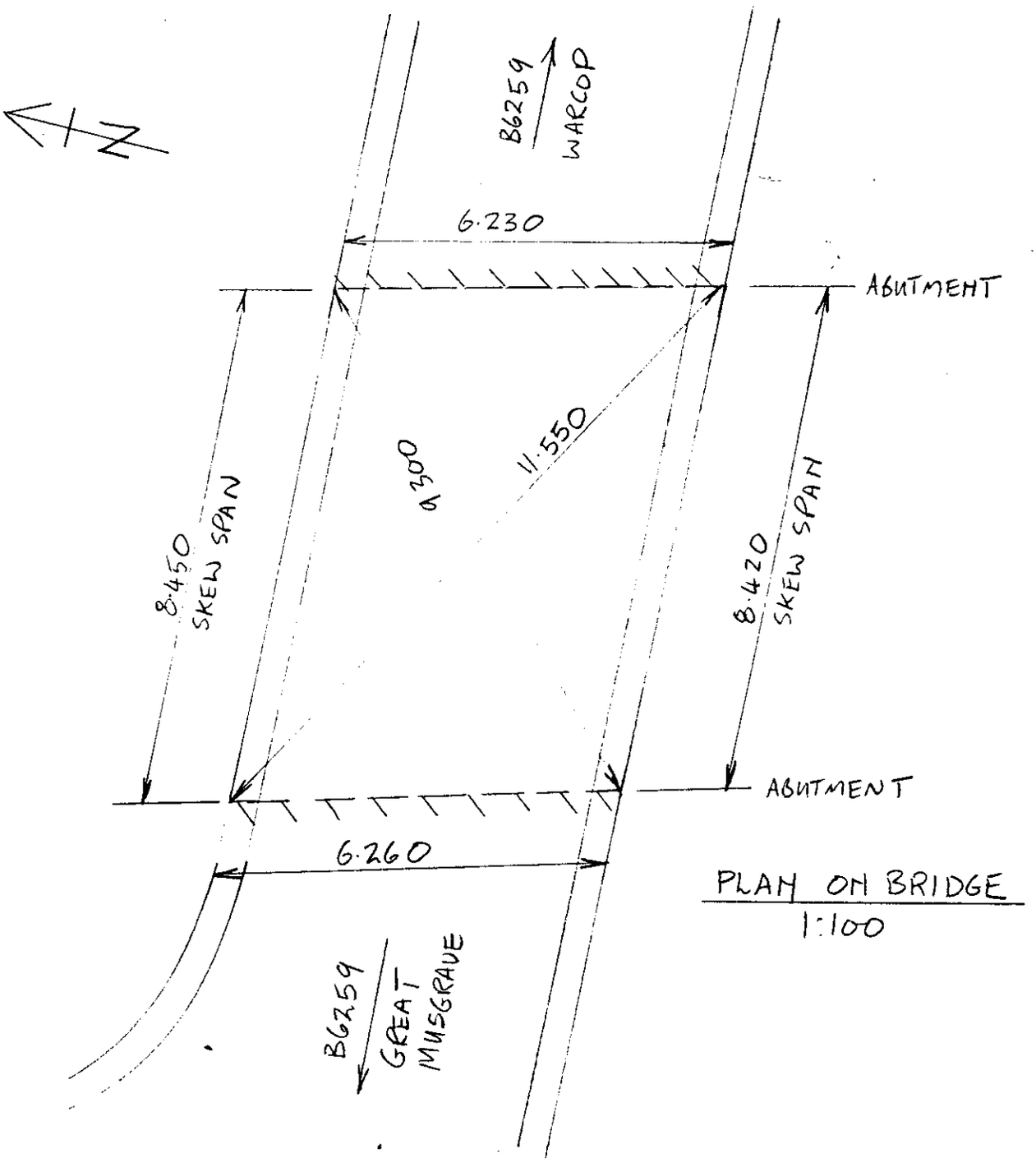
Reset masonry blocks
Repoint open/cracked joints

CARRIAGEWAY (Item No. 21)

The bitmac surfacing over the structure was found to be in a satisfactory condition, however very minor rutting was evident to the surfacing.

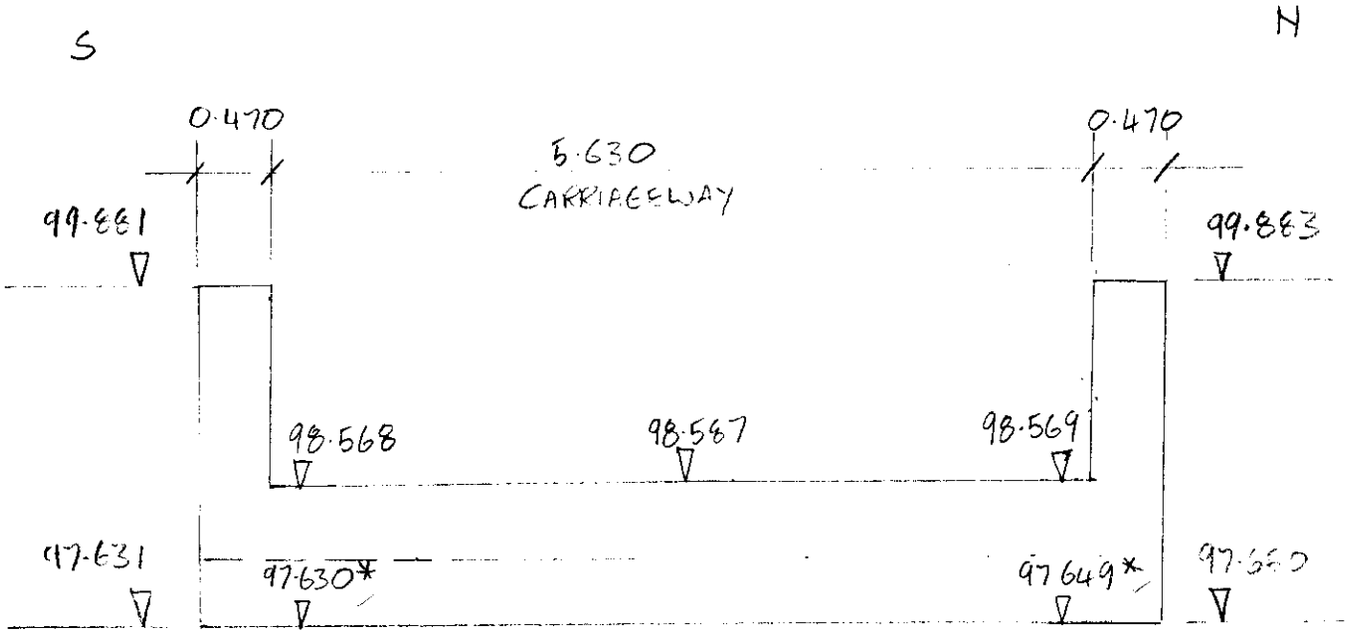
Inspection of the surfacing did not reveal any significant settlements/rutting therefore the unknown barrel fill is assumed to be well compacted (Ff = 0.7).

INSPECTION AND SURVEY INFORMATION



PLAN ON BRIDGE
1:100

INSPECTION AND SURVEY INFORMATION



* INTERPOLATED LEVEL

SKEW CROSS SECTION AT CROWN
1:50

INSPECTION AND SURVEY INFORMATION

(NOT TO SCALE)

SOUTH ELEVATION

r_c = 97.631 − 95.331 = 2.300 m

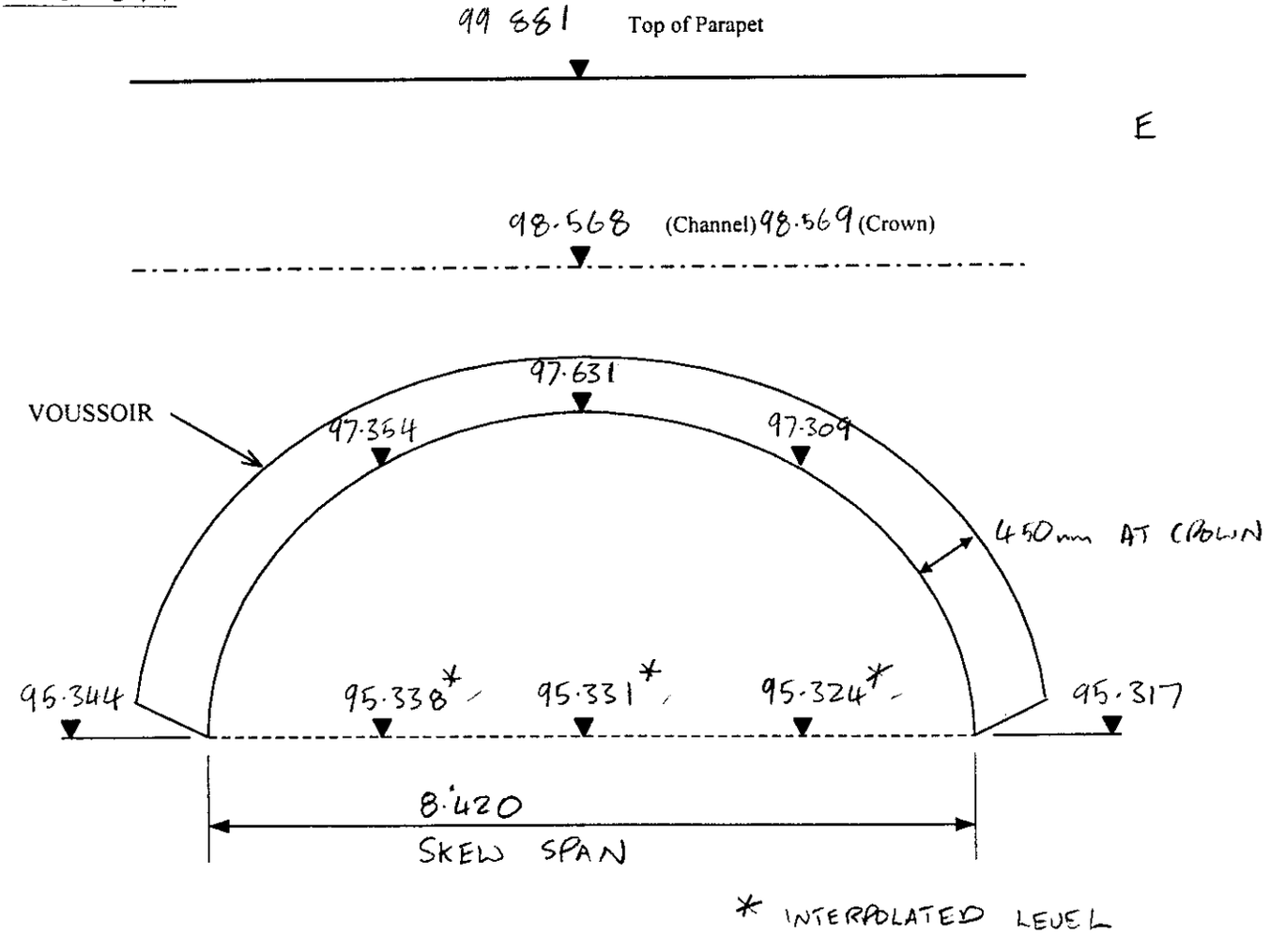
r_q = { (97.354 − 95.338) + (97.309 − 95.324) } ½ = 2.001 m

d = ⅔ × 0.450 = 0.300 m

h = (98.568 − 97.630*) − 0.300

= 0.638 m

* DENOTES INTERPOLATED LEVEL



INSPECTION AND SURVEY INFORMATION

(NOT TO SCALE)

NORTH ELEVATION

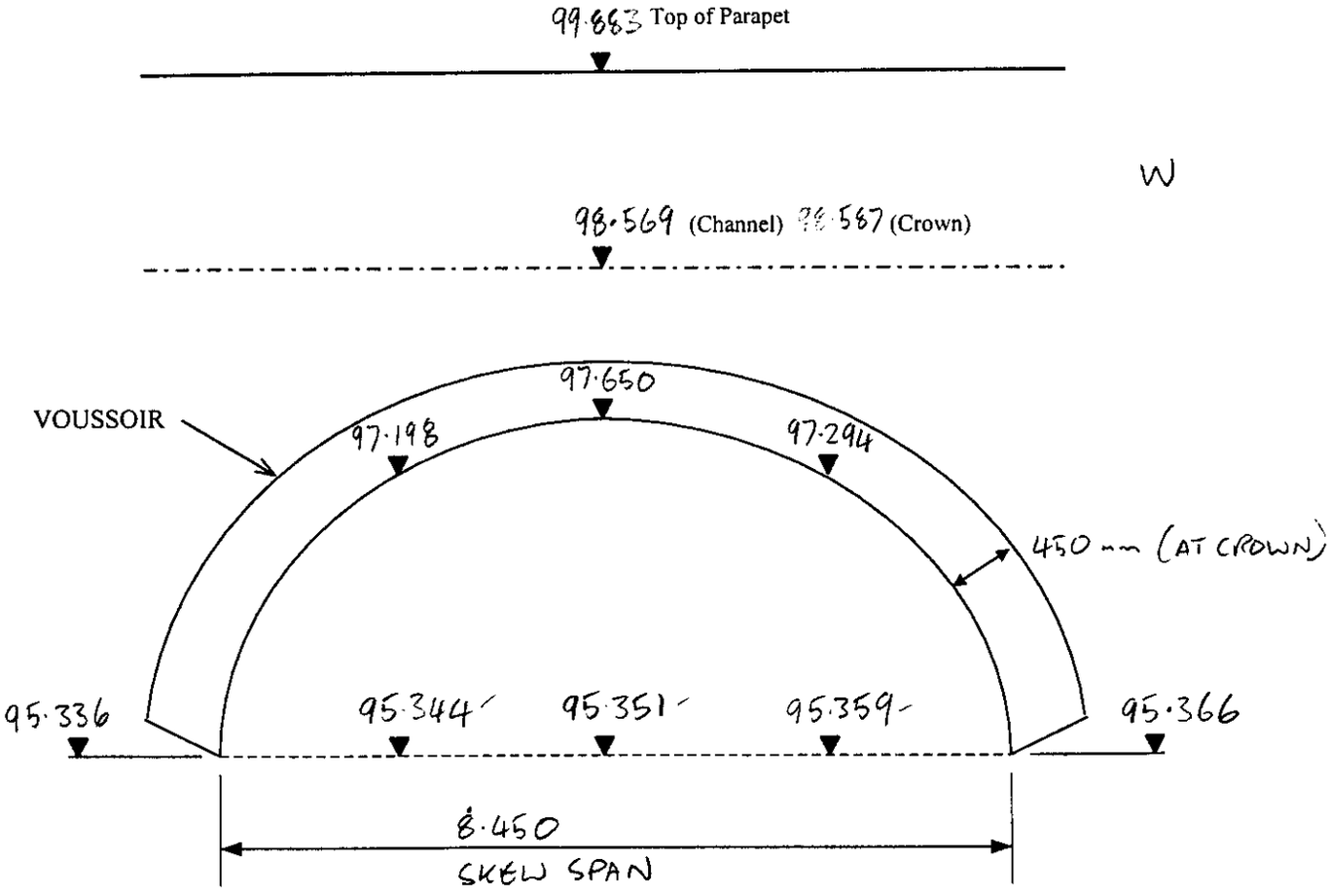
r_c = 97·650 − 95·351 = 2·299 m

r_q = { (97·198 − 95·344) + (97·294 − 95·359) } ½ = 1·895 m

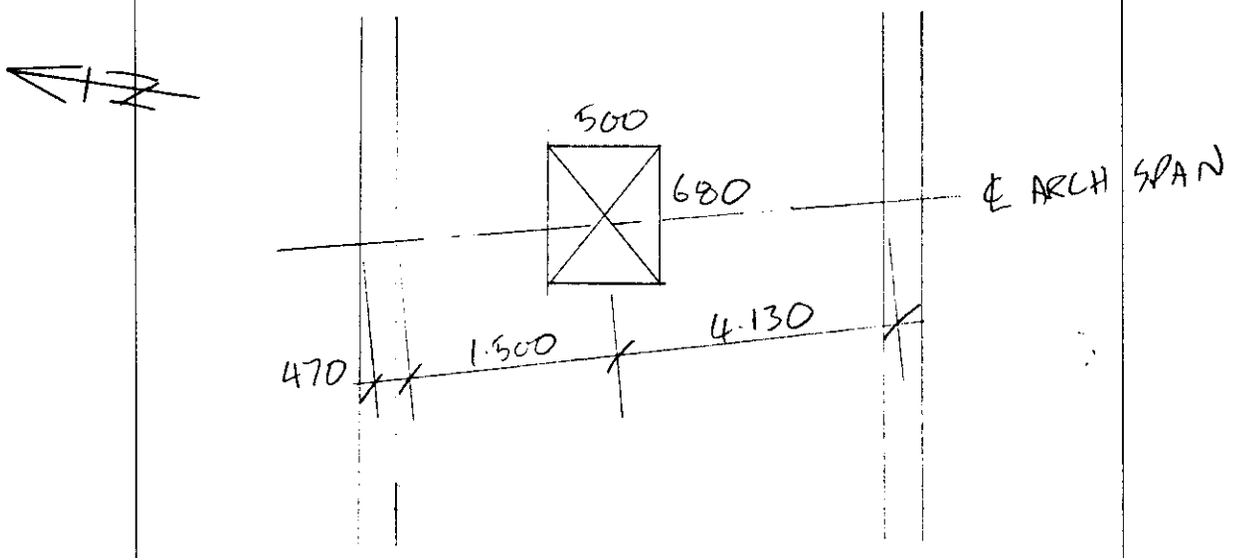
d = ⅔ × 0·450 = 0·300 m

h = (98·569* − 97·649*) − 0·3 = 0·620 m

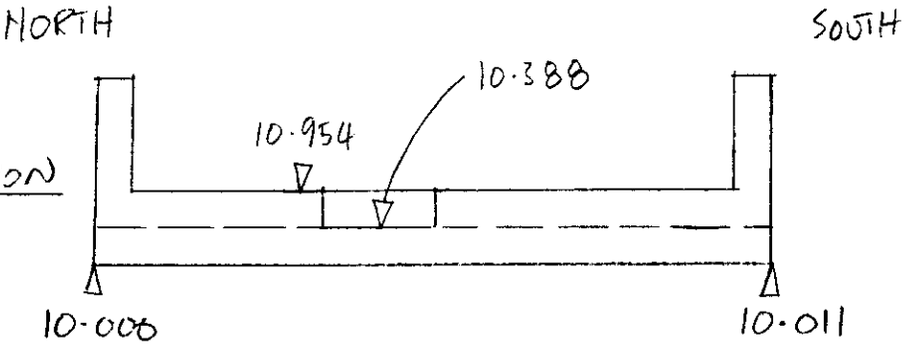
* DENOTES INTERPOLATED LEVEL



TRIAL HOLE 16/12/97



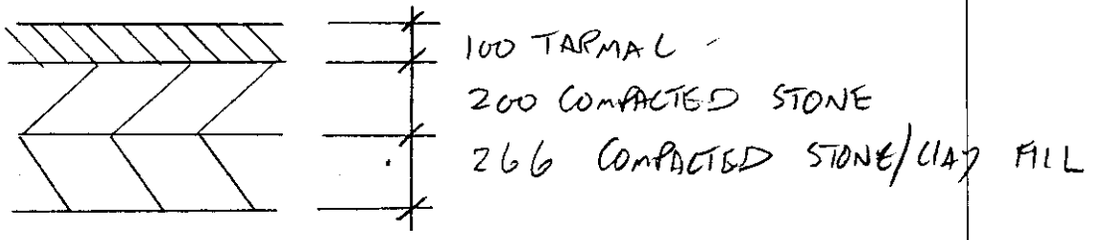
PLAN



SKEW CROSS-SECTION

$$\therefore \text{ARCH RING} = 10.388 - \left[10.000 + \left(\frac{1.97}{6.57} \times 0.011\right)\right]$$

$$= 0.385\ \text{m}$$



SECTION THROUGH TRIAL HOLE

ASSESSMENT TO BD 21/97
CALCULATIONS

BD 21/97 LOAD ASSESSMENT
DESIGN BASIS STATEMENT AND CALCULATIONS
FIRST SHEET

Sheet No: 21 of 38 sheets
Rev No: 0

FOR: B6259 GREAT MUSGRAVE RAILWAY BRIDGE

Date Prepared:	Prepared by:
oct 98	[redacted]
Date Checked:	Checked by:
Nov 1998	[redacted]

1. **NAME OF ASSESSOR** [redacted]
2. **NAME OF CHECKER**
3. **CHECK CATEGORY** C1/I
   (MS-04/03)

4. **PURPOSE OF CALCULATIONS**
   BD 21/97 ASSESSMENT FOR:- a) C & U VEHICULAR LOADING
   b) PROPOSED EC 40T LOADING

   ASSESSMENT OF TYPE HB LOADING CAPACITY FOR A SINGLE VEHICLE ON THE BRIDGE ONLY (WITH THE EXCEPTION OF MASONRY ARCH BRIDGES AND ALL U ROAD BRIDGES)

5. **STANDARDS, CODES OF PRACTICE AND REFERENCE DOCUMENTS USED FOR ASSESSMENT** *(Erase as appropriate)*
   SEE APPENDIX DBSC1 OVERLEAF
   SEE APPROVAL IN PRINCIPLE FORM TA1

6. **SOURCES OF INPUT DATA**
   SITE SURVEY AND INSPECTION DATA
   ~~RECORD DRAWINGS~~

7. **DESCRIPTION OF METHODS OF ANALYSIS AND DETAILS OF COMPUTER PROGRAMS USED**

   CASIO CALCULATOR - PROGRAM 'MEXE v1.5'

8. **REVIEW AND VERIFICATION OF ASSESSMENT BY TEAM LEADER**
   The assessment output meets above requirements

   Signed ..... [redacted] ..... Date 14 Nov. 98

   Name ..... [redacted] .....

   Comments ..... Satisfactory. .....

   .....

(Note: Erase references not applicable)

A. MANDATORY DOCUMENTS

		Dated
~~BD 16/82~~	~~Design of Composite Bridges - Use of BS 5400 Pt 5:1979~~	~~Nov 1982~~
	~~Amendment No. 1~~	~~Dec 1987~~
~~BD 24/92~~	~~The Design of Concrete Bridges - Use of BS 5400 : Pt 4: 1990~~	~~Nov 1992~~
~~BD 37/88~~	~~Loads for Highway Bridges~~	~~Aug 1989~~
~~BD 2/89~~	~~Technical Approval of Highway Structures on Motorways and Other Trunk Roads. Part 1 - General Procedures~~	~~Oct 1989~~
~~BS 5400~~	~~Steel, Concrete and Composite Bridges~~	
	~~Part 3: 1982 - CP for Design of Steel Bridges (see BD 13/90)~~	~~1982~~
	~~Part 4: 1990 - CP for Design of Concrete Bridges (see BD 24/92)~~	~~1990~~
	~~Part 5: 1979 - CP for Design of Composite Bridges (see BD16/82)~~	~~1979~~
~~BD 13/90~~	~~The Design of Steel Bridges - Use of BS 5400: Part 3: 1982~~	~~Feb 1991~~
~~BD 34/90~~	~~Technical Requirements for the Assessment and Strengthening Programme for Highway Structures - Stage 1 - Older, Short Span Bridges and Retaining Structures~~	~~Sept 1990~~
~~BD 44/95~~	~~The Assessment of Concrete Highway Bridges and Structures~~	~~Jan 1995~~
~~BD 52/93~~	~~The Design of Highway Bridge Parapets~~	~~April 1993~~
~~BD 48/93~~	~~The Assessment and Strengthening of Highway Bridge Supports~~	~~June 1993~~
BD 21/97	The Assessment of Highways Bridges and Structures	Feb 1997
	Amendment No. 1	Aug 1997
BD 63/94	The Inspection of Highway Structures	Oct 1994
~~BD 31/87~~	~~Buried Concrete Box Type Structures~~	~~Jan 1988~~

B. ADVICE NOTES AND OTHER REFERENCE DOCUMENTS

(Note: Add references as appropriate)

~~BA 39/93~~	~~Assessment of Reinforced Concrete Half Joints~~	~~April 1993~~
~~BA 32/89~~	~~Technical Approval of Highway structures on Motorways and other Trunk Roads. Part 1 - General Procedures~~	~~Oct 1989~~
BA 16/97	The Assessment of Highway Bridges and Structures	May 1997
	Amendment No. 1	Nov 1997
~~BA 55/94~~	~~The Assessment of Bridge Substructures and Foundations, Retaining Walls and Buried Structures~~	~~1994~~
	~~Amendment No. 1~~	~~Nov 1997~~
~~NNMD 34/61/8~~	~~Assessment of Buried Concrete Box Structures - HA Letter~~	~~29 May 1997~~
BA 63/94	The Inspection of Highway Structures	Oct 1994
~~BA 44/96~~	~~The Use of BD 44/95 - The Assessment of Concrete Highway Bridges and Structures~~	~~Nov 1996~~
~~BS 8110~~	~~Structural Use of Concrete~~	
	~~Part 1: Code of Practice for Design and Construction~~	~~March 1997~~
Bridge Inspection Guide (HMSO ISBN 0 11 550638 1)		1984

C. LIST ANY DEPARTURES FROM STANDARDS

Scheme	Scheme Ref.	Date Prepared	Prepared by
BRITISH RAIL PROPERTY BOARD		SEPT 96	[redacted]
Element / Item	**Joblog No.**	**Date Checked**	**Checked by**
GREAT MUSGRAVE RLY No 25	2177	NOV 98	[redacted]

Code Ref.	CALCULATIONS / WORK	Output / Remarks

MASONRY ARCH TO BA 16/93 & BO 21/93

NORTH ELEVATION - SOUTH ELEVATION FACTORS SIMILAR EXCEPT WERE NOTED *

BARREL FACTOR (F_b)

LARGE COURSED SANDSTONE BLOCKS IN SATISFACTORY CONDITION — $F_b = 0.95$ ✓

FILL FACTOR (F_f)

UNKNOWN WELL COMPACTED FILL — $F_f = 0.70$ ✓

JOINT WIDTH FACTOR (F_w)

JOINT WIDTHS GENERALLY 6-12 mm — $F_w = 0.90$ ✓

MORTAR FACTOR (F_{mo})

LOOSE OR FRIABLE MORTAR — $F_{mo} = 0.90$ ✓

DEPTH FACTOR (F_d)

JOINTS WITH UPTO ½ UNFILLED — $F_d = 0.80$ ✓

CONDITION FACTOR (F_c) 0.90

WATER PENETRATION / LEACHATE −0.05

EDGE LOADING −0.1

F_c 0.75 — $F_c = 0.75$

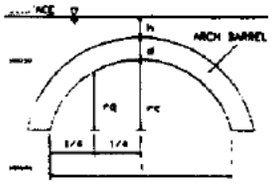
CUMBRIA COUNTY COUNCIL - CONSULTANCY & DESIGN
ARCH ASSESSMENT DESIGN SHEET - MODIFIED MEXE METHOD FOR BRPB

Bridge No: 25 | Bridge Name: GREAT MUSGRAVE RAILWAY

LOAD ASSESSMENT OF ARCHES IN ACCORDANCE WITH "THE ASSESSMENT OF HIGHWAY BRIDGES AND STRUCTURES"
DEPARTMENTAL STANDARD BD 21/97
AND ADVICE NOTE BA 16/97
(REFERENCES ARE TO BA 16/97 UNLESS NOTED OTHERWISE)

DATE PREPARED: APRIL 98 | PREPARED BY: [redacted]
DATE CHECKED: NOV. 98 | CHECKED BY: [redacted]

STRUCTURAL DIMENSIONS



		NORTH	SOUTH	
SPAN (square/skew)	L=	8.450	8.420	(m)
RISE OF ARCH BARREL AT CROWN	rc=	2.294	2.300	(m)
RISE OF ARCH BARREL AT 1/4 POINT	rq=	1.895	2.001	(m)
EFFECTIVE THICKNESS OF ARCH BARREL	d=	0.385*	0.385*	(m)
EFFECTIVE DEPTH OF FILL AT CROWN	h=	0.385**	0.385**	(m)
	d + h=	0.770	0.770	(m)

PROVISIONAL ASSESSMENT (Cl 3.10)

PAL = 740 (d + h)²/L^1.3 but ≯ 70T

	NORTH	SOUTH		NORTH	SOUTH	(T)
SPAN (L) =	8.450	8.420				
TOTAL CROWN THICKNESS (d + h) =	0.770	0.770	PAL =	27.37	27.50	
PAL =	27.37	27.50	(70T max)			

SPAN /RISE FACTOR (Fsr) (Cl 3.11)

(Fig 3.3) l / rc = 3.68 / 3.66 | Fsr= | 1.0 | 1.0 |

PROFILE FACTOR (Fp) (Cl 3.12)

Fp = 2.3 [(rc - rq)/rc]^0.6

rq / rc = 0.824 / 0.67 | Fp= | 0.81 | 0.676 |

MATERIAL FACTOR (Fm) (Cl 3.13)

BARREL FACTOR (Fb) (TABLE 3/1) Fb = 0.95
FILL FACTOR (Ff) (TABLE 3/2) Ff = 0.7
MATERIAL FACTOR (Fm) = (Fb x d) + (Ff x h) / d + h

0.975 | Fm = | 0.825 | 0.825 |

JOINT FACTOR (Fj) (Cl 3.16)

WIDTH FACTOR (Fw) (TABLE 3/3) Fw = 0.9
MORTAR FACTOR (Fm) (TABLE 3/4) Fmo = 0.9
DEPTH FACTOR (Fd) (TABLE 3/5) Fd = 0.9
JOINT FACTOR (Fj) = Fw x Fmo x Fd Fj = 0.648

0.648 | 0.648 |

CONDITION FACTOR (Fc_H) (Cl 3.17 To 3.23 Inclusive)

0.85 | Fc = | 0.75 | 0.75 |

MULTI SPAN FACTOR

Single Span or Massive Piers Msf = 1.0
End span normally ~~Msf = 0.9~~
interMediate span normally ~~Msf = 0.8~~

1.0 | 1.0 |

MODIFIED AXLE LOAD (MAL) (Cl 3.24)

MAL = Msf x Fsr x Fp x Fm x Fj x Fc_H x PAL | MAL = | 8.89 | 7.46 |

CENTRIFUGAL EFFECT (Fa) (Cl 3.29)

Is Centrifugal Effect considered applicable? ~~YES~~/NO
Radius (r) = _____ | Fa = | NA | NA |

ALLOWABLE AXLE LOAD (AAL) (Cl 3.25)

Is Axle Lift-Off applicable?

	YES (Fig 3/5b)	NO (Fig 3/5a)		NORTH	SOUTH	(T)
AXLE FACTORS (Af) SINGLE AXLE =				1.34	1.33	
2 AXLE BOGIE =			AAL =	13.50	11.50	
3 AXLE BOGIE =			AAL =	9.0	7.50	
			AAL =	8.0	6.50	

GROSS VEHICLE WEIGHT RESTRICTION (Table 3/6) | 25T GVW | 17T GVW | (T)

* 'd' OBTAINED FROM TRIAL HOLE
** 'h' LIMITED TO 'd'

STRENGTHENING OPTIONS

OPTION 1

REPOINT OPEN JOINTS

$\therefore f_m = 1.0$, $f_d = 1.0$

M.A.L = 10.335 TONNES

$\therefore$ SINGLE AXLE = 16 TONNES
DOUBLE AXLE = 10.5 TONNES
TRIPLE AXLE = 9.5 TONNES

$\therefore$ SATISFACTORY FOR FULL 40 TONNE ASSESSMENT LOADING

PHOTOGRAPHS

PHOTO NO. 1 – VIEW OVER LOOKING EAST

PHOTO NO. 2 – VIEW OVER LOOKING WEST

PHOTO NO. 3 – NORTH ELEVATION

PHOTO NO. 4 – SOUTH ELEVATION

PHOTO NO. 5 – WEST ELEVATION

PHOTO NO. 6 – EAST ABUTMENT

PHOTO NO. 7 – EAST SIDE OF ARCH BARREL

PHOTO NO. 8 – GENERAL VIEW OF BARREL SOFFIT AT CROWN

PHOTO NO. 9 – SPALLING TO BARREL STONES 2ND COURSE ABOVE WEST SPRINGING

PHOTO NO. 10 – OPEN MORTAR JOINT ALONG EXTRADOS JOINT ABOVE S.W QUARTER POINT

PHOTO NO. 11 – CRACKED/OPEN JOINT ALONG N.W EXTRADOS

PHOTO NO. 12 – GENERAL VIEW ALONG N.E SPANDREL

PHOTO NO. 13 – VIEW ALONG NORTH SPANDREL/STRINGCOURSE

PHOTO NO. 14 – VERTICAL CRACK IN MORTAR JOINTS ON S.E WINGWALL

PHOTO NO. 15 – SPALLED MASONRY BLOCK IN N.W WINGWALL

PHOTO NO. 16 – GENERAL VIEW OF S.W WINGWALL

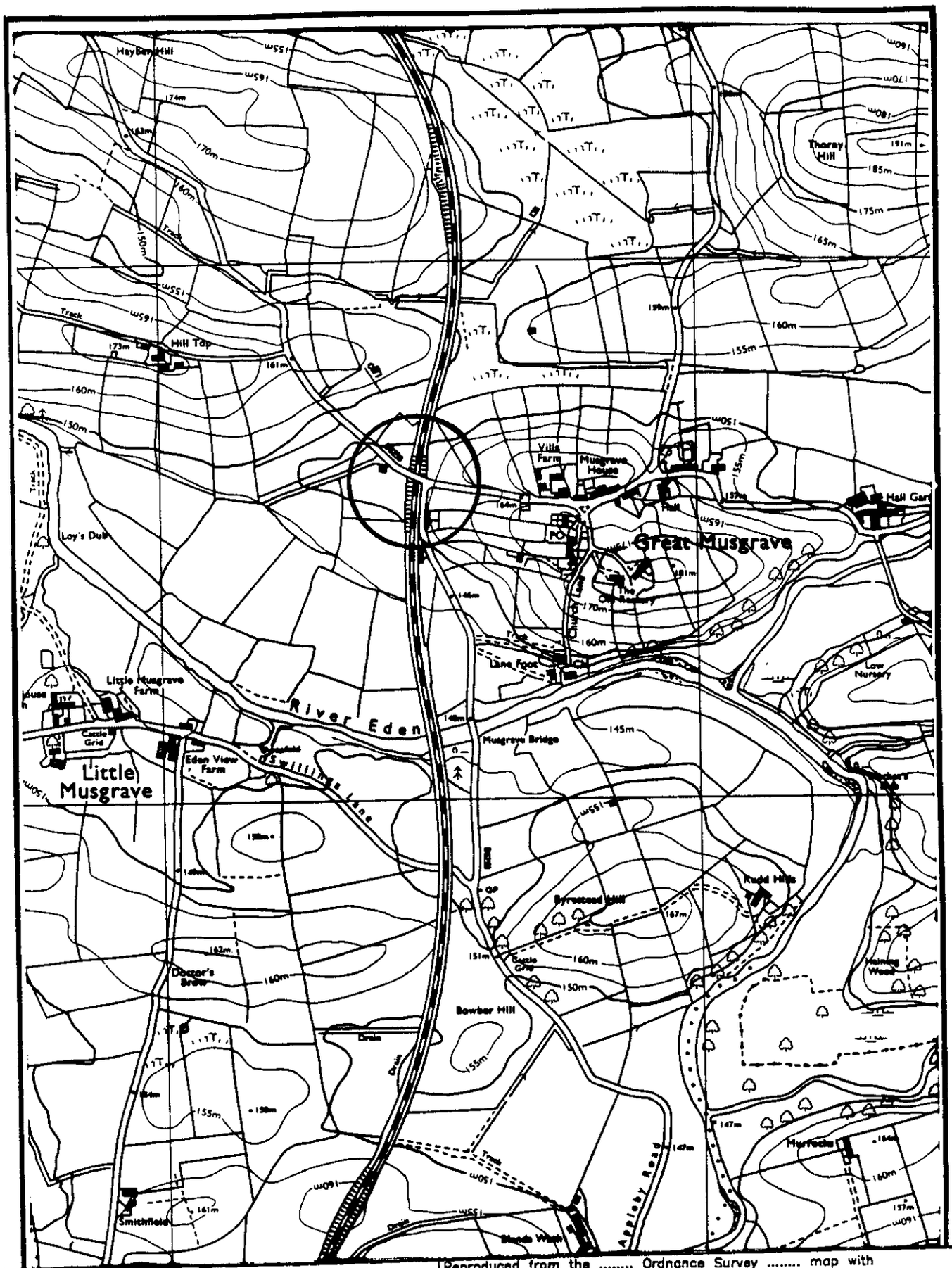
PHOTO NO. 17 – ACCIDENTAL DAMAGE AT EAST END OF NORTH PARAPET

PHOTO NO. 18 – TYPICAL AREA OF OPEN JONTS TO SOUTH FACE OF NORTH PARAPET

PHOTO NO. 19 – TYPICAL VIEW OF NORTH FACE TO SOUTH PARAPET

APPENDIX

LOCATION PLAN



CONSULTANCY DESIGN

CUMBRIA COUNTY COUNCIL

Cumbria

CONSULTANCY & DESIGN
Viaduct Estate
CARLISLE
Cumbria
CA2 5BN

O.S. Reference	NY 765 136
Structure Name	GREAT MUSGRAVE RLY No. 25
Road No & Name	B6259
Scale	1:10000

BR 12327/17

BRITISH RAIL — BRIDGE & STRUCTURAL EXAMINATION REPORT

LM Region
PRESTON Divn. District
Line EDEN VALLEY
MUSGRAVE
Stn. between WARCOP

Type of Over/~~Under~~ Bridge Structure: STONE ARCH 27'-0" SPAN
Carrying PUBLIC ROAD
Over DISUSED LINE

Bridge No. S 25
Name
At 11 + 1/4 MLP Kms.
Route Code

Sheet 1 of 1

Condition of Part	G-good F-fair P-poor	Part No.
1. Main Girders		
2. Cross Girders		
3. Rail Bearers		6
4. Floor		
5. Infilling to Girders/Troughs		
6. Arch Rings	G	
7. Spandrels	G	
8. Concrete Deck Slab		
9. Rivets & Bolts		
10. Welds		6
11. Suspension Bolts		
12. Bracing		
13. Ballast Plates/Boards		
14. Handrails		15
15. Parapets & Pilasters	F	
16. Longitudinal Timbers		
17.		
18.		
19. Bearings		15
20. Bedstones & Cills		
21. Abutments	G	
22. Wing Walls	G	
23. Copings & Caps	G	
24. Piers		
25. Cols/Stanchions/Cylinders		
26. Trestles		24
27. Crossheads		
28. Ballast Walls		
29. Foundations	G	
30. Scour		
31. Retaining Walls		
32. Tie Bolts		33
33. Pointing	G	
34. Waterproofing		
35. Drainage		
36. Gutters & Downpipes		
37. Painting		
38. Road Surfacing	G	
39. Track Condition		
40. Notice Plates		
41.		
42.		
43.		
44.		
45.		
46.		
47.		
48. Location of Rail Joints		

Remarks (Refer to parts by number)

2ND STONES DRUMMY + SPALLED TO 1" DEEP ABOVE SPRINGER COURSE - SOUTHEND - DOWNLINE [OLD-STANDING]

SIGNS OF SEEPAGE AT HAUNCH

7'-6" x 3'-6" AREA OF MASONRY DISPLACED 1" TO 3" NORTHEND PARAPET [UPLINE] [OLD-STANDING]

4'-0" x 3'-6" AREA OF MASONRY SLIGHTLY DISPLACED SOUTHEND PARAPET - UPLINE [OLD-STANDING]

FOUNDATIONS - SUPERFICIAL EXAMINATION ONLY

OPEN JOINTS TO SOFFIT + SPANDRELS.

Comments
GOOD CONDITION IN GENERAL

Examiner [redacted] (Examiner) on APRIL 77

Recommendations
No action

Signed [redacted] 3-5-77 (date)

Action

[redacted] ing 6.77 (date)

FORM 'BA' (BRIDGES)

GC/TP0356
Appendix: 5
Issue: 1
Revision: A
Date: FEB 93

CERTIFICATION FOR ASSESSMENT CHECK

STRUCTURE/LINE NAME GREAT MUSGRAVE RLY. CATEGORY OF CHECK 1

ELR/STRUCTURE NO. EDE 25 No 25

I certify that reasonable professional skill and care have been used in the assessment of the above structure with a view to securing that:

(1) It has been assessed in accordance with the Approval in Principle (where appropriate) as recorded on Form AA approved on 10 Nov. 97 (DATE).

(2) It has been checked for compliance with the following principal British Standards, Codes of Practice, BR Technical notes and Assessment standards.
BD 21/97 BD 63/94 BA 16/97 BA 63/94 BRIDGE INSP. GUIDE (1984).

List any departures from the above, and additional methods or criteria adopted, with reference and justification for their acceptance (commenting on the results if appropriate).

CATEGORY 1

NAME [redacted] SIGNATURE [redacted]

(ASSESSOR) 19/11/98 (DATE)

(ASSESSMENT CHECKER) 19/11/98 (DATE)

PARTNER OF THE FIRM OF CONSULTING ENGINEERS TO WHOM ASSESSOR/ CHECKER IS RESPONSIBLE 19 Nov 98 (DATE)

CATEGORY 2 AND 3 (NOTE: CATEGORY 1 CHECK MUST ALSO BE SIGNED)

(a) ASSESSMENT

NAME SIGNATURE

(ASSESSOR) (DATE)

BRB SECTION ENGINEER OR THE PARTNER IN FIRM OF CONSULTING ENGINEERS TO WHOM ASSESSOR IS RESPONSIBLE (DATE)

(b) CHECK

NAME SIGNATURE

(ASSESSMENT CHECKER) (DATE)

BRB SECTION ENGINEER OR THE PARTNER IN FIRM OF CONSULTING ENGINEERS TO WHOM CHECKER IS RESPONSIBLE (DATE)

THE CERTIFICATE IS ACCEPTED BY [redacted]

FORM 'BAA' (BRIDGES)

GC/TP0356
Appendix: 6
Issue: 1
Revision: A
Date: FEB 93

CERTIFICATION FOR ASSESSMENT CHECK

NOTIFICATION OF ASSESSMENT CHECK

STRUCTURE NAME/ROAD NO. GREAT MUSGRAVE RLY. Nº 25 B6259

LINE NAME .....

ELR CODE/STRUCTURE NO. EDE 25

The above bridge has been assessed and checked in accordance with Standards which are listed on the appended Form BA. A summary of the results of the assessment in terms of capacity and restrictions is as follows:

STATEMENT OF CAPACITY

ARCH RING UNSATISFACTORY FOR FULL C+U INCL. 40T VEH
MAX. SINGLE AXLE LOAD 11.5T
MAX. DOUBLE AXLE LOAD 7.5T PER AXLE
MAX. TRIPLE AXLE LOAD 6.5T PER AXLE
~~tonnes~~

[redacted]

Critical member/s: ARCH RING

RECOMMENDED LOADING RESTRICTIONS

[redacted]

DESCRIPTION OF STRUCTURAL DEFICIENCIES AND RECOMMENDED STRENGTHENING

SEE REPORT FOR DETAILS

Name: [redacted] Signed: [redacted] Structural Assessment Engineer

Name: [redacted] Signed: [redacted] Civil Engineer

5

FORM 'AA' (BRIDGES)

GC/TP0356
Appendix: 4
Issue: 1
Revision: A
Date: FEB 93

APPROVAL IN PRINCIPLE FOR ASSESSMENT

STRUCTURE/LINE NAME GREAT MUSGRAVE RLY Nº 25

ELR/STRUCTURE NO. EDE 25

BRIEF DESCRIPTION OF EXISTING BRIDGE:

(a) Span Arrangement
SINGLE SPAN (APPROX 8.420)

(b) Superstructure Type
MASONRY ARCH (APPROX SKEW 13°)

(c) Substructure Type
MASS MASONRY ABUTMENTS.

(d) Details of any Special Features

ASSESSMENT CRITERIA

(a) Loadings and Speed
N/A.

(b) Codes to be used
BD 21/97 BD 63/94 BA16/97 BA 63/94 BRIDGE INSPECTION GUIDE (1984)

(c) Proposed Method of Structural Analysis
MODIFIED MELE METHOD.

(d) Details of any Special Requirements
NONE.

STRUCTURAL ASSESSMENT ENGINEER'S COMMENTS

SEE APPENDIX A ATTACHED.

6

FORM 'AA' (BRIDGES)

GC/TP0356
Appendix: 4
Issue: 1
Revision: A
Date: FEB 93

APPROVAL IN PRINCIPLE FOR ASSESSMENT

CIVIL ENGINEER'S COMMENTS

BRB WORKS GROUP COMMENTS – IF APPLICABLE

PROPOSED CATEGORY FOR INDEPENDENT CHECK:

SUPERSTRUCTURE ....CAT. 1.....

SUBSTRUCTURE ..VISUAL FOR CURRENT LOADING.

NAME OF CHECKER SUGGESTED IF CAT 2 OR 3 .....

CATEGORY 1

THE ABOVE ASSESSMENT, WITH AMENDMENTS SHOWN, IS APPROVED IN PRINCIPLE:

SIGNED [redacted].....

TITLE SENIOR CIVIL ENGINEER

DATE 10/11/97

CATEGORY 2 AND 3

THE ABOVE ASSESSMENT, WITH AMENDMENTS SHOWN, IS APPROVED IN PRINCIPLE:

SIGNED .....

TITLE .....

DATE .....

SIGNED .....

TITLE .....

DATE .....

British Railways Board | Group Standard

FORM 'AA/1' (BRIDGES)

GC/TP0356
Appendix: 4
Issue: 1
Revision: A
Date: FEB 93

APPROVAL IN PRINCIPLE FOR ASSESSMENT

ADDITIONAL INFORMATION REQUIRED FOR BRB OWNED PUBLIC ROAD OVERBRIDGES ASSESSED AS PART OF BRIDGEGUARD III

STRUCTURE/LINE NAME ..GREAT MUSGRAVE RLY No 25.....

ELR/STRUCTURE NO. ....EDE 25.....

SCOPE OF ASSESSMENT

ARCH RING. INSPECTION FOR CURRENT LOADING AND MODIFIED MEHE FOR CALCULATED CAPACITY.

REMAINDER OF STRUCTURE. INSPECTION FOR CURRENT LOADING.

ASSESSMENT CRITERIA

a) Standards and Codes of Practice to be used in assessment

BD 21/97 BD 63/94 BA 16/97 BA 63/94 BRIDGE INSPECTION GUIDE (1984)

b) Proposed method of structural analysis

MODIFIED MEHE METHOD.

c) Planned Highway works/modifications at this site

TRIAL HOLES MAY BE REQUIRED.

d) Road designation/class and whether classed as a heavy load route

B 6259 NOT A HEAVY LOAD ROUTE.

e) Any other requirement

NONE

The above is agreed subject to the amendments and comments shown below.

*SIGNED [redacted] .....

TITLE STRUCTURES MANAGER .....

DATE 5-11-97 .....

*A team leader or chief officer employed by an Agent Authority may sign "for and on behalf of" ..DIRECTOR OF ECONOMY & ENVIRONMENT.. where authorised to do so.

BRPB ASSESSMENTS

APPENDIX A

The use of modified MEXE method for assessment of single span masonry arch bridges with angle of skew 0° up to 20°.

1 FACTORS

BARREL FACTOR Fb as table 3/1 except that:-

Large coursed sandstone - Good quality workmanship	1.2
Uncoursed masonry (sandstone, limestone, slate) and non-engineering brickwork.	1.0

FILL FACTOR Ff as table 3/2. If no settlement or tracking of surfacing. 0.7

JOINT FACTOR Fj
Fw, Fmo, Fd as tables 3/3, 3/4, 3/5 respectively.

CONDITION FACTOR Fc

BASIC FACTOR TAKEN AS	0.9
deduct if verge less than approx 0.75m thus allowing wheel load near edge.	-0.1

Further deductions where appropriate (eg flaking or exfoliating masonry, isolated area of open joints).

2 DIMENSIONS

SPAN. Use skew span for L.

BARREL AND DEPTH OF COVER. In the absence of definite information from BR regarding 'd' the barrel thickness a figure of 2/3 of the depth of the edge voussoirs is taken, and the depth of fill limited to a maximum of the voussoir depth. If the structure passes the 40t assessment, no further investigation is deemed necessary. If fails (but would pass with d = voussoir thickness) then trial holes would be made over the crown of the arch to determine the actual barrel thickness.

3 CALCULATIONS

The the modified MEXE calculation is mounted on CASIO FX-730P personal computers which are monitored under the County Council's quality assurance scheme.

ARCH OVERBRIDGE ASSESSMENT — EDE/25 BEA CHECK. | E.L.R. | BRDGE NO

Reference BA 16/84	Page	BASED ON DEPARTMENT OF TRANSPORT; DEPARTMENTAL STANDARD BD 21/84 & ADVICE NOTE BA 16/84	CAPACITY & FACTORS

DIMENSIONS (m)

	N	S		N	S
Span L (m)	21.72	27.62	Ring thickness d	1.26	1.26
Rise (crown) r_c	7.54	7.54	Fill Depth h	1.75	1.81
Rise (quarter) r_q	6.35	6.61	Crown (h + d)	3.01	3.07

			N	S
5.4 Fig 5.1	17, 18			
5.5 Fig 5.2	18, 19, 20	**PROVISIONAL AXLE LOADING, PAL** $PAL = \frac{740 \times (d+h)^2}{L^{1.3}}$ for 1.5m < L < 18m & 0.25m < (h+d) < 1.8m	40t PAL =	40t
6.1 Fig 5.3	20	**SPAN / RISE FACTOR** F_{sr} $\frac{L}{r_c} = \frac{27.72}{7.54} = 3.67$ ∴	1.0 F_{sr} =	1.0
5.6.2 Fig 5.4	21	**PROFILE FACTOR** F_p Nmm $= 2.3(1 - 6.35/7.54)^{0.6}$ Soon $= 2.3(1 - 6.61/7.54)^{0.6}$ For r_q/r_c <= 0.75 F_p = 1.0 r_q = ____ For r_q/r_c > 0.75 r_c = ____ $F_p = 2.3 \times (1 - r_q/r_c)^{0.6}$	0.76 F_p =	0.66
5.6.3 Table 5.1 Table 5.2 5.6.3	21 22 22 21	**MATERIAL FACTOR** F_m $\{F_m = \frac{(F_b \times d) + (F_f \times h)}{(h+d)}\}$ Barrel Factor F_b = 0.95 Fill Factor F_f = 0.7 $F_m = \frac{(F_b \times d) + (F_f \times h)}{(h+d)} = \frac{(0.95 \times 1.26) + (0.7 \times 1.81)}{(1.26 + 1.81)}$ Nmm $= \frac{(0.95 \times 1.26) + (0.7 \times 1.75)}{(1.26 + 1.75)}$ Soon	0.80 F_m =	0.80
5.6.4 Table 5.3 Table 5.4 Table 5.5 5.6.4	23 24 24 24 23	**JOINT FACTOR** F_j $(F_j = F_w \times F_{mo} \times F_d)$ Width Factor F_w = ____ Mortar Factor F_{mo} = ____ Depth Factor F_d = ____ $F_j = F_w \times F_{mo} \times F_d$ = ____ × ____ × ____	0.648 F_j =	0.648
5.7	25-7	**CONDITION FACTOR** F_c	F_c 0.25	0.75
5.8	27	**MODIFIED AXLE LOAD MAL** MAL = PAL × Fsr × Fp × Fm × Fj × Fc	11.82 MAL = t	10.26

5.8 — 28

CONVERSION OF MODIFIED AXLE LOAD TO SINGLE DOUBLE & TRIPLE AXLE LOADS

Fig 5.5 — 29

Axle Type	Axle Factor A_f	Allowable Axle Load A_f × MAL	PERMITTED LOADING ON SPAN
Single Axle		____ t	
Double Axle Without Lift Off		____ t	
Double Axle With Lift Off		____ t	
Triple Axle 2.6m Spacing		____ t	

CALCULATED | CHECKED | DATE | SHEET OF

ASSESSMENT GROUP LEEDS

BRIDGE & STRUCTURE EXAMINATION REPORT

For British Rail Property Board

JARVIS Facilities

Line: EDEN VALLEY

Location: MUSGRAVE
O.S. Grid Ref. NY 765 136

Type of Over/~~Under~~/Bridge/~~Structure~~

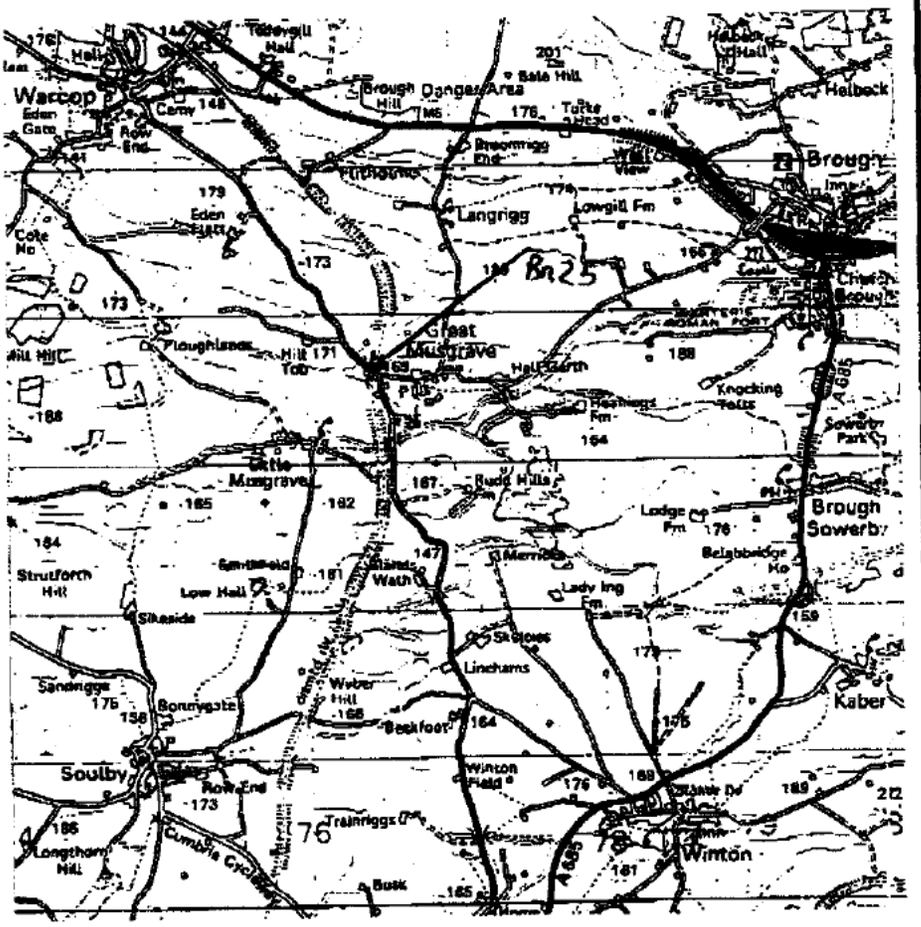
Carrying PUBLIC ROAD
Over ABANDONED TRACK
Use PUBLIC ACCESS

Bridge No 25 No of spans 1
Name MUSGRAVE

At 04M 10CH (Mileage)
E.L.R. EDE B.R.S.

Sheet 1 of 17

Name of Part	G - Good F - Fair P - Poor	*Remarks* (Refer to parts by name)
Main Girders	-	
Cross Girders	-	
Rail Bearers	-	
Floor	-	
Rivets & Bolts	-	
Arch Ring : Stone	F	
Spandrels : Stone	F	
Abutments : Stone	F	
Piers	-	
Wing & Retaining Walls	F	
Pointing	F	
Parapets & Pilasters	F	
Columns & Cylinders	-	
Trestles & Crossheads	-	
Bedstones & Cills: Springers	G	
Bearings	-	
Ballast Plates/Boards	-	
Longitudinal timbers	-	
Waterproofing	NE	
Drainage	-	
Gutters & Downpipes	-	
Handrails	-	
Painting	-	
Road Condition	G	
Vegetation	F	
Foundations	NE	
Approach Boundary Walls	G	
Approach Fencing	G	
String Courses	G	
Bridge Numbers	P	



General Comments

Structure is in fair condition.

RECEIVED
21 JAN 1999
BRPB PROPERTY
C-PACE

Date of Ex[redacted]

Signed .....
(Examiner)

Tick as appropriate	
Change of construction	
Closed line	✓
C.W.R.	
Rail Joints	
25T Axle/Abnormal Rd Loads	
Weight restriction plates	
Inaccessible Parts	✓
Tell Tales	
Plumbing Points	

(Date) Date of previous detailed examination 17/8/93

Recommendations

[redacted]achon

Signed [redacted] date 19/1/99

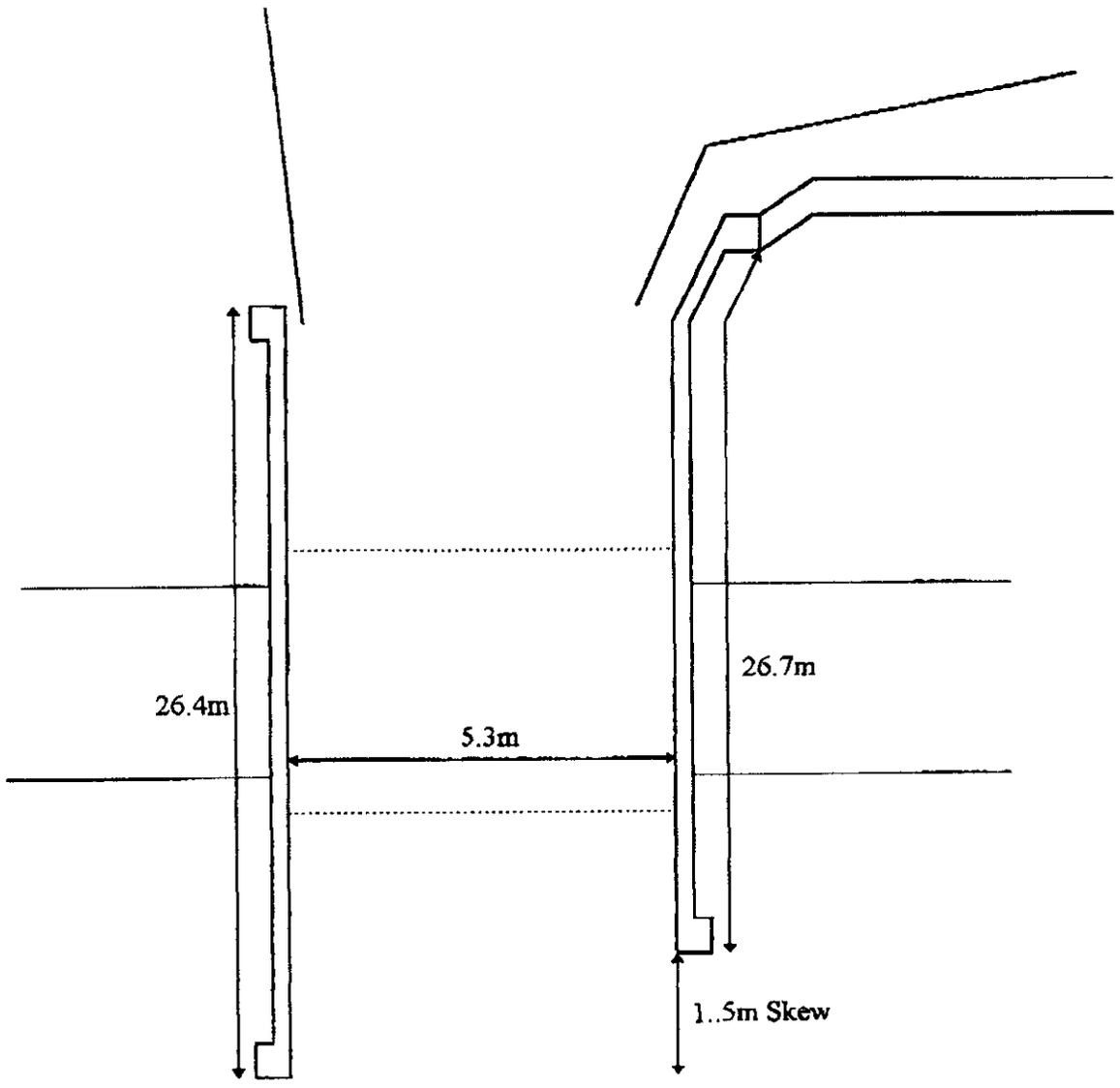
Action

No [illegible] this time.

Signed [redacted] date 10/2/99

Next detailed examination due 18/11/2004

ASSESSMENT GROUP LEEDS/JARVIS Facilities	**BRIDGE & STRUCTURE EXAMINATION REPORT** (continuation sheet)
Line: EDEN VALLEY Sms. between: and O.S. Grid Ref.: NY 765 136	Particulars of Bridge/~~Structure~~: STONE ARCH,STONE ABUTMENTS, WINGS, SPANDRELS AND PARAPETS
Remarks (Refer to parts by name)	Sheet 2 of 17



Parapet Height East 1.230m
Parapet Height West 1.280m
Span 8.2m
Abutment Length 6.300m
Arch Heigh 4.4m
Width of Parapets 470mm

ASSESSMENT GROUP LEEDS/JARVIS Facilities	BRIDGE & STRUCTURE EXAMINATION REPORT (continuation sheet)
Line: EDEN VALLEY Stns. between: and O.S. Grid Ref.: NY 765 136	Particulars of Bridge/~~Structure~~: STONE ARCH,STONE ABUTMENTS, WINGS, SPANDRELS AND PARAPETS
Remarks (Refer to parts by name)	Sheet 3 of 17

Stone Arch
Located 2.5m in from west side voussoir face - spalled area to north crown 400mm * 400mm, 45mm deep. See photo 1.
Isolated areas of spalling throughout soffit up to 50mm deep above springer courses. See photo 2 and 3.
Loss of mortar in isolated areas 10mm wide, up to 30mm deep. Water percolation and leaching various to soffit. See photo 4.
Isolated drummy areas.

Stone Spandrels
North East - 2/3m² deep open joint, 20mm wide up to 30mm deep. Sep. fracture over voussoir stones 2.8m long, bulging 10mm. See photo 5.
South East - Sep. fracture over voussoir stones 1.8m long, bulging 5mm. See photo 6.
South West - Sep. fracture over voussoir stones 2.1m long, open 2mm. See photo 7.
North West - Sep. fracture over voussoir stones 1.4m long, open 3mm. See photo 8.

Stone Abutments
North and south abutments - isolated drummy areas. See photo 9 and 10.

Wing Walls Box
North East - In mitre area 800mm above embankment - spalled area 330mm high, 200mm wide, 80mm deep. See photo 11.
1.650m above ground level - spalled to quoin 270mm high, 420mm long, 180mm deep. See photo 12.
0.5m² deep open joint to wing mitre 20mm wide, 40mm deep.
South East - Located 3.2m back from mitre, 900mm above embankment - spalled area 800mm long, 300mm high, 200mm deep. See photo 13.

Stone Parapets
East and west inner faces have been pointed.
Outer faces - deep open joints in various area 20mm wide up to 40mm deep.
East parapet south end - vehicle impact 2.250m long, 360mm high, displaced outward 60mm, has been pointed. See photo 14.
East parapet, located 3.1m from south end - spalling to bottom course 400mm long, 360mm high, 60mm deep. See photo 15.
West side parapet south end - pilaster cap displaced inwards 20mm at south end.

Waterproofing
Not examined due to no access. Visible evidence of failure with water percolation and leaching through stone arch soffit.

Foundations
Not examined due to no access. No visible evidence of failure.

Bridge Numbers
None fitted to this structure.

ASSESSMENT GROUP LEEDS/JARVIS Facilities	**BRIDGE & STRUCTURE EXAMINATION REPORT** (continuation sheet)
Line: EDEN VALLEY Sites between: and O.S. Grid Ref: NY 765 136	Particulars of Bridge ~~Structure~~ STONE ARCH STONE ABUTMENTS, WINGS, SPANDRELS AND PARAPETS

Sheet 12 of 17

Remarks (Refer to parts by name)

PHOTO No 17

WEST SIDE VIEW

PHOTO No 18

EAST SIDE VIEW

ASSESSMENT GROUP
LEEDS/JARVIS Facilities

BRIDGE & STRUCTURE EXAMINATION REPORT
(continuation sheet)

Line: EDEN VALLEY
Stns. between:
and
O S Grid Ref: NY 765 136

Particulars of Bridge/~~Structure~~

STONE ARCH STONE ABUTMENTS, WINGS, SPANDRELS AND PARAPETS

Sheet 13 of 17

Remarks (Refer to parts by name)

PHOTO No 19

EAST SIDE PARAPET

PHOTO No 20

WEST SIDE PARAPET

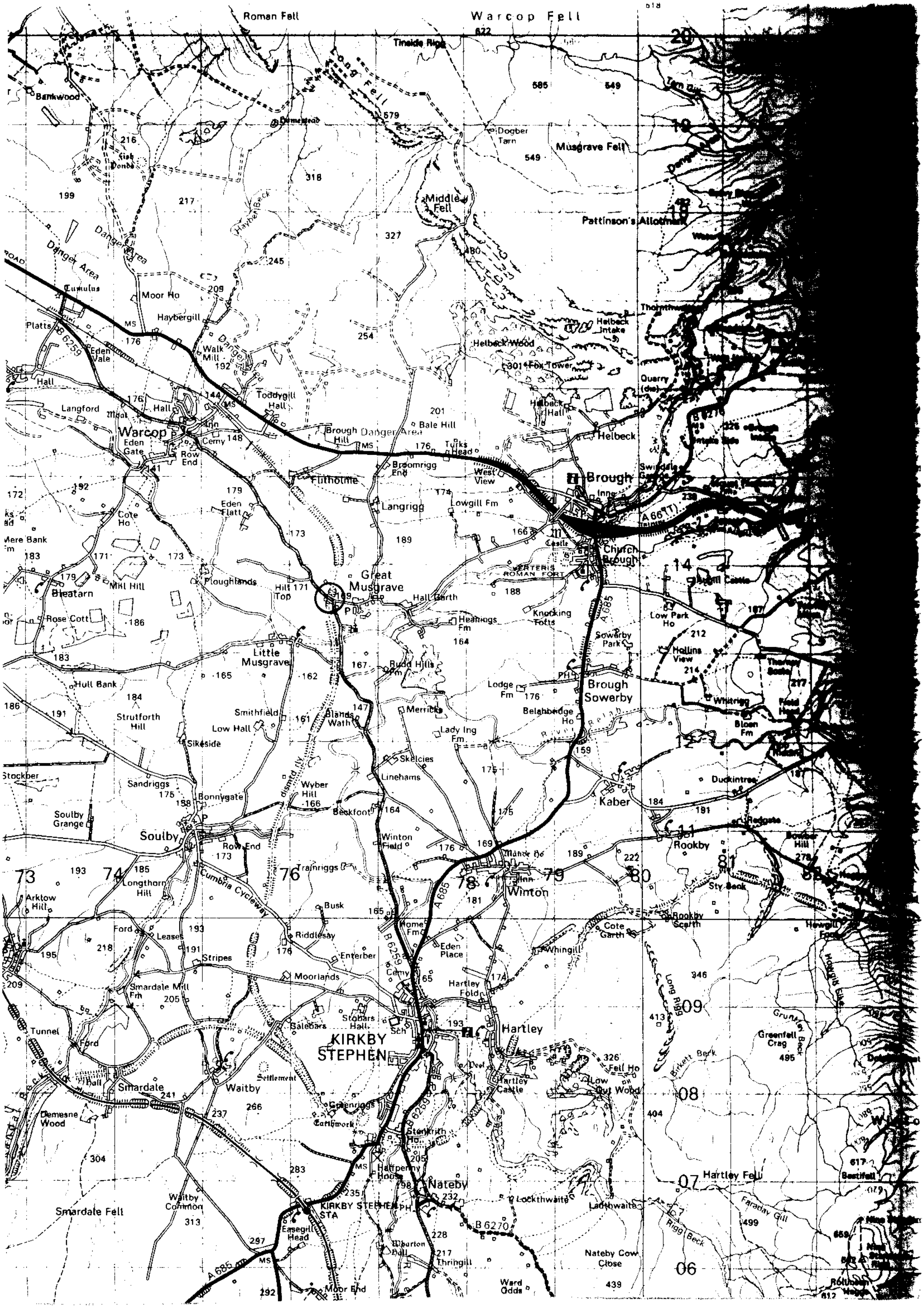
ASSESSMENT GROUP LEEDS/JARVIS Facilities	BRIDGE & STRUCTURE EXAMINATION REPORT (continuation sheet)
Line: EDEN VALLEY Stns between: and O.S. Grid Ref.: NY 765 136	Particulars of Bridge/~~Structure~~ STONE ARCH STONE ABUTMENTS, WINGS, SPANDRELS AND PARAPETS
Remarks (Refer to parts by name)	Sheet 14 of 17

PHOTO No 21

SOUTH APPROACH

PHOTO No 22

SOUTH APPROACH



Roman Fell
Warcop Fell
622
Tinside Rigg
Long Fell
Bankwood
Demesne
579
Dogber Tarn
585
549
Musgrave Fell
216
318
199
217
Middle Fell
327
Pattinson's Allotment
Danger Area
Hayber Beck
245
Cumulus
Moor Ho
209
Haybergill
Platts
B 6259
MS
176
Eden Vale
Walk Mill
192
254
Helbeck Wood
Helbeck Intake
301 Fox Tower
Quarry (dis)
Hall
Langford
Moat
Warcop
Eden Gate
Row End
Cemy
Inn
144
148
Toddygill Hall
Brough Hill
Danger Area
201
Bale Hill
176
Turks Head
Helbeck Hall
Helbeck
B 6276
141
172
192
179
Flitholme
Broomrigg End
West View
Brough
Inn
Mere Bank Fm
Cote Ho
Eden Flatt
Langrigg
174
Lowgill Fm
A 66(T)
183
171
173
173
189
166
Castle
Church Brough
14
179
Bleatarn
Mill Hill
Ploughlands
Hill Top
171
Great Musgrave
VERTERIS ROMAN FORT
188
Hall Garth
Knocking Tofts
A 685
Low Park Ho
Rose Cott
186
Heanings Fm
164
212
Sowerby Park
Hollins View
183
Little Musgrave
165
162
167
Rudd Hills
214
Hull Bank
184
Strutforth Hill
Lodge Fm
176
Brough Sowerby
217
186
191
Smithfield
161
Blands Wath
147
Merricks
Belahbridge Ho
River Belah
Low Hall
Sikeside
Lady Ing Fm
159
12
Stockber
175
Skelcies
Sandriggs
Lineham
Duckintree
175
Bonnygate
Wyber Hill
166
dismtd rly
Kaber
184
191
Soulby Grange
158
Beckfoot
164
175
Redgate
Soulby
Row End
Winton Field
169
Manor Ho
11
Rookby
173
176
189
222
73
193
74
185
Longthorn Hill
Cumbria Cycleway
76
Trainriggs
78
Winton
79
80
81
Sty Bank
Arktow Hill
Busk
A 685
181
165
Home Fm
Rookby Scarth
Ford
Leases
193
Riddlesay
Cote Garth
Hewgill
218
191
176
B 6259
Eden Place
Whingill
195
Stripes
Enterber
Long Rigg
346
209
Moorlands
Cemy
65
Hartley Fold
174
Smardale Mill Fm
205
413
09
Stobars Hall
Sch
193
Hartley
Tunnel
Ford
Galebars
KIRKBY STEPHEN
326
Fell Ho
Greenfell Crag
495
Settlement
Hartley Castle
Low Out Wood
Birkett Beck
Smardale
241
Waitby
08
Demesne Wood
237
266
Greenriggs
404
Earthwork
Stenkrith Ho
B 6259
304
283
MS
Halfpenny House
205
07
Hartley Fell
617
198
Nateby
232
Lockthwaite
Ladthwaite
Waitby Common
235
Smardale Fell
313
KIRKBY STEPHEN STA
Easegill Head
228
B 6270
Rigg Beck
499
Faraday Gill
297
Wharton Hall
217
Thringill
Nateby Cow Close
MS
A 685
06
Ward Odds
439
292
Moor End

[redacted]

Adviced that this structure
for a 17 Ton Wt Limit

[redacted]

8/12/99