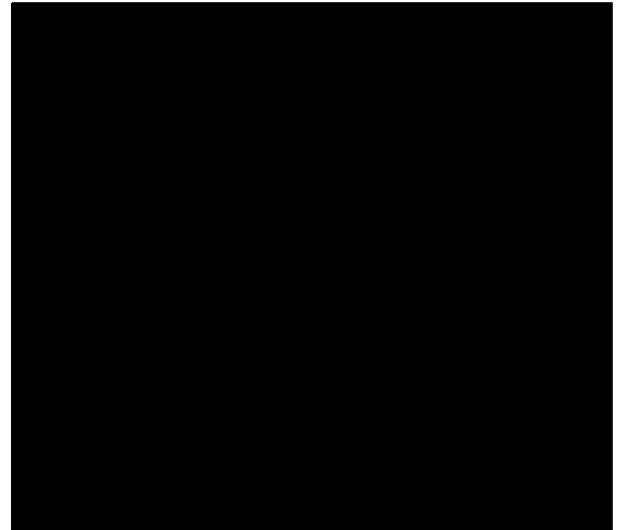


SIE | 2289

**ASSESSMENT OF HIGHWAY STRUCTURES
PACKAGE No 25 (COUNTY)
PRINCIPAL BRIDGE INSPECTION**

**BLUNTISHAM RAILWAY BRIDGE
BRIDGE NUMBER 365743**

INSPECTION DATE: SEPTEMBER 1995



Cambridgeshire County Council
Bridge Client Section
Transportation Department
Shire Hall
Castle Hill
Cambridge CB3 OAP

WS Atkins - East Anglia
Wellbrook Court
Girton Road
Cambridge
CB3 0NA

Issue: Final

March 1996

BC6272/704/R1 Rev 1

BRIDGE CONDITION RATING

DoT Bridge No: Not applicable **CCC Bridge No/**
OS Map Reference: TL 365743

Bridge Name: Bluntisham Bridge

Description: Single span brick arched bridge with a 7.95 m square span at a skew angle of 40°. Brick wingwalls and parapets.

CONSULTING ENGINEERS CONDITION RATING		
	★★★	Satisfactory condition
✓	★★	Repairs required
	★	Urgent repairs required
	★	Bridge in dangerous condition

To be filled in by Cambridgeshire County Council

BRIDGE CLIENT		BRIDGE NO 365743	
FILE	INITIAL	DATE	SUGGESTED CONDITION RATING
RECEPTION	[REDACTED]	9.4.96	
INITIAL PERUSE			
READ BY			
READ BY			
READ BY			
COMMENTS			

CAMBRIDGESHIRE COUNTY COUNCIL

TRANSPORTATION DEPARTMENT

COUNTY ROAD STRUCTURE PRINCIPAL INSPECTION REPORT

CCC Bridge Number: 365743
 Bridge Name: Bluntisham Railway Bridge
 Location: On the A1123 south of Bluntisham,
 crossing a dismantled railway
 Next Principal Inspection Date: September 2001

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2	General Condition Classification
3 to 23 inc	Defect Summary Tables with Recommendations Appendix 1: Diagrams, Illustrations and Plans Appendix 2: Photographs Appendix 3: Forms CS1, CS2, CS3 Appendix 4: Test Results

JM Sharpe MSc CEng FICE FIHT
 Director of Transportation

Consulting Engineer:
 WS Atkins - East Anglia
 Wellbrook Court
 Girton Road
 CAMBRIDGE
 CB3 0NA

	Date
Inspected by	8.9.95
Prepared by	1.2.96
Checked by	3.96
Sent Reg Office	

1. INTRODUCTION

- 1.1 Bluntisham Railway Bridge is a single 7.95 m square span brick arched bridge. The bridge carries the A1123 over a dismantled railway. The parapets are constructed in brick and the bridge is at a 40° skew angle.
- 1.2 On Friday 8 September 1995 a principal inspection of the structure was undertaken. On the day of the inspection the weather was fine.
- 1.3 General views of the bridge can be seen in Photographs F15/10 and F15/27.
- 1.4 The location plan can be found on Figure Number R6272/704/Fig1 in Appendix 1.

2. GENERAL CONDITION CLASSIFICATION

- 2.1 The general condition of the structure, as inspected, is reasonable. The bridge has been subject to minor brickwork repairs in the past.
- 2.2 The abutments have vertical cracks near the ends and there are also extensive areas of spalling of various depths.
- 2.3 The arch barrel is not deformed in any way. There is a repaired longitudinal crack that is opening up again, as well as hairline cracks continuing from other longitudinal repairs. There are extensive areas of spalling on both elevations and areas of new brickwork from previous repairs.
- 2.4 The north-west wingwall has a large diagonal crack separating it into two sections, of which the upper one has moved forward by 25mm from its original line. The other wingwalls do not show any signs of movement, although they have extensive areas of spalling and some mortar loss.
- 2.5 The surfacing is in reasonable condition but with some loss of skid resistance and tracking. The parapets are brick construction and the south side shows signs of having been replaced with new brickwork. There are no serious defects on this side. On the north parapet there are vertical cracks, but they do not appear to be structurally significant.
- 2.6 A full dimensional survey was carried out and the diagrams are included in Appendix 1. Materials testing was undertaken and the findings are presented in Appendix 4 and summarised below.
- 2.7 Small diameter drilling was carried out at the springing and crown of the arch to ascertain the depth of the arch barrel in these locations. The thickness of the abutment was also determined by core drilling in each abutment.
- 2.8 The construction of the carriageway was ascertained using a 25mm diameter drill hole.

Defect Summary Tables with Recommendations

3.0 DEFECT SUMMARY TABLES

The main body of the report is based on the layout of form BE 11/94. The inspection of each element of the structure has been recorded as follows:-

A detailed defect summary table has been completed, based on the check list items given in the annex to chapter 2 of the Bridge Inspection Guide. Additional items have been added where appropriate.

The element numbering used is the same as on form BE 11/94.

- eg. 1 - Foundations
 2 - Abutments

In order to distinguish between discrete components coming under the same element description, letters A, B, C, etc., have been added where appropriate. Each defect item has been numbered sequentially and includes the element number.

eg. For the east abutment, the defects may be shown as follows:-

- 05A01 - Cracking
05A02 - Scaling

The extent and severity of each defect is recorded against each check list item based on the scales given in BA 63/94 Inspection of Highway Structures as follows:-

- Extent: A - No significant defect.
 B - Slight, not more than 5% of length or affected area.
 C - Moderate, 5% - 20% affected.
 D - Extensive, more than 20 % affected.

- 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 action is needed.

DEFECT SUMMARY TABLE

STRUCTURE NAME: Bluntisham Railway Bridge DATE: 8.9.95
CCC BRIDGE NO: 365743
ELEMENT NO: 1.
DESCRIPTION: 1. FOUNDATIONS

DEFECT SUMMARY TABLE

Ref No	Defect Description	Extent	Severity	Photographs Diagrams	Comments
1.1	Cracking	-	-		
1.2	Corrosion	-	-		
1.3	Spalling	-	-		
1.4	Signs of movement	A	1		
1.5	Scour	A	1		
1.6	Erosion	A	1		
1.7	Debris	A	1		
1.8	Decay of timber piles	N/A			
1.9	Settlement	A	1		
1.10	Tilting	A	1		
1.11	Differential movement	A	1		

ENGINEER'S DESCRIPTION, COMMENTS AND RECOMMENDATIONS

General

The foundations of the structure were inaccessible at the time of the inspection. Therefore only general comments can be made about the present state of the foundations from the overall appearance of the bridge.

Remedial Works

No action required.

DEFECT SUMMARY TABLE

STRUCTURE NAME: Bluntisham Railway Bridge **DATE:** 8.9.95
CCC BRIDGE NO: 365743
ELEMENT NO: 5A.
DESCRIPTION: 5A. SUBSTRUCTURE ABUTMENTS

DEFECT SUMMARY TABLE

Ref No	Defect Description	Extent	Severity	Photographs Diagrams	Comments
5A.1	Cracking	B	2	D1	Yes
5A.2	Scaling	A	1		
5A.3	Spalling	C	3	D1 D2 F14/14 F14/13	Yes
5A.4	Mortar loss	B	2	D2	Yes
5A.5	Staining	A	1		
5A.6	Leakage, seepage & leaching	C	3	D1 F14/19 D2	Yes
5A.7	Excessive or abnormal movement	A	1		
5A.8	Debris	A	1		
5A.9	Drains and weepholes	-	-		None noted
5A.10	Vegetation	A	1		
5A.11	Chemical attack	A	1		

ENGINEER'S DESCRIPTION, COMMENTS AND RECOMMENDATIONS

5A.1 Cracking

Several vertical cracks ranging from 0.1 mm to 1 mm wide, 600 mm away from the west end of the north abutment. There is also a single vertical crack from the top of the east end of the north abutment. This is 0.1 mm wide.

Remedial Work

Priority: Medium
Action: Repair crack in mortar joint by repointing.
Estimated Cost: £300

5A.3 Spalling

Extensive areas of spalling on both abutments, varying from minor to deep spalling.

Remedial Work

Priority: Medium

Action: Brickwork repair - remove spalled brickwork and replace.

Estimated Cost: £1500

5A.4 Mortar loss

Area of mortar loss on the south abutment near the top.

Remedial Work

Priority: Low

Action: Mortar repair - repoint area with mortar loss.

Estimated Cost: £200

5A.6 Leakage, seepage & leaching

Damp areas on both abutments. This has caused efflorescence in some areas and spongy mortar in other areas.

Remedial Work

See 21.6

General

Areas of new brickwork at both ends of the north abutment and on the west end of the south abutment. This probably replaces badly spalled old brickwork.

DEFECT SUMMARY TABLE

STRUCTURE NAME: Bluntisham Railway Bridge **DATE:** 8.9.95
CCC BRIDGE NO: 365743
ELEMENT NO: 6A
DESCRIPTION: 6A. SUBSTRUCTURE WINGWALL - NORTH WEST

DEFECT SUMMARY TABLE

Ref No	Defect Description	Extent	Severity	Photographs Diagrams	Comments
6A.1	Cracking	C	3	D5 F14/22	Yes
6A.2	Scaling	A	1		
6A.3	Spalling	A	1		
6A.4	Mortar loss	A	1		
6A.5	Staining	A	1		
6A.6	Leakage, seepage & leaching	A	1		
6A.7	Excessive or abnormal movement	C	3	D5 F14/22	Yes
6A.8	Debris	A	1		
6A.9	Drains and weepholes	-	-		None noted
6A.10	Vegetation growth	A	1		
6A.11	Chemical attack	A	1		

ENGINEER'S DESCRIPTION, COMMENTS AND RECOMMENDATIONS

6A.1 Cracking

Large crack running diagonally from the direction change at the top edge of the wingwall, down to the bottom corner, nearest the abutment. The crack varies in width from 30 mm at the top to 5 mm at the bottom. Approximately half way along, there is a 170 mm deep void where a brick is missing. There is a full height wide vertical crack where the wingwall has moved away from the buttress. There is also a 2 mm diagonal crack at the bottom corner of the wingwall nearest the abutment.

Remedial Work

Priority: Medium
Action: Repair and strengthen wingwall.
Estimated Cost: £20,000

6A.7 Excessive or abnormal movement

See 6A.1. These cracks were caused by movement of the wingwall. The top section has moved forwards by 25 mm from the bottom section which is on its original line.

Remedial Work

See 6A.7

DEFECT SUMMARY TABLE

STRUCTURE NAME: Bluntisham Railway Bridge DATE: 8.9.95
CCC BRIDGE NO: 365743
ELEMENT NO: 6B
DESCRIPTION: 6B. SUBSTRUCTURE WINGWALL - NORTH EAST

DEFECT SUMMARY TABLE

Ref No	Defect Description	Extent	Severity	Photographs Diagrams	Comments
6B.1	Cracking	B	2	D4	Yes
6B.2	Scaling	A	1		
6B.3	Spalling	B	2	D4	Yes
6B.4	Mortar loss	B	2	D4	Yes
6B.5	Staining	A	1		
6B.6	Leakage, seepage & leaching	A	1		
6B.7	Excessive or abnormal movement	A	1		
6B.8	Debris	A	1		
6B.9	Drains and weepholes	-	-		None noted
6B.10	Vegetation growth	C	3	D4	Yes
6B.11	Chemical attack	A	1		

ENGINEER'S DESCRIPTION, COMMENTS AND RECOMMENDATIONS

6B.1 Cracking

Vertical 2 mm crack from the top of the wingwall towards the bottom, at the east end.

Remedial Work

Priority: Medium
Action: Repair crack in mortar joint by repointing.
Estimated Cost: £200

6B.3 Spalling

Small areas of light spalling towards the top of the wingwall, near the east end.

Remedial Work

Priority: Medium
Action: Brickwork repair - remove spalled brickwork and replace.
Estimated Cost: £100

6B.4 Mortar loss

Some mortar loss in a patch at the base of the wingwall. This also includes some voids where the mortar is completely missing.

Remedial Work

Priority: Low
Action: Mortar repair - repoint area with mortar loss.
Estimated Cost: £100

6B.10 Vegetation growth

Moss covers the bottom three courses of most of the wingwall. Also there are small patches of moss towards the top of the wingwall. There are large amounts of vegetation covering the coping of the wingwall. It is also growing out of the mortar joint between the coping and the wall at the east end.

Remedial Work

Priority: Low
Action: Cut down and remove vegetation, reinstate mortar
Estimated Cost: £50

General

Area of new brickwork midway up the wingwall adjacent to the abutment.

DEFECT SUMMARY TABLE

STRUCTURE NAME: Bluntisham Railway Bridge DATE: 8.9.95
CCC BRIDGE NO: 365743
ELEMENT NO: 6C
DESCRIPTION: 6C. SUBSTRUCTURE WINGWALL - SOUTH WEST

DEFECT SUMMARY TABLE

Ref No	Defect Description	Extent	Severity	Photographs Diagrams	Comments
6C.1	Cracking	B	2	D7 F14/7 F14/5	Yes
6C.2	Scaling	A	1		
6C.3	Spalling	C	3	D7 F14/2	Yes
6C.4	Mortar loss	B	2	D7	Yes
6C.5	Staining	A	1		
6C.6	Leakage, seepage & leaching	B	2	D7 F14/5	Yes
6C.7	Excessive or abnormal movement	A	1		
6C.8	Debris	A	1		
6C.9	Drains and weepholes	-	-		None noted
6C.10	Vegetation growth	C	3	D7 F14/2	Yes
6C.11	Chemical attack	A	1		

ENGINEER'S DESCRIPTION, COMMENTS AND RECOMMENDATIONS

6C.1 Cracking

Area of cracking towards the west end of the wingwall. There is a vertical crack with a maximum width of 3 mm and a horizontal crack that is 2 mm wide. There is also a small vertical crack where the pipe across the bridge enters the wingwall.

Remedial Work

Priority: Medium
Action: Repair crack in mortar joint by repointing.
Estimated Cost: £200

6C.3 Spalling

Large areas of spalling, up to half a brick deep in places on the wingwall.

Remedial Work

Priority: Medium

Action: Brickwork repair - remove spalled brickwork and replace.

Estimated Cost: £800

6C.4 Mortar loss

Mortar loss along the base of the wingwall in the western half.

Remedial Work

Priority: Low

Action: Mortar repair - repoint area with mortar loss.

Estimated Cost: £100

6C.6 Leakage, seepage & leaching

Area of efflorescence in the centre of the wingwall.

Remedial Work

No action required

6C.10 Vegetation growth

Foliage along the top of the coping of the wingwall. Also vegetation climbing up and growing out of the wall near the abutment.

Remedial Work

Priority: Low

Action: Cut down and remove vegetation.

Estimated Cost: £50

DEFECT SUMMARY TABLE

STRUCTURE NAME: Bluntisham Railway Bridge DATE: 8.9.95
CCC BRIDGE NO: 365743
ELEMENT NO: 6D
DESCRIPTION: 6D. SUBSTRUCTURE WINGWALL - SOUTH EAST

DEFECT SUMMARY TABLE

Ref No	Defect Description	Extent	Severity	Photographs Diagrams	Comments
6D.1	Cracking	C	3	D6	Yes
6D.2	Scaling	A	1		
6D.3	Spalling	B	2	D6	Yes
6D.4	Mortar loss	B	2	D6	Yes
6D.5	Staining	A	1		
6D.6	Leakage, seepage & leaching	A	1		
6D.7	Excessive or abnormal movement	A	1		
6D.8	Debris	A	1		
6D.9	Drains and weepholes	-	-		None noted
6D.10	Vegetation growth	C	3	D6	Yes
6D.11	Chemical attack	A	1		

ENGINEER'S DESCRIPTION, COMMENTS AND RECOMMENDATIONS

6D.1 Cracking

Various vertical cracks ranging from a maximum of 50 mm wide at the top to 1 mm wide near the base of the wingwall. Some of these cracks connect to deep voids where parts of bricks are missing.

Remedial Work

Priority: Medium
Action: Repair crack in mortar joint by repointing.
Estimated Cost: £300

6D.3 Spalling

Several isolated areas of spalling where individual bricks are affected.

Remedial Work

Priority: Medium

Action: Brickwork repair - remove spalled brickwork and replace.

Estimated Cost: £400

6D.4 Mortar loss

Mortar loss between some of the coping stones. Also in a patch of bricks adjacent to the abutment.

Remedial Work

Priority: Low

Action: Mortar repair - repoint area with mortar loss.

Estimated Cost: £100

6D.10 Vegetation growth

Several areas where vegetation is growing out of the mortar joints, particularly at the east end and at the base of the wall.

Remedial Work

Priority: Low

Action: Cut down and remove vegetation.

Estimated Cost: £50

DEFECT SUMMARY TABLE

STRUCTURE NAME: Bluntisham Railway Bridge DATE: 8.9.95
CCC BRIDGE NO: 365743
ELEMENT NO: 8.
DESCRIPTION: 8. APPROACH EMBANKMENTS

DEFECT SUMMARY TABLE

Ref No	Defect Description	Extent	Severity	Photographs Diagrams	Comments
8.1	Signs of movement	A	1		
8.2	Debris	A	1		
8.3	Settlement	A	1		
8.4	Differential movement	A	1		

ENGINEER'S DESCRIPTION, COMMENTS AND RECOMMENDATIONS

Remedial Work

No action required.

DEFECT SUMMARY TABLE

STRUCTURE NAME: Bluntisham Railway Bridge DATE: 8.9.95

CCC BRIDGE NO: 365743

ELEMENT NO: 16A & 17

DESCRIPTION: 16A. MASONRY AND BRICK ARCH RINGS including 17.
SPANDRELS

DEFECT SUMMARY TABLE

Ref No	Defect Description	Extent	Severity	Photographs Diagrams	Comments
16A.1	Spalling or erosion of masonry	C	3	D8, D9 F14/25	Yes
16A.2	Cracking or splitting of masonry	B	2	D8, D9	Yes
16A.3	Opening of joints	A	1		
16A.4	Movement of supports	A	1		
16A.5	Loss of arch shape	A	1		
16A.6	Longitudinal cracks in surfacing	A	1		
16A.7	Inadequate drainage	A	1		
16A.8	Condition of mortar joints	B	2	D8, D9	Yes
16A.9	Leakage of water	A	1		
16A.10	Debris and vegetation growth	C	3	D8, D9 F14/25	Yes
16A.11	Adequacy of waterway	N/A			
16A.12	Condition of invert	N/A			
17.1	Bulging and outward movement of spandrel walls	A	1		
17.2	Loss of infill materials between spandrel walls	A	1		

ENGINEER'S DESCRIPTION, COMMENTS AND RECOMMENDATIONS

16A.1 Spalling or erosion of masonry

Extensive areas of spalling over both spandrels and all of the buttresses. This includes minor and heavy spalling ie. up to half a brick deep.

Remedial Work

Priority: Medium

Action: Brickwork repair - remove spalled brickwork and replace.

Estimated Cost: £1000

16A.2 Cracking or splitting of masonry

On the west face, there are two vertical cracks above the string course. These are only approximately 2 mm wide. On the east face there are horizontal cracks above the string course, these are hairline cracks.

Remedial Work

Priority: Medium

Action: Repair crack in mortar joint by repointing.

Estimated Cost: £200

16A.8 Condition of mortar joints

Mortar loss in the top north corner of the west face spandrel. Also some mortar loss in the arch ring of the east face.

Remedial Work

Priority: Low

Action: Mortar repair - repoint area with mortar loss.

Estimated Cost: £200

16A.10 Debris and vegetation growth

Ivy and vegetation growing up the north buttress of the east face. Vegetation is growing out of the string course on the west face. It is also growing out of the parapet on the north edge of the west face.

Remedial Work

Priority: Low

Action: Cut down and remove vegetation, reinstate mortar

Estimated Cost: £100

General

It appears that extensive areas of new brickwork have been built into the buttresses and spandrels of both faces. The majority of the deep spalling occurs at the interface between the old and the new bricks. This implies that the new brickwork has replaced badly spalled brickwork.

DEFECT SUMMARY TABLE

STRUCTURE NAME: Bluntisham Railway Bridge DATE: 8.9.95

CCC BRIDGE NO: 365743

ELEMENT NO: 16B

DESCRIPTION: 16B. MASONRY AND BRICK BARREL

DEFECT SUMMARY TABLE

Ref No	Defect Description	Extent	Severity	Photographs Diagrams	Comments
16B.1	Spalling or erosion of masonry	C	3	D3 F14/11	Yes
16B.2	Cracking or splitting of masonry	B	2	D3 F14/21	Yes
16B.3	Opening of joints	A	1		
16B.4	Movement of supports	A	1		
16B.5	Loss of arch shape	A	1		
16B.6	Longitudinal cracks in surfacing	A	1		
16B.7	Inadequate drainage	B	2	D3	Yes
16B.8	Condition of mortar joints	A	1		
16B.9	Leakage of water	B	2	D3	Yes
16B.10	Debris and vegetation growth	A	1		
16B.11	Adequacy of waterway	N/A			
16B.12	Condition of invert	N/A			

ENGINEER'S DESCRIPTION, COMMENTS AND RECOMMENDATIONS

16B.1 Spalling or erosion of masonry

Areas of spalling along the east and west edge of the barrel, probably due to weathering.

Remedial Work

Priority: Medium

Action: Brickwork repair - remove spalled brickwork and replace.

Estimated Cost: £200

16B.2 Cracking or splitting of masonry

A longitudinal hairline crack has already been repaired but has opened up again. This is on the east side of the barrel. There are two other longitudinal hairline cracks in the barrel. Two lines of mortar repair follow the diagonal line of the brickwork, near the north abutment. The repairs have not cracked, but hairline cracks continue on from them.

Remedial Work

Priority: Low

Action: Monitor the cracks

Estimated Cost: £ Nil

16B.7 Inadequate drainage

Large damp patch in the south west corner of the barrel. This area has efflorescence on it and some spalling.

Remedial Work

See 21.6

16B.9 Leakage of water

See 16B.7

General

Most of the barrel is covered in black soot, which hinders inspection of the brickwork.

Remedial Works

Priority: Low

Action: Remove soot and dirt staining prior to the next principal inspection.

Estimated Cost: £200

DEFECT SUMMARY TABLE

STRUCTURE NAME: Bluntisham Railway Bridge **DATE:** 8.9.95
CCC BRIDGE NO: 365743
ELEMENT NO: 21.
DESCRIPTION: 21. SURFACING AND WATERPROOFING

DEFECT SUMMARY TABLE

Ref No	Defect Description	Extent	Severity	Photographs Diagrams	Comments
21.1	Cracking	B	2	F32/12	
21.2	Condition of seals	N/A			
21.3	Deformation and tracking	B	2	F33/1 F33/10	Yes
21.4	Sliding of surfacing	A	1		
21.5	Skid resistance	B	2	F33/10	Yes
21.6	Defects in waterproofing	C	3		Yes
21.7	Clearance under bridges	N/A			

ENGINEER'S DESCRIPTION, COMMENT AND RECOMMENDATIONS

21.1 Cracking

Minor cracking in surface dressing probably along the line of a trench reinstatement.

21.3 Deformation and tracking

There is some minor tracking over the bridge. There are also some sunken cat's eyes.

21.5 Skid resistance

The skid resistance of the surfacing is reducing due to polishing.

Remedial Work

The surface defects will be addressed during the next routine road maintenance programme.

21.6 Defects in waterproofing

Damp areas on both abutments and on the barrel due to leakage of water from failure or lack of waterproofing. This is not a significant defect and therefore is considered a low priority.

Remedial Work

Priority: Low

Action: Place/replace waterproofing, possibly in-line with routine road maintenance.

Estimated cost: £40,000

DEFECT SUMMARY TABLE

STRUCTURE NAME: Bluntisham Railway Bridge DATE: 8.9.95
CCC BRIDGE NO: 365743
ELEMENT NO: 24.
DESCRIPTION: 24. BRICK PARAPETS

DEFECT SUMMARY TABLE

Ref No	Defect Description	Extent	Severity	Photographs Diagrams	Comments
24.1	Traffic impact damage	A	1		
24.2	Spalling	B	2	D10, D11 F32/6	Yes
24.3	Tightness of bolts	N/A			
24.4	Soundness of welds	N/A			
24.5	Alignment of rails and fences	A	1		
24.6	Cracks	C	3	D10, D11 F31/2 F31/10 F31/12A	Yes
24.7	Mortar loss	B	2	D10 F31/3	Yes
24.8	Wingwall protection	C	3	F32/3	Yes
24.9	Vegetation	B	2	D10, D11 F31/10	Yes

ENGINEER'S DESCRIPTION, COMMENT AND RECOMMENDATIONS

24.2 Spalling

The west parapet has only slight spalling on the north end. The east parapet has more extensive spalling on the south pillar along a vertical crack and near the coping.

Remedial Work

Priority: Medium

Action: Brickwork repair - remove spalled brickwork and replace.

Estimated cost: £300

24.6 Cracking

Large vertical cracks 1-2mm in west parapet at the approximate quarter points. The east parapet has a vertical crack at the north pilaster at the join between the old and newer brickwork. A similar defect is found at the south end but with spalling as well. This brickwork contains hairline cracks along the mortar joints with efflorescence.

Remedial Work

Priority: Low

Action: Repair cracks in mortar joints by repointing.

Estimated cost: £300

24.7 Mortar loss

Some mortar loss along the base of the west parapet.

Remedial Work

Priority: Low

Action: Mortar repair - repoint area with mortar loss

Estimated cost: £200

24.8 Wingwall protection

The only protection available at the moment is from wooden fences at either end of the parapets, and these are in a poor condition. A medium to low priority for remedial works is recommended as there are no signs of regular impact damage to the pilasters.

Remedial Work

Priority: Medium / Low

Action: Replace all substandard fences with safety fences.

Estimated cost: £8,000

24.9 Vegetation

Ivy is growing up the west end of the west parapet. There is also a small amount of vegetation growing out of the crack at the north end of the east parapet.

Remedial Work

Priority: Low

Action: Cut down and remove vegetation.

Estimated cost: £50

Appendix 1

Diagrams, Illustrations and Plans

Contents

R6272/704/Fig1 - Location Plan

BC6272/704/Fig2 - Plan

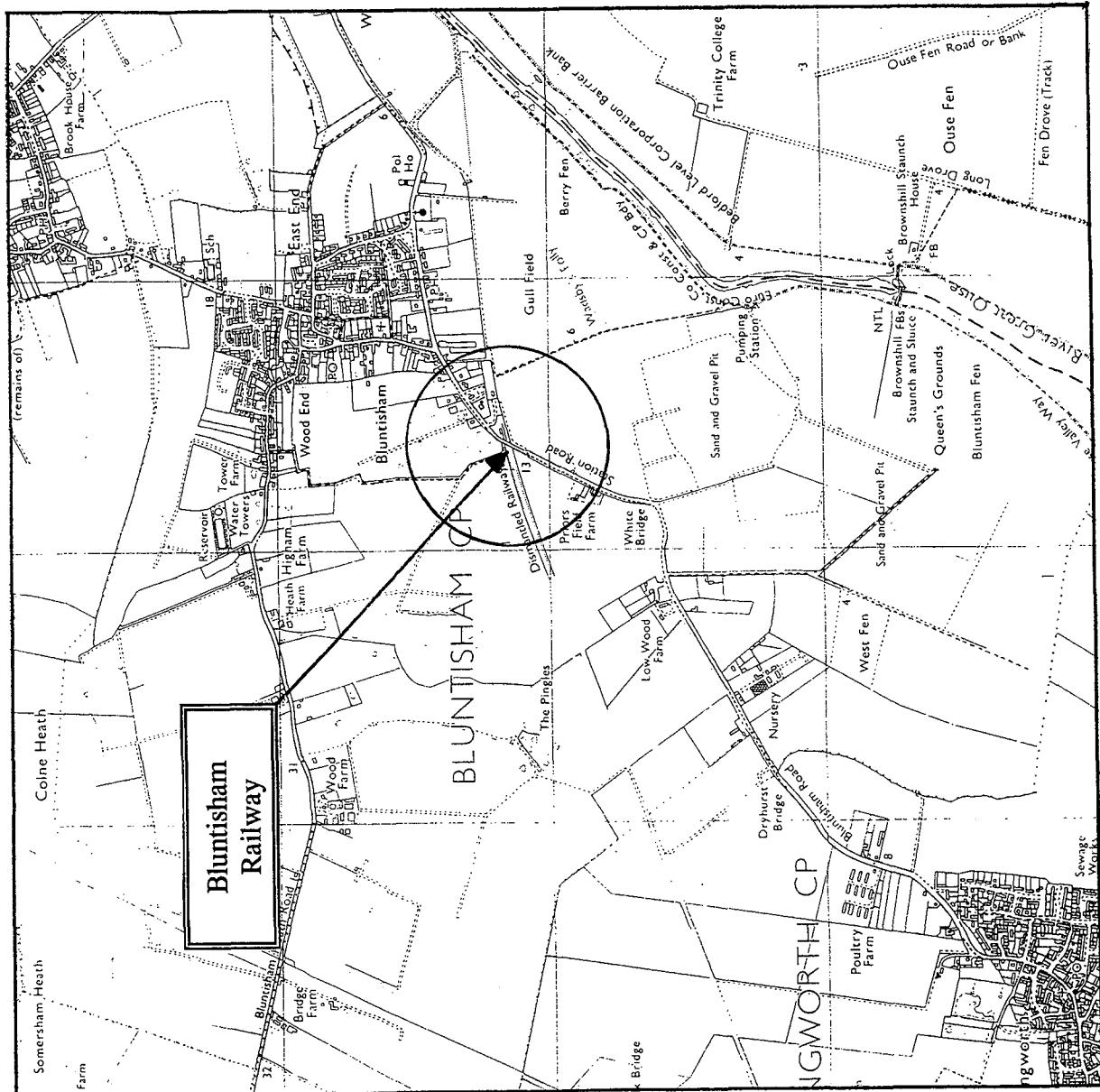
BC6272/704/Fig3 - Elevations

Defect diagrams sheets 1 to 11 inclusive

BC6272/704/Fig4 - Photograph locations, plan

BC6272/704/Fig5 - Photograph locations, elevations

DO NOT SCALE



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**CAMBRIDGESHIRE
COUNTY COUNCIL**
Client
Project
**BLUNTISHAM
RAILWAY**

Title

LOCATION PLAN

Original Scale	Drawn By	Checked By	Authorised By
NTS	Date	Date	Date
	SEAN	SEAN	SEAN
	Fig 1	Fig 1	Fig 1

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NOTES.

1670

11690

1670

Client:



Cambridgeshire
County Council

WS Atkins Consultants Ltd.

Wellbrook Court, Girton Road
Cambridge, CB3 0NA

Tel. (01223) 276002
Fax (01223) 277529

**Project ASSESSMENT OF HIGHWAY
STRUCTURES PACKAGE NO.25**

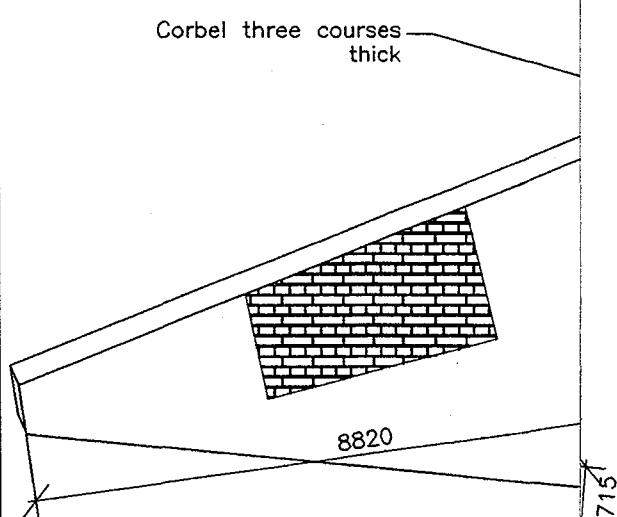
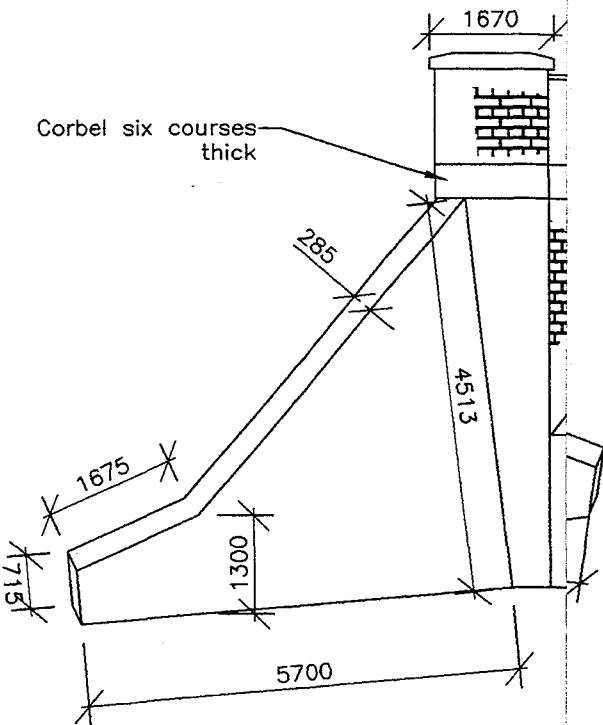
**Title BLUNTISHAM RAILWAY BRIDGE
PLAN**

Original Scale NTS	Drawn DMA	Checked CJS	Authorised ✓
Date 12/10/94	Date 16/11/94	Date 27/11/94	

**Figure Number
BC6272/704/ FIG2**

Rev

NOTES.



Client:



Cambridgeshire
County Council

WS Atkins Consultants Ltd.

Wellbrook Court, Girton Road Tel. (01223) 276002
Cambridge, CB3 0NA Fax (01223) 277529

Project

**ASSESSMENT OF HIGHWAY
STRUCTURES PACKAGE No.25**

Title

**BLUNTISHAM RAILWAY
BRIDGE - ELEVATIONS**

Original Scale	Drawn CJF	Checked <i>CLS</i>	Authorised <i>BC</i>
N.T.S	Date 2/96	Date 3/96	Date 3/96

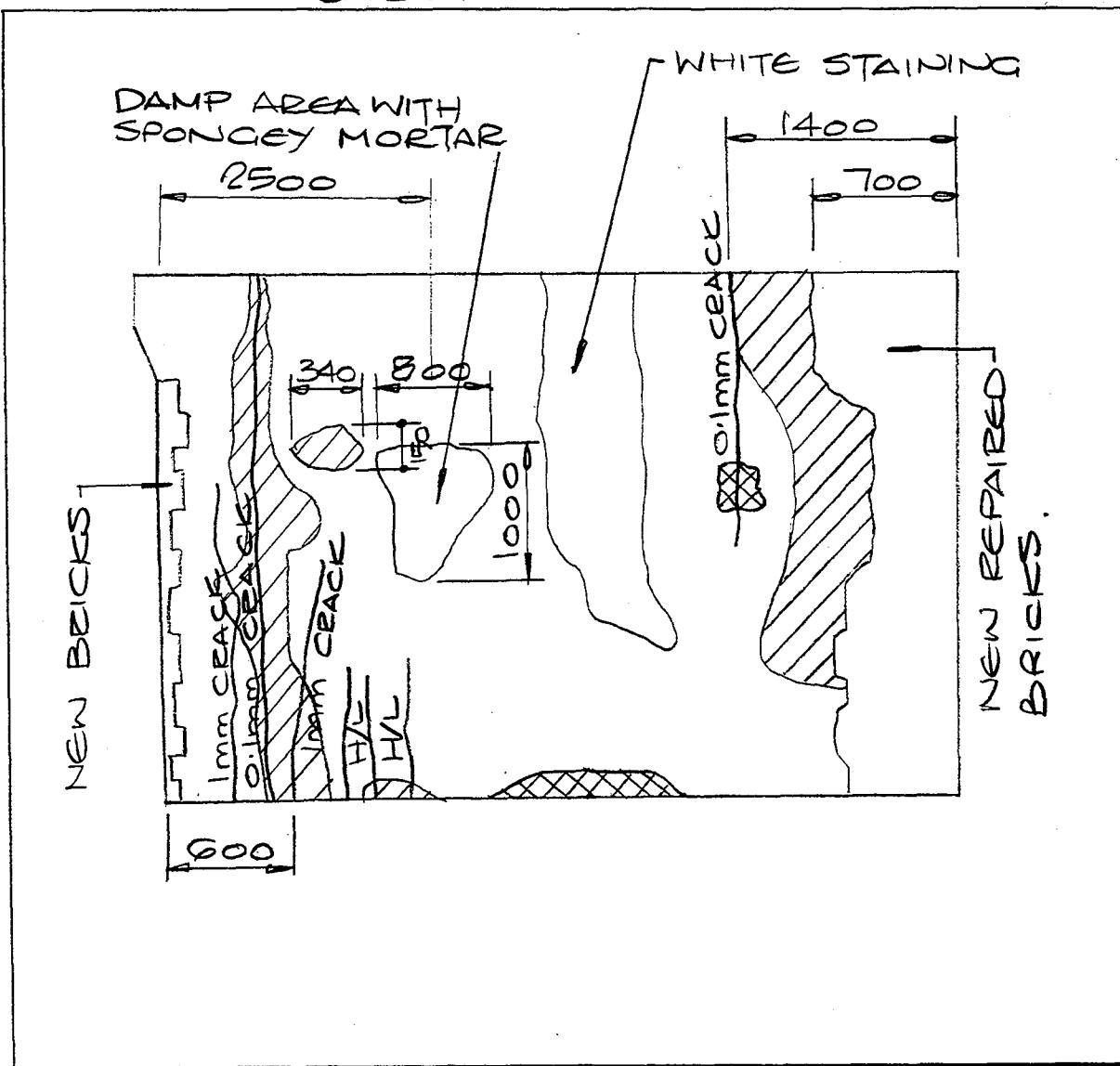
Drawing Number	Rev
BC6272/704/FIG3	-

D1

Form P.I.2

COUNTY ROAD PRINCIPAL INSPECTION - BRIDGE NO. 305743

DETAIL OF NORTH ABUTMENT
SHEET 1 OF 11



Key:-

= SPALLING

H/L = HAIRLINE CRACKS.

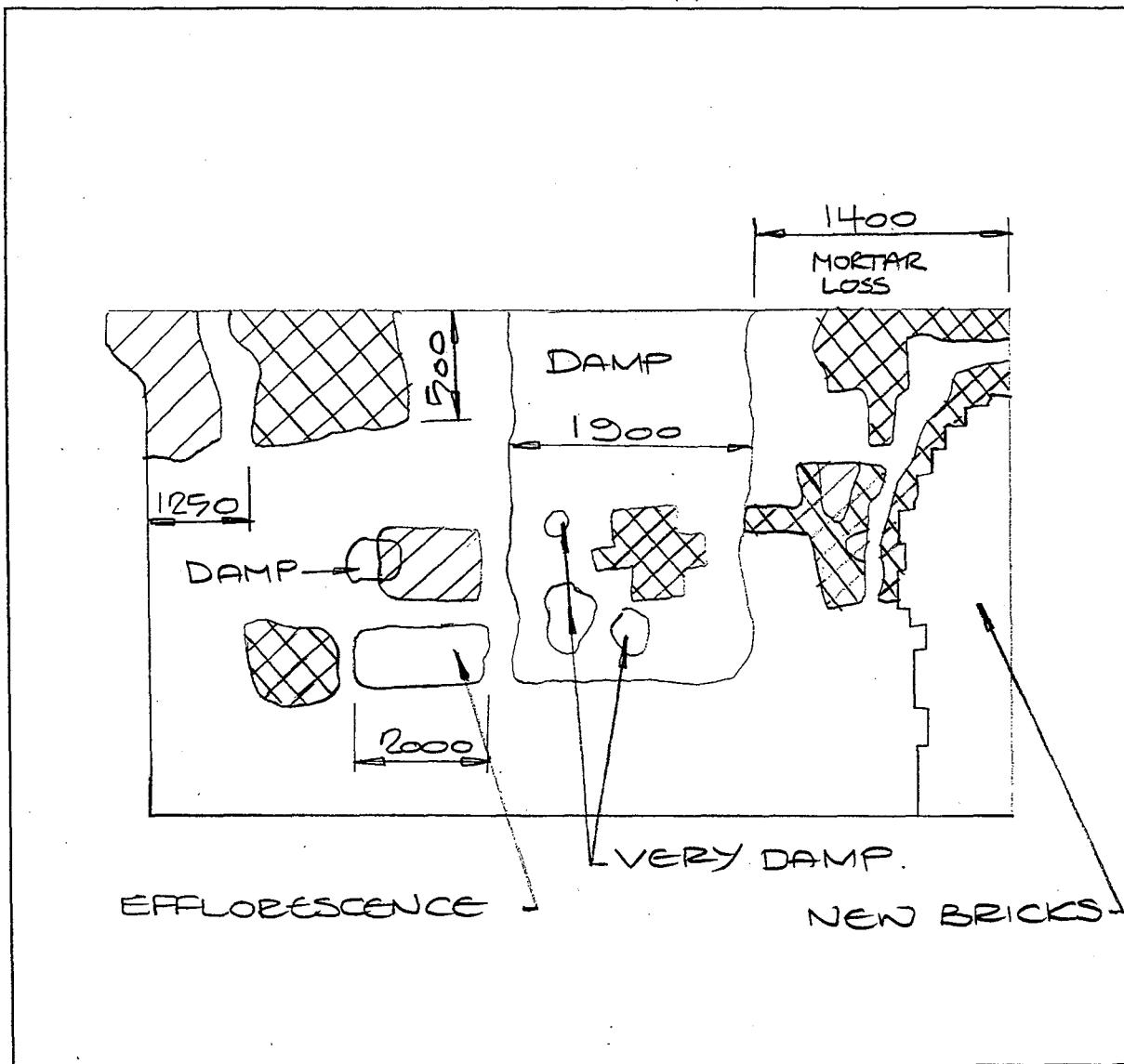
= DEEP SPALLING

D2

Form P.I.2

COUNTY ROAD PRINCIPAL INSPECTION - BRIDGE NO. 365743

DETAIL OF ...SOUTH ABUTMENT
SHEET 2 OF 11

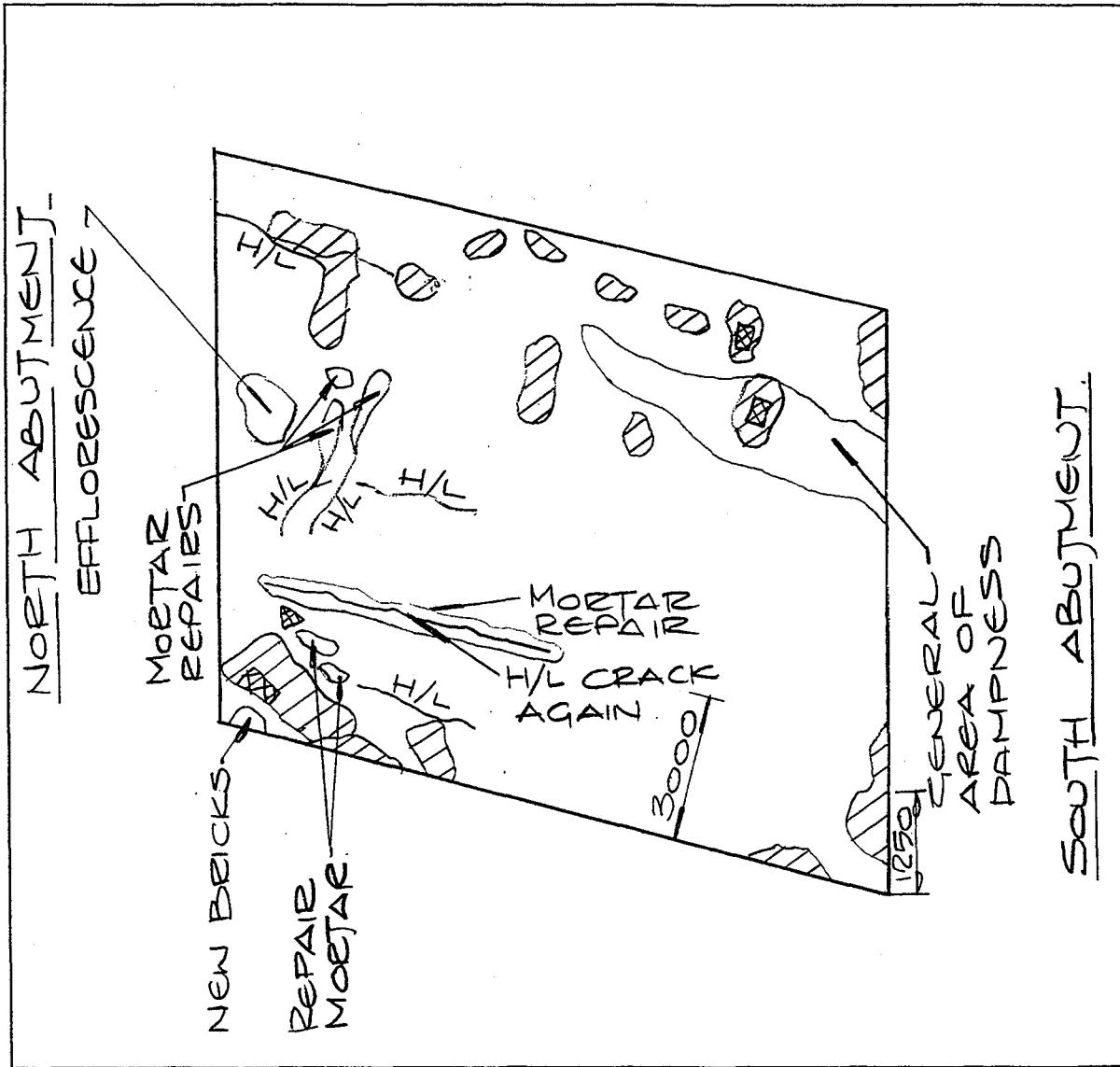


KEY:-

 = SPALLING

 = DEEP SPALLING.

COUNTY ROAD PRINCIPAL INSPECTION - BRIDGE NO. 365743

DETAIL OF SOFFIT OF BARREL
SHEET 3 OF 11NOTE:-

SOOT ON BARREL SO DIFFICULT TO SEE DEFECTS.

KEY:-

= SPALLING.

H/L = HAIR LINE CRACKS.

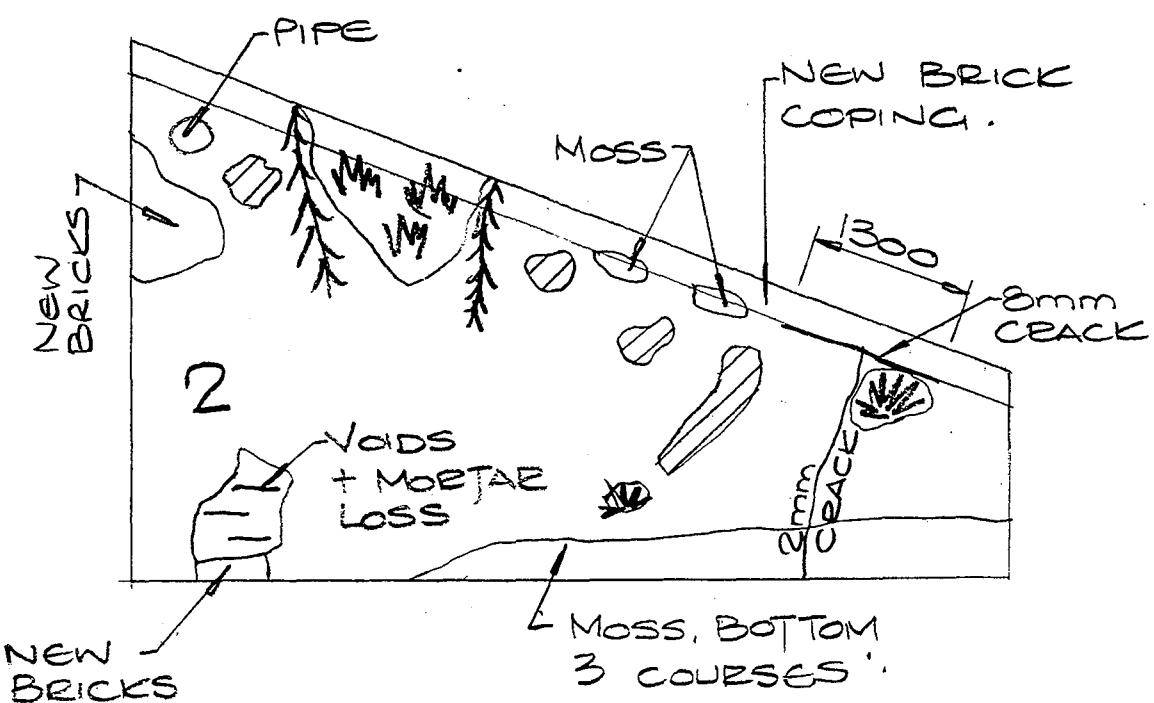
= DEEP SPALLING.

D4

Form P.I.2

COUNTY ROAD PRINCIPAL INSPECTION - BRIDGE NO. 305743

DETAIL OF NORTH EAST WING WALL
SHEET 4 OF 11



NOTE:-

MANY OF THE JOINTS ARE MOSSY.

KEY:-

 = VEGETATION

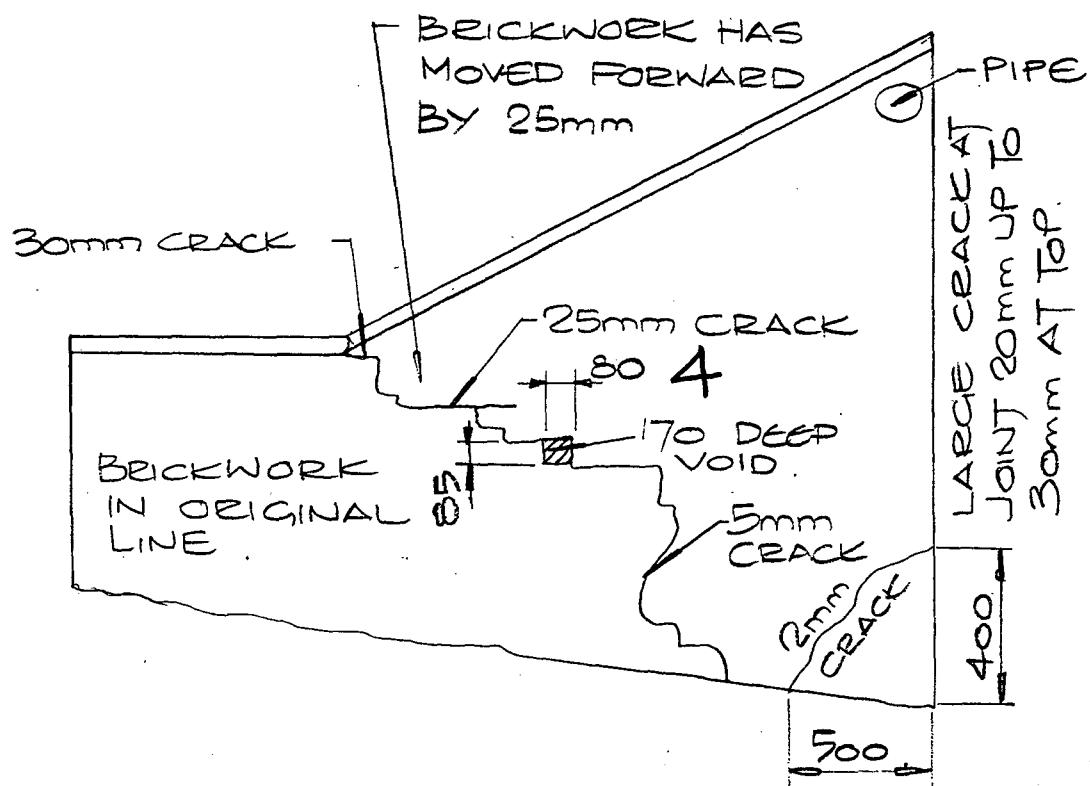
 = SPALLING.

DS

Form P.I.2

COUNTY ROAD PRINCIPAL INSPECTION - BRIDGE NO. 3005743

DETAIL OF ..NORTH WEST WING WALL
SHEET 5 OF 11

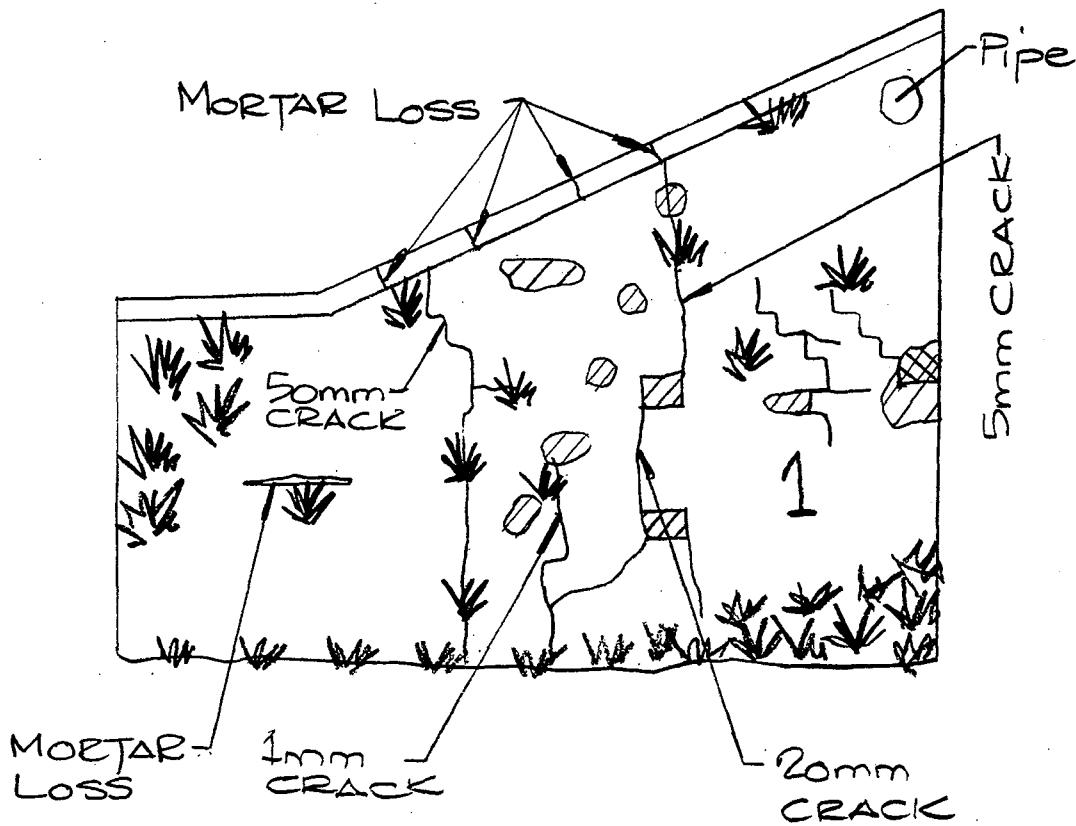


D6

Form P.I.2

COUNTY ROAD PRINCIPAL INSPECTION - BRIDGE NO. 305743

DETAIL OF SOUTH EAST WINGWALL
SHEET 6 OF 11



KEY:-

(○) = SPALLING.

(*) = VEGETATION.

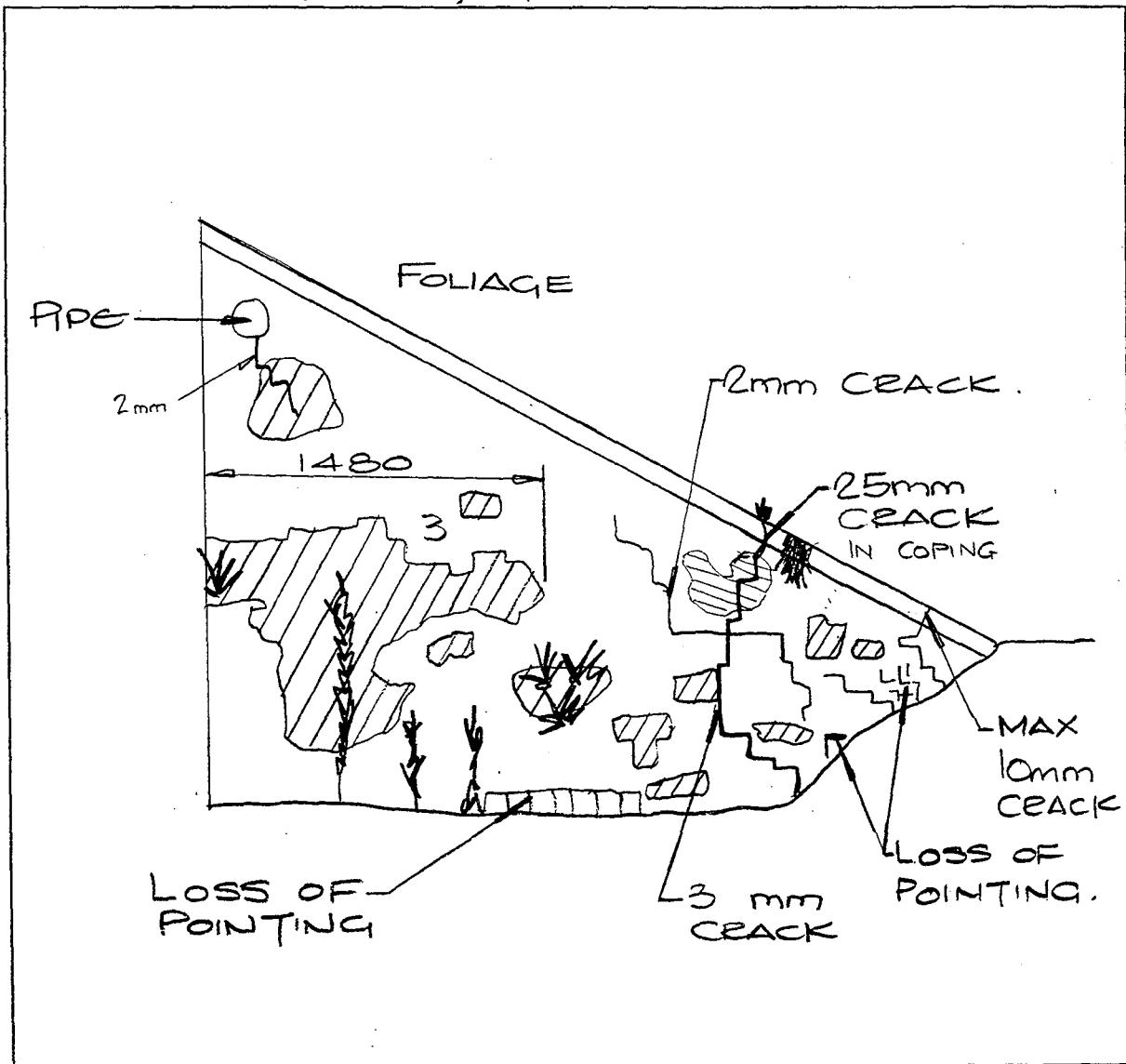
(▨) = DEEP SPALLING.

D7

Form P.I.2

COUNTY ROAD PRINCIPAL INSPECTION - BRIDGE NO. 305743

DETAIL OF SOUTH WEST WINGWALL
SHEET 7 OF 11



Key:-

= SPALLING

= EFFLORESCENCE

= CRACKS

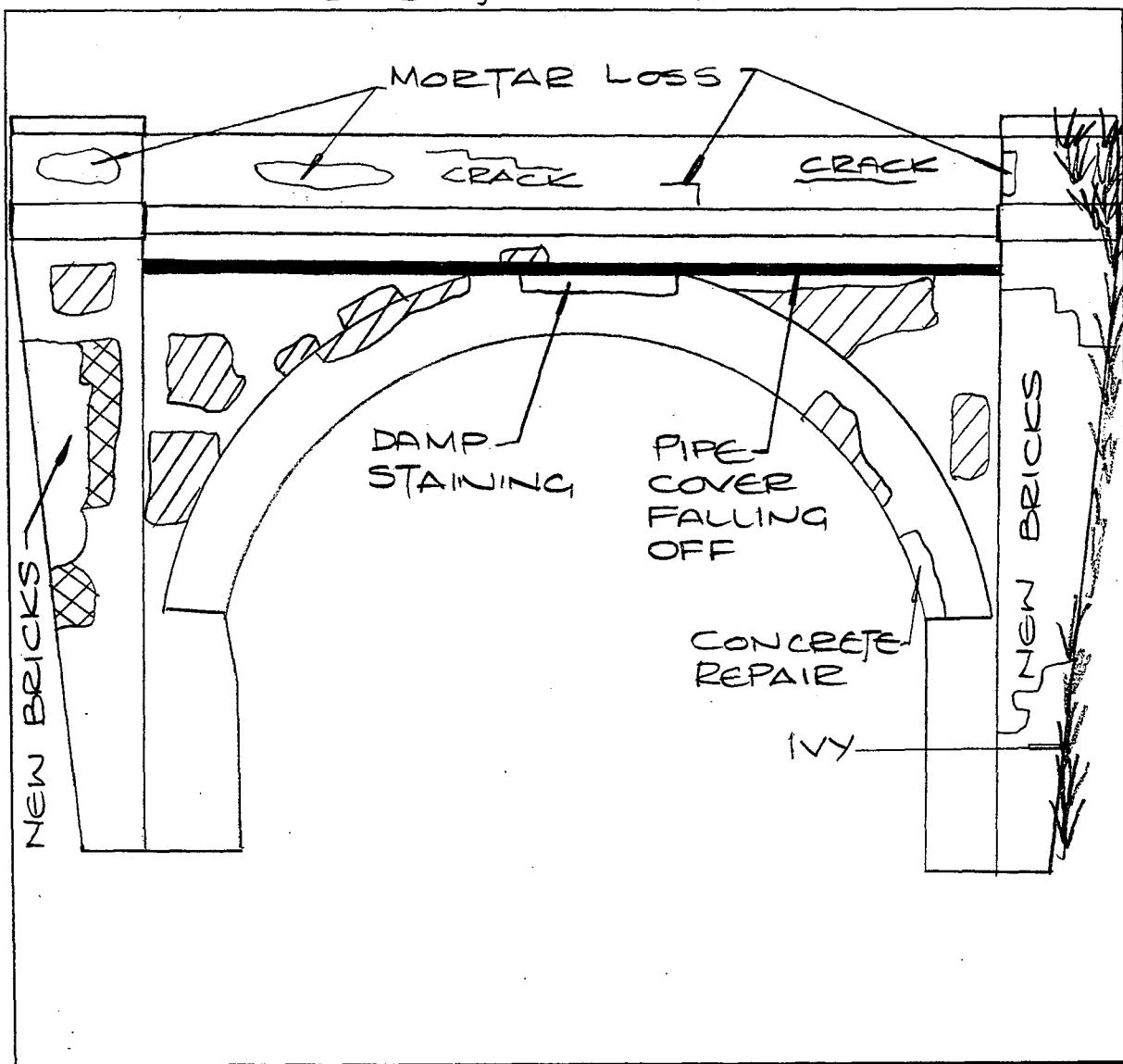
= VEGETATION.

D8

Form P.I.2

COUNTY ROAD PRINCIPAL INSPECTION - BRIDGE NO. 365743

DETAIL OF EAST ELEVATION
SHEET 8 OF 11



KEY:-

= SPALLING.

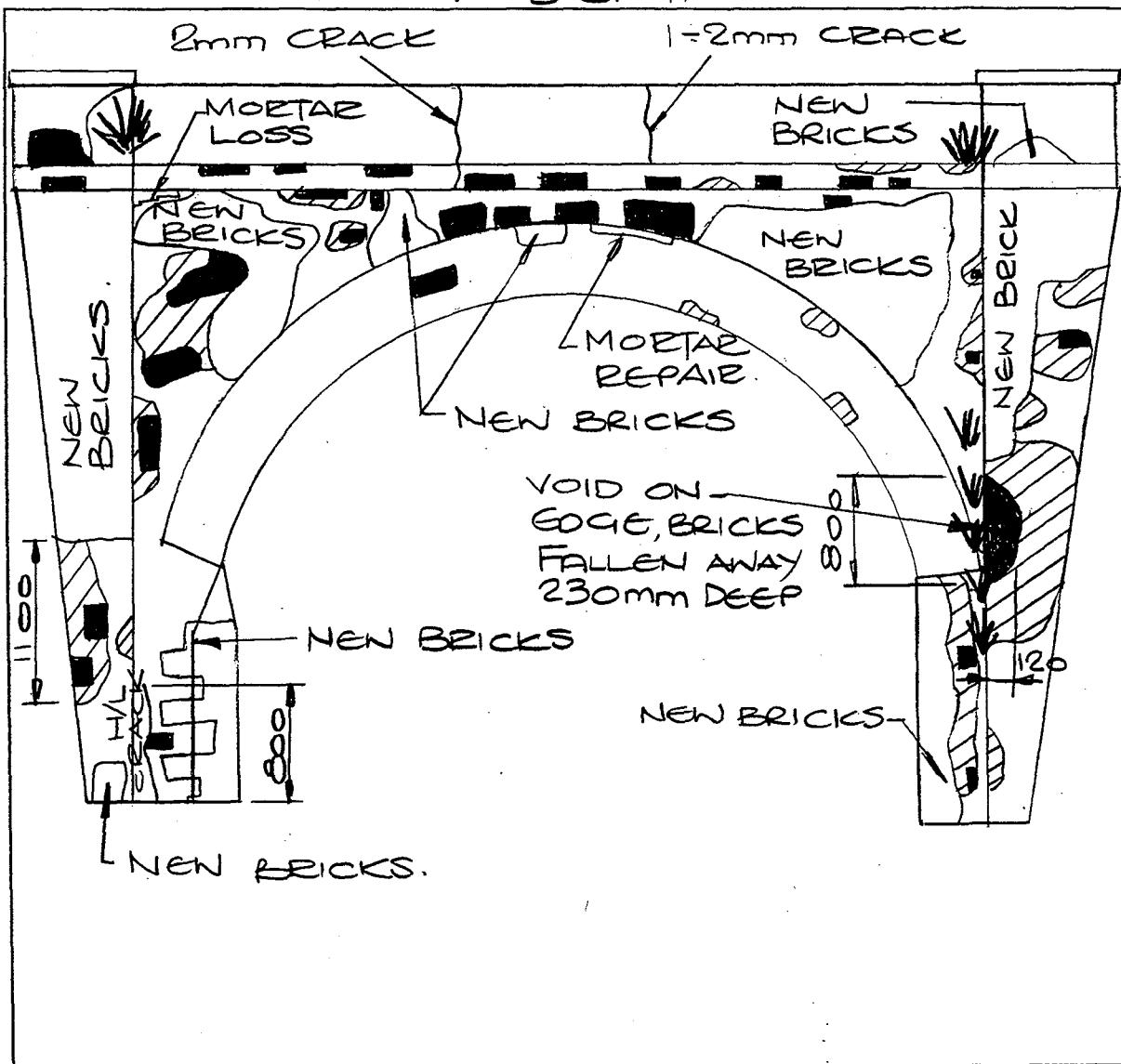
= DEEP SPALLING

D9

Form P.I.2

COUNTY ROAD PRINCIPAL INSPECTION - BRIDGE NO. 3005743

DETAIL OF WEST ELEVATION
SHEET 9 OF 11



KEY:-



= SPALLING



= HEAVY SPALLING UP TO 1 BRICK



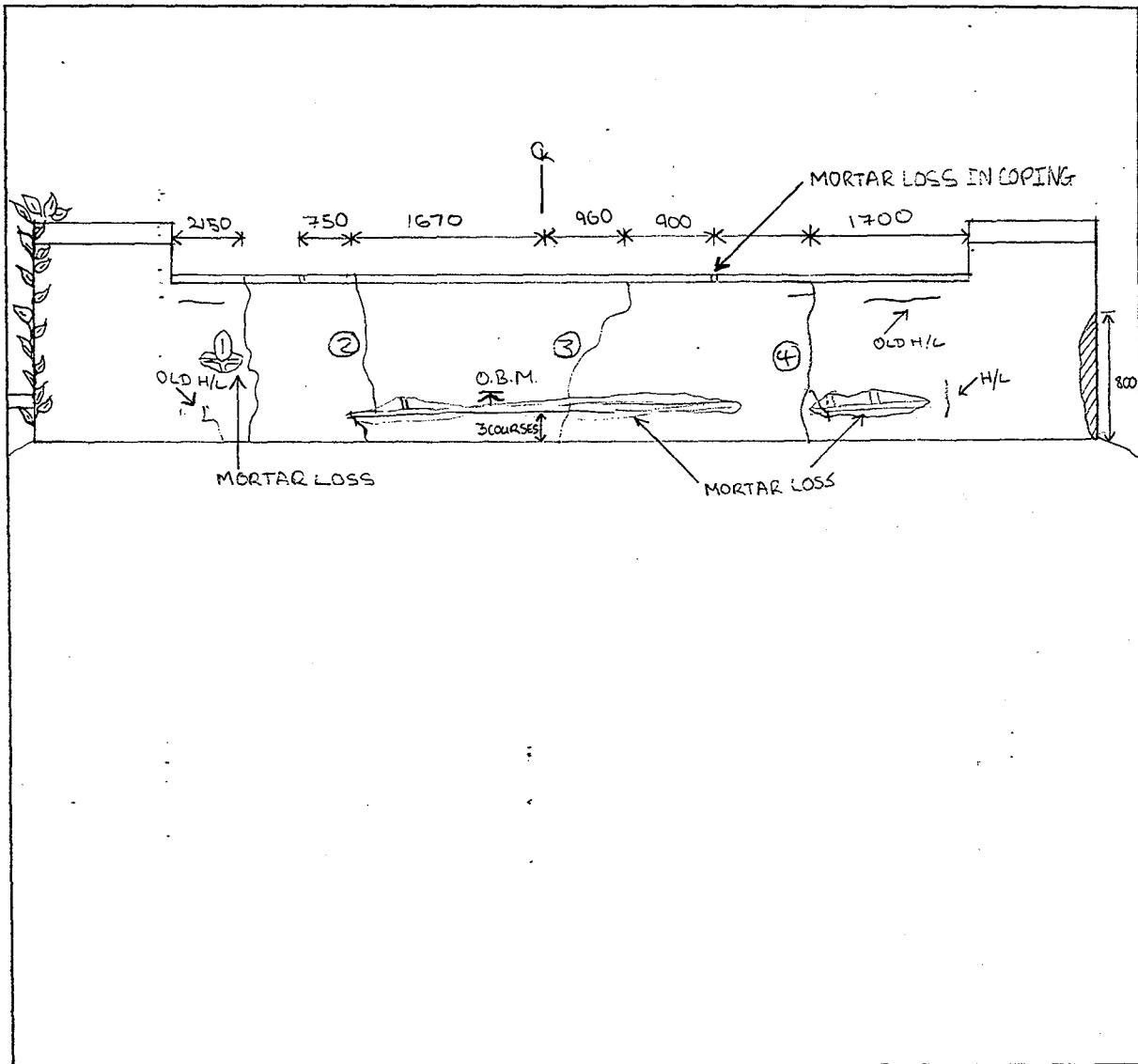
= VEGETATION

D10

Form P.I.2

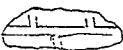
COUNTY ROAD PRINCIPAL INSPECTION - BRIDGE NO. 365743.

DETAIL OF ... BLINTISHAM RAILWAY - WEST PARAPET
SHEET 10 OF 11



KEY :-

= CRACK - < 1mm or
as stated



= IVY



= SPALLING

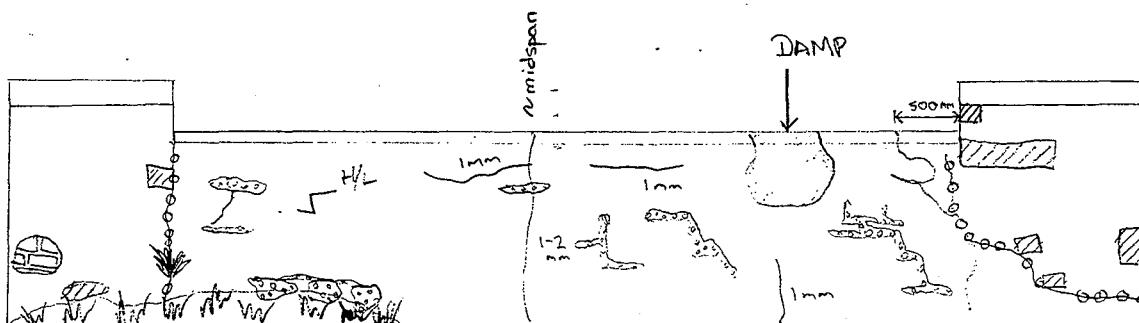
NOTE LICHEN ON TOP OF COPINGS + LOWER PART OF WALL ESPECIALLY WHERE
THERE IS MORTAR LOSS.

D 11

Form P.I.2

COUNTY ROAD PRINCIPAL INSPECTION - BRIDGE NO. 365743.

DETAIL OF BLUNTSHAM RAILWAY - EAST PARAPET
SHEET 11 OF 11



KEY :-

(D) = DAMP

(M) = MORTAR LOSS

(S) = SPALLING

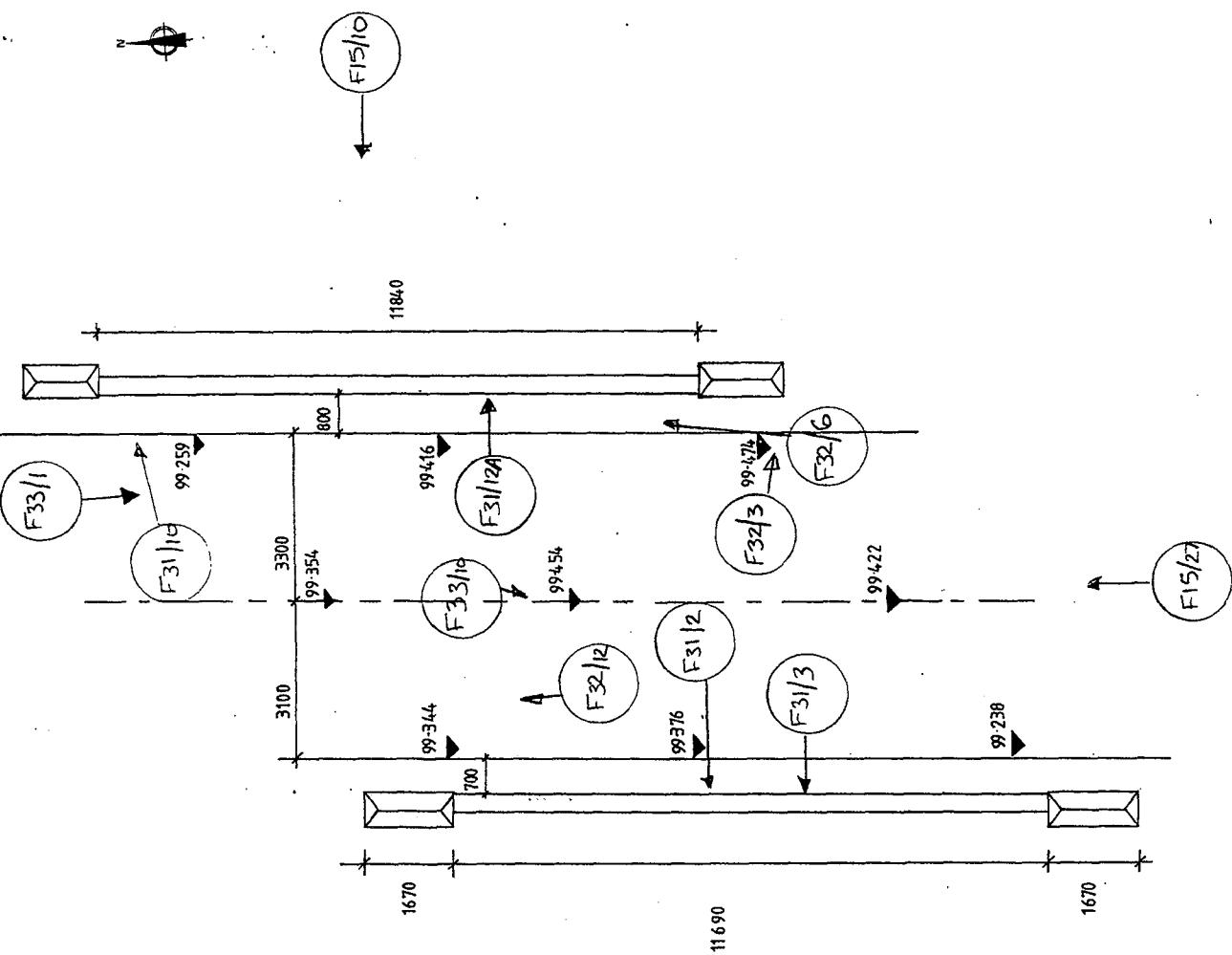
(E) = EFFLORESCENT

(V) = VEGETATION

(C) = CRACK

(R) = CRACK BETWEEN TWO TYPES OF BRICKWORK.

NOTES.



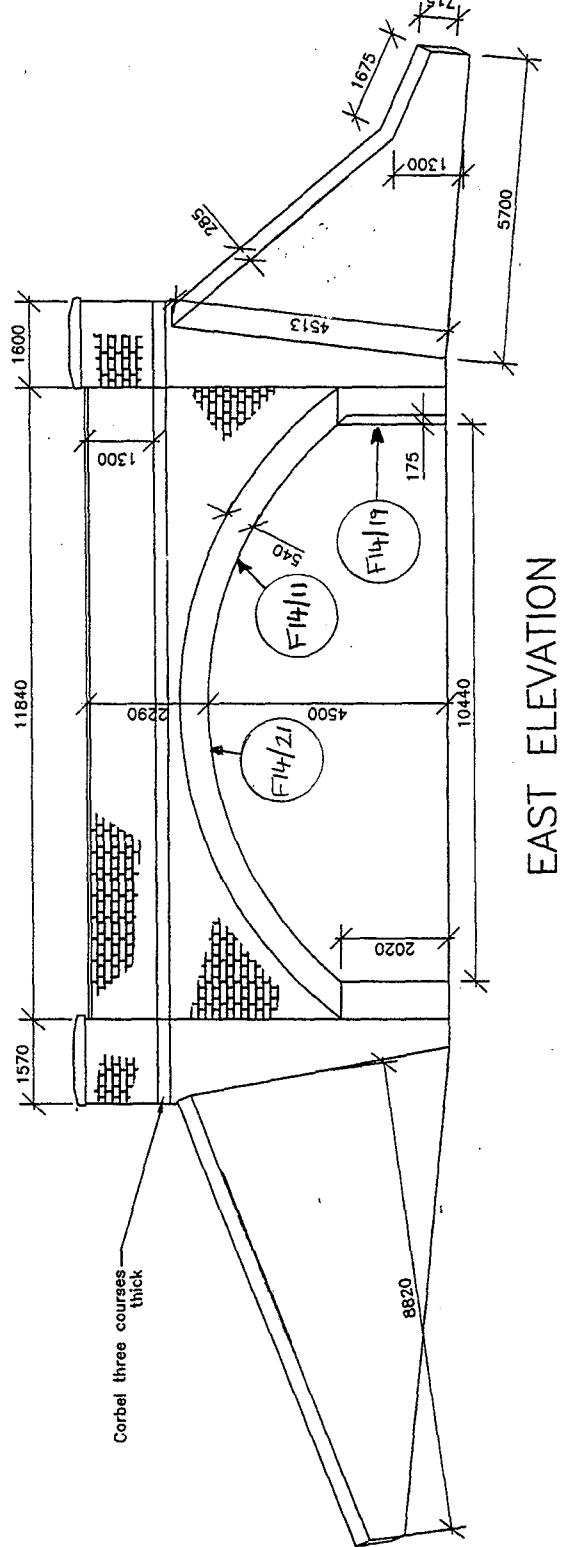
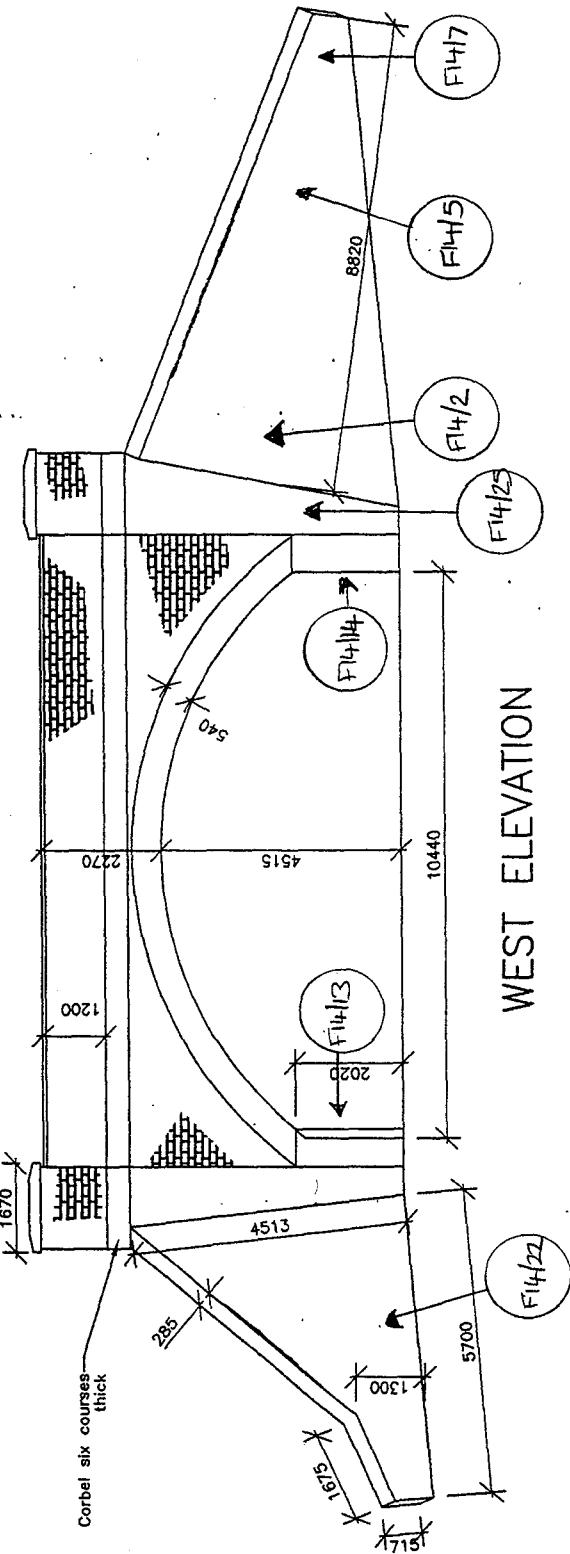
WS Atkins Consultants Ltd.
Wellbrook Court, Girton Road
Cambridge, CB3 0NA

Tel. (01223) 276002
Fax (01223) 277529

Project ASSESSMENT OF HIGHWAY
STRUCTURES PACKAGE NO.25

Title BLUNTISHAM RAILWAY BRIDGE
PLAN
Photograph Locations

Original Scale NTS	Drawn Date 25/01/96	Checked Date 25/01/96	Approved Date 25/01/96	Rev
Figure Number BC6272/704/ FIG 4				A3



Client:
Cambridgeshire
County Council

WS Atkins Consultants Ltd.

Project
**ASSESSMENT OF HIGHWAY
STRUCTURES PACKAGE No.25**

Title

**BLUNTISHAM RAILWAY
BRIDGE - ELEVATIONS
PHOTOGRAPH LOCATIONS**

Original Scale	Drawn Date	Chkd	Approved
N.T.S.	Date	Rev.	Date

BC6272/704/FIG5

-

Appendix 2 Photographs

Pages 1 to 12 inclusive



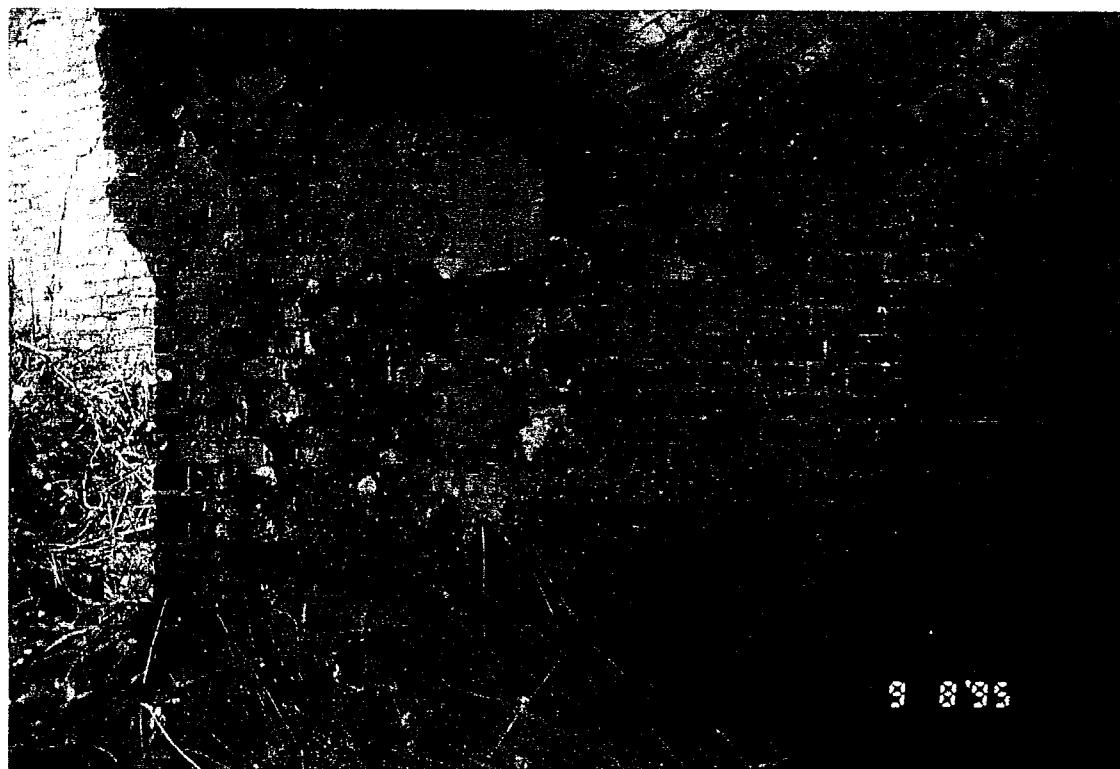
F15/10 - Elevation of Bluntisham Railway Bridge.



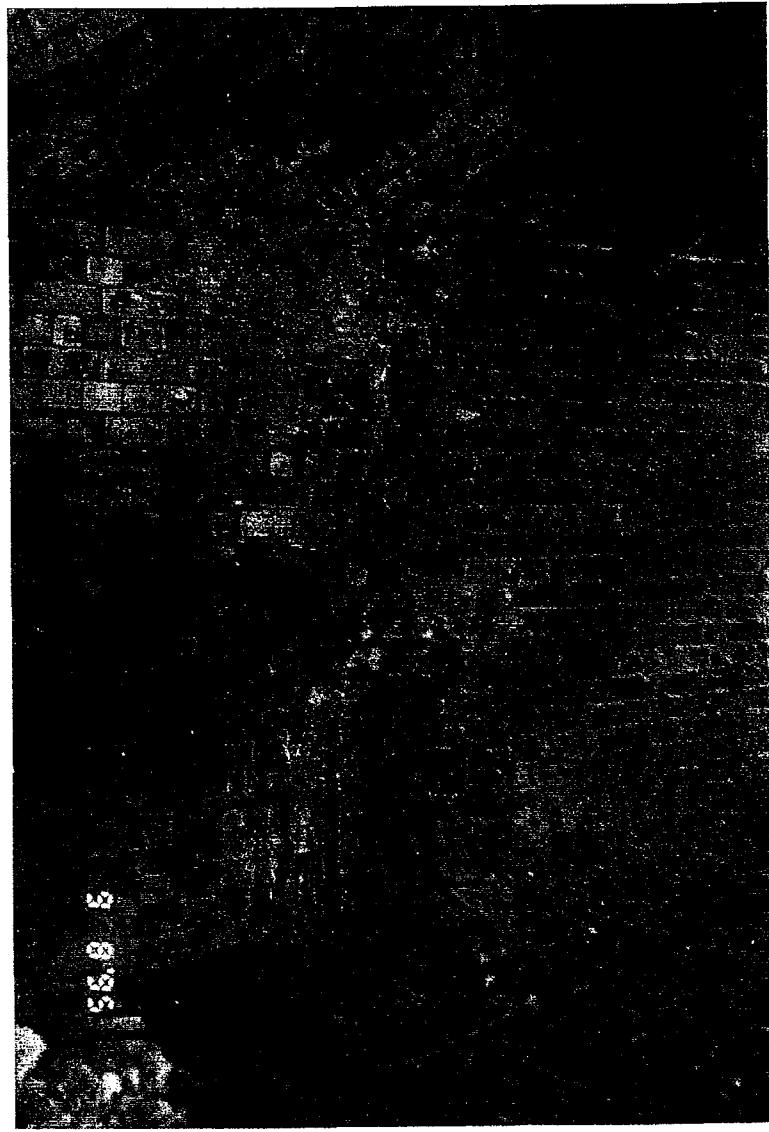
F15/27 - A1123 crossing Bluntisham Railway Bridge.



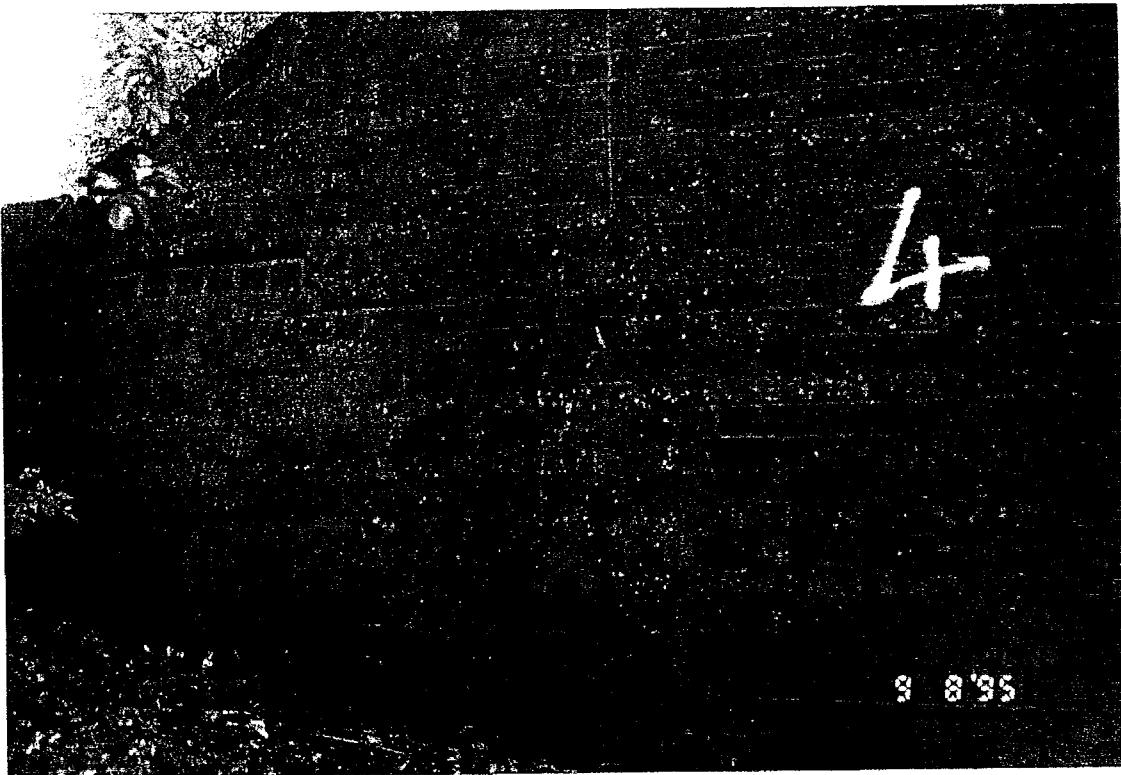
F14/14 - Spalling on the south abutment.



F14/13 - Deep spalling on the north abutment.



F14/19 - Leakage, causing staining on the north abutment and efflorescence.



F14/22 - Cracking and movement in the north west wingwall.



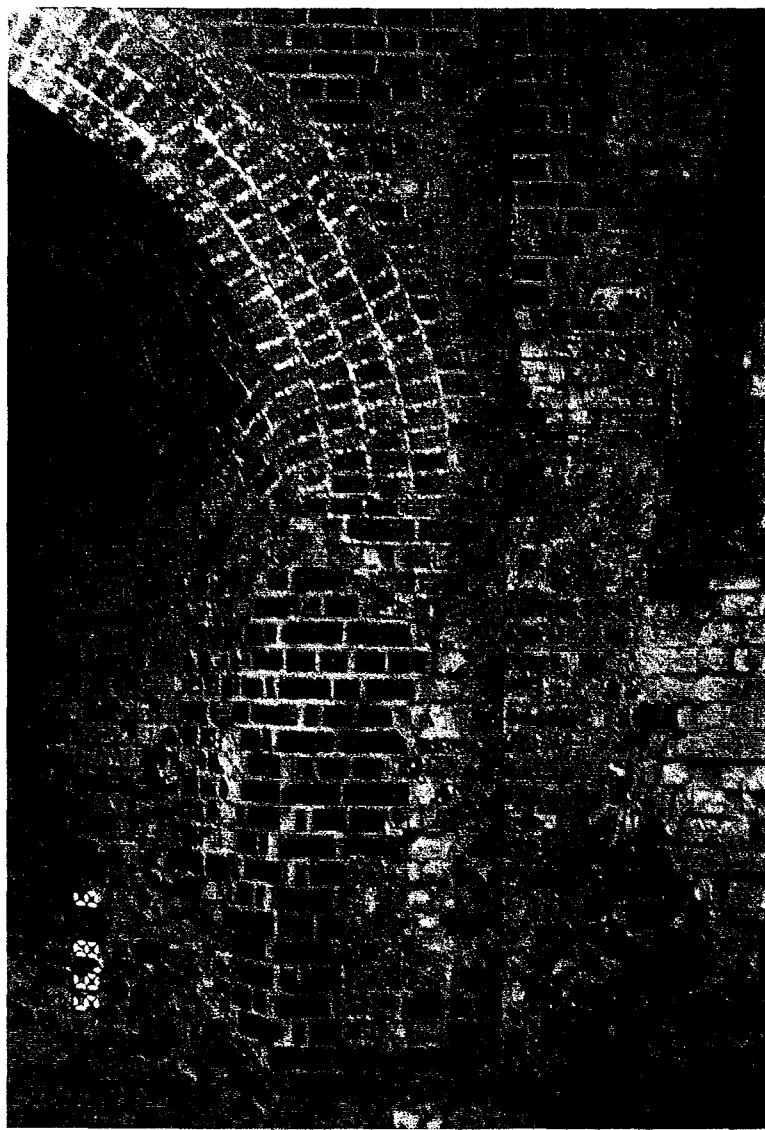
F14/7 - Cracking in south west wingwall.



F14/2 - Spalling and vegetation on south west wingwall.



F14/5 - Efflorescence in the centre of south west wingwall.



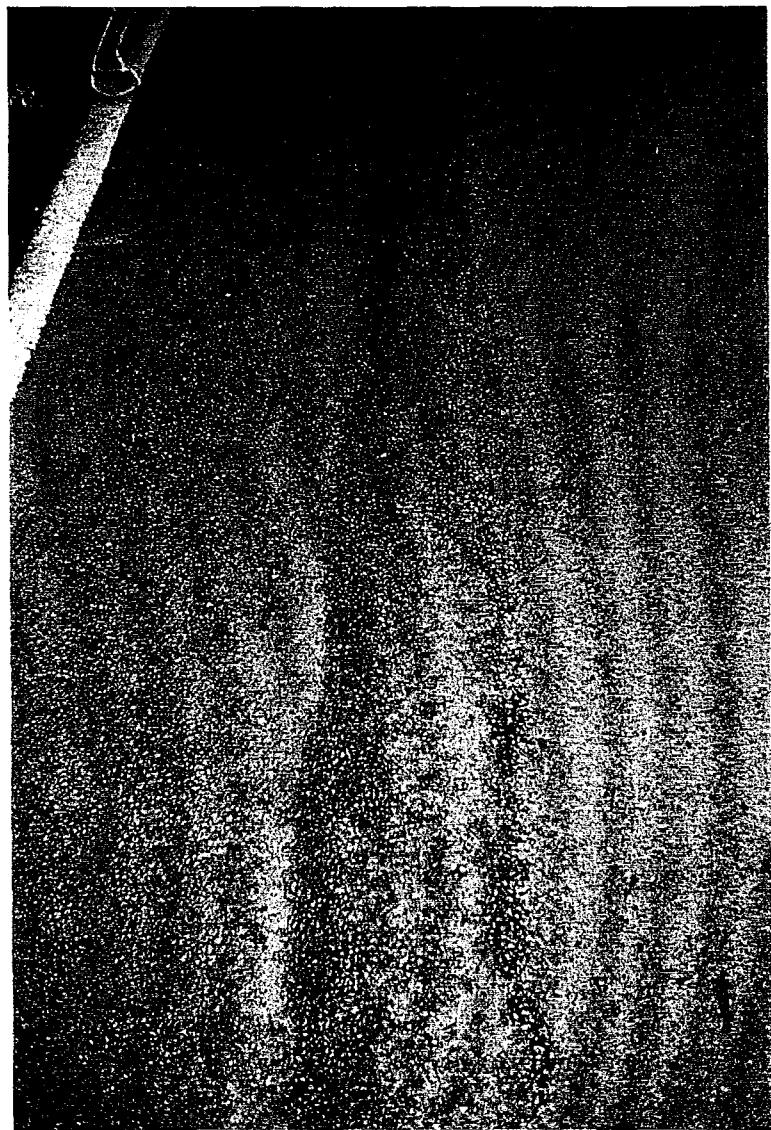
F14/25 - Spalling of masonry on spandrel walls and buttresses.



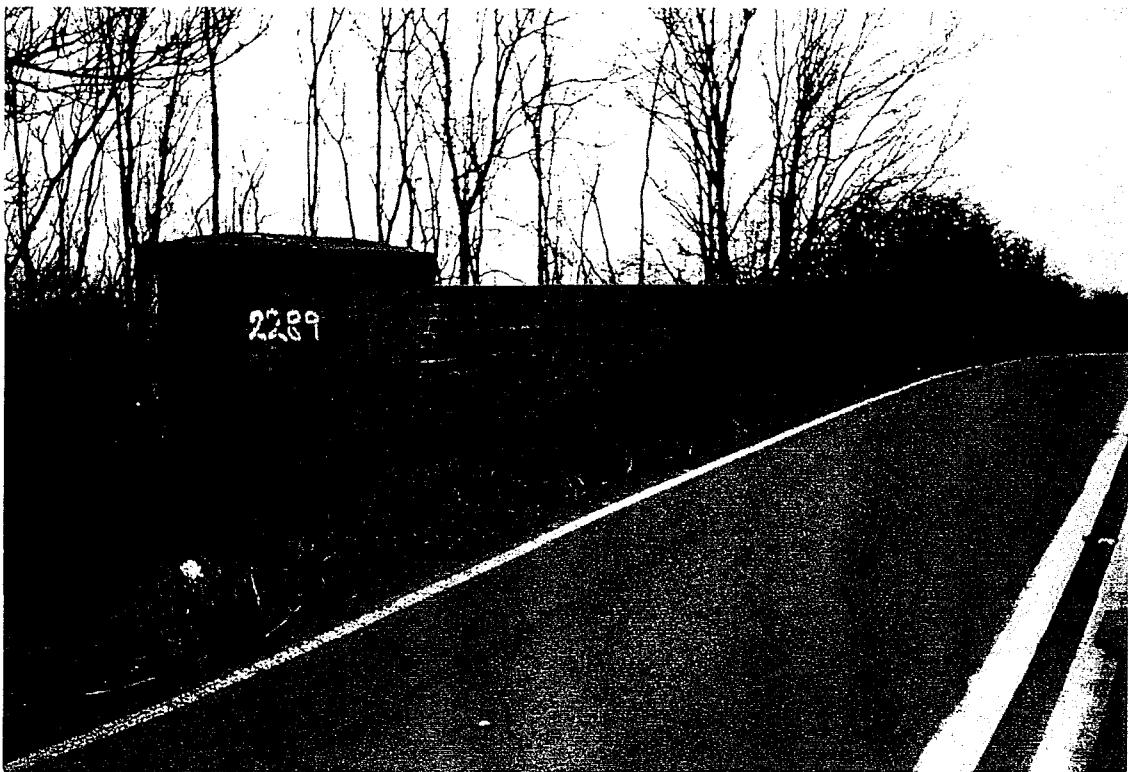
F14/11 - Spalling along the east edge of the barrel.



F14/21 - Cracking of masonry on barrel.



F32/12 - Minor cracking in surface dressing



F33/1 - Minor tracking in surfacing



F33/10 - Slight polishing of surfacing and sunken cats eyes



F31/10 - Vertical crack between old and newer brickwork on east parapet



F32/6 - Spalling on east parapet pillar



F31/2 - Vertical crack in west parapet



F31/12A - Hairline cracks with efflorescence in east parapet



F31/3 - Mortar loss along base of west parapet



F32/3 - Substandard wingwall protection

Appendix 3
Forms CS1, CS2, CS3

Cambridgeshire County Council

Structure Inspection Report

CS1 Mar '95

Name of Bridge ...BLUNTISHAM...RATLAWY...

Road NameA1123.....

Bridge No ..365743.....

Parish ...BLUNTISHAM.....

Division .WEST

Type ...ARCH.....

Over ~~DISUSED~~
~~RAILWAY~~

Inspection Risk **LOW**

O	8	S	E	P	1	9	9	5
(eg	0	1	JUN	1	9	9	2)

Type of inspection G P S Inspected by
(Please tick)

Defect Assessment

Defect Assessment	Estimated Cost (£)	Extent	Severity	Work recd & Priority		Comments
				A	I	
1. Foundations	-	-	-	-	-	
2. Inverts or Aprons	-	-	-	-	-	
3. Fenders	-	-	-	-	-	
4. Piers or Columns	-	-	-	-	-	
5. Abutments	2,000	C	3	R	M	Vertical cracks on North abutment. Areas of spalling. Some deep mortar loss on the South abutment near the top. Dams of old concrete and spans of new affected.
6. Wing walls	22,450	C	3	R	M	Large vertical cracks along the wing walls. Some mortar loss and spalling. Cracking in the base of some wing walls.
7. Retaining walls or Revetments	-	-	-	-	-	
8. Approach Embankments	A	I	-	-	-	
9. Bearings	-	-	-	-	-	
10. Main beams/Tunnel portals/Mast	-	-	-	-	-	
11. Transverse beams/Catenary cables	-	-	-	-	-	
12. Diaphragms or bracings	-	-	-	-	-	
13. Concrete Slab	-	-	-	-	-	
14. Metal deck plates/Tunnel linings	-	-	-	-	-	

Please turn over

Cambridgeshire County Council

Structures Database - Input Sheet

CS2 Mar '95

Name of BridgeBUNTERSHAM RAILWAY BRIDGE.....

Bridge No ...365143.....

Location of BridgeBUNTERSHAM.....

ParishAll23.....

National Grid Ref TL 36500 74300

Bridge OwnerBUTTERSHAM RAIL.....

Road Classification No ...All23.....

Structure File

- County Bridge No 365143
- Name BUNTERSHAM RAILWAY BRIDGE
- Class A
 - Road 1.1.1.1
 - Grid (E) 361500
 - Grid (N) 74300
 - District 1500
 - Parish BUNTERSHAM
- Year 1900
- Maint Agent 9114
 - Parish BUNTERSHAM
- Owner BUNTERSHAM RAIL
- Agent Ref 365143111111
 - Division MEET
- Detrunked
 - Listed
 - Grade

Bridge File

- Nospans • Load 1 • Load 2
- Bridge Type • Paint Sys
- Designer • Defect
- Bridge Length • Variations
- Services MEET
- Microfilm No.s

Small Culvert File

- No of Spans • Material
- Variations • Designer
- Length
- Width
- Defect • Construction Type
- Skew

Other/Services File

- Headroom
- Comments 1
- Comments 2
- Lane Width
- Hilliness
- Design Speed
- Light
- Vent
- Pump
- Emergency Services
- Obstacle
- Int Pavement
- Lining Finish
- Carriage Way

Tunnel File

- Construction Type
- Form of Deck
 - Mat 1
 - Obst 1
 - Length
 - Width
 - Mat 2
 - Obst 2
 - Width
- Headroom
 - Max Gradient
- Lane Width
- Hilliness
 - Bendingness
- Tunnel Type
- XRef to Roads
- Length of Scheme

Sign Gantry File

- No of masts • Material
- Type of Lighting
- Foundations
- Manufacturer • Material
- Paint Sys
- Lighting DB Ref
- XRef to Roads
- Length of Scheme

Retaining Wall File

- No of Panels
 - Length of Wall
- X Ref
 - Prestress
 - Material
- Structural Form
 - Designer
- Construction Type
 - Designer

Panels/Independent Lighting File

- Panel/Mast No
- Panel/Mast Length
- Panel/Mast Height

Panels/Independent Lighting File

- Panel/Mast No
- Panel/Mast Length
- Panel/Mast Height

Non Standard Elements

• Span No	ALL		
• Element	PARAPETS		
• Description	P A R A P E T S - B R I C K		

• Span No	1				
• Deck Thickness	—				
• Arch Ring Thickness	650				
• Arch Rise	2480				
• Cover (Pipe or Arch)	380				
• Parapet Length	15030	15180			
• Parapet Height	1137	1053			
• Parapet Thickness	345	345			
• Retaining } Min. Ht	—				
• Headwall } Max. Ht	—				

Road Dimensions

• Casingway Width	6400		
• Central Reserve Width	—		
• Footway Widths	700	800	
• Verge Widths	OK:		
• Approach Gradients	NO		
• Humpback	OK		
• Visibility	OK		
• Horizontal Alignment	OK		

- Span No
- Element
- Work
- Frequency of Operation
- Date of Last Maintenance
- Date Maintenance due

Routine Maintenance

Accident Damage Record

- Date Last General Inspection
- Date Last Principal Inspection
- Date Last Special Inspection
- Diver Inspection Required
- Date Last Diver Inspection
- Boat Inspection
- Date Assessment

Maintenance Record

• Span No	N	A	
• Element	S E P	1995	
• Defect	N	A	
• Date of Last Maintenance	NO		
	N	A	
	NO		
	MEP	1996	

NAME OF BRIDGE — BLUNTISHAM RAILWAY BRIDGE

BRIDGE No. — 365743

NATIONAL GRID REF

TL

Form CS3 (Rev 5/95)

365

743

LOCATION OF BRIDGE — BLUNTISHAM

PARRSH

Road Name — A1123

BRIDGE OWNER

Road Classification No. — A1123

*Region Railway

Date of Construction

Construction Details

BRICKWORK

Gated

River

Is Bridge scheduled as an

N

Ancient Monument?

Road *over Disused Road

Under

Design Office

Railway Bridge No.

Nature of Foundations (e.g. Caissons)

Name of Navigation

Joints

Manufacturer

Type

and/or

Bearings

Brickwork

—

Drainage Authority

Parapets

Waterproofing

—

Names of statutory

Prestressing System

Paint System:

—

undertakers having

Internal

Parapet

—

services on bridge

External

External

—

Min Headroom Clearance

{ N.BOUND/W.BOUND

—

Design Loading

—

—

Special loading/restriction

—

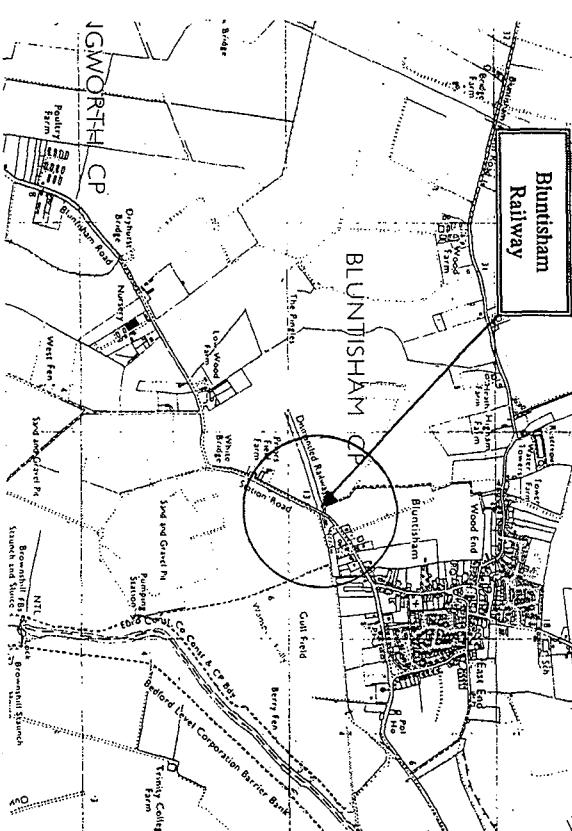
—

Other loadings, i.e. Assessment

—

—

Site Plan 1:25000 Indicate Angle of Skew and a North point



Colour Photograph(s) of Structure Elevation

Pages 1 to 10 inclusive
(unnumbered)

Appendix 4
Test Results

Newark, Telford
Leeds, Middlesbrough, Manchester,
Daventry, Glasgow, Hayes,
Labourtrades
Glasgow, Middlesbrough, Tamworth
Offices
Maidstone, Kent ME14 5LH
Newham Court, Beeston Road,
Registered Office: The Daisies,
Registered in England No. 2162241

WS ATKINS - EAST ANGLIA
for
BLUNTSHAM RAILWAY BRIDGE - BLUNTSHAM
STRUCTURAL INVESTIGATION OF
on
REPORT

Fax: 01622 687267
 Tel: 01622 679951
 Kent ME14 2RU
 Canning Street
 Middlesbrough
 New Melboume House
 LTD
 WEEKS
 MELBOURNE
 CONTEST

Laboratory Services

WEEKS
MELBOURNE
CONTEST



This report shall not be used for engineering or contractual purposes unless signed above by the author and the checker/approver, and unless the report status is 'Final'.
Any such party relies upon the report at their own risk.
This report is confidential to the Client and Consort Melbourne Weeks Limited accepts no responsibility whatsoever to third parties to whom this report or any part thereof, is made known.

Report Status : FINAL		Date of Issue: 23rd February 1996	Name _____	Signature & Date _____
		Author:		
		Check & Approved:		

WS ATKINS - EAST ANGLIA
for
BLUNTISHAM RAILWAY BRIDGE - BLUNTISHAM
STRUCTURAL INVESTIGATION OF
on
REPORT

Our Ref: L11141/6

CONTENTS

L11141/6

Bluntnisham Railway Bridge, Bluntnisham
WS Atkins - East Anglia

1.	INTRODUCTION
1.1	General Description
1.2	Location
1.3	Description of Structure
2.	INSPECTION AND TEST METHODS
2.1	Small Diameter Drilling
2.2	Reinstatement
3.1	Extent of Testing
3.2	Trial Pit Details
3.3	Table 1 : Summary of Small Diameter Drilling
	Appendix A - Test Location Plan
	Photographs

RESULTS

Appendix A -	Test Location Plan
	Trial Pit
	Photographs

INTRODUCTION

L11141/5
Bluntisham Railway Bridge , Bluntisham
WS Atkins - East Anglia
Page 1 of 3

- 1.1 General
- 1.1.1 Following an invitation to tender dated 29th November 1995, for Cambridgeshire County Council Assessments Package No.25 (County), Connect Mellbourne Weeks Limited was awarded the contract by WS Atkins - East Anglia by official order (number BC/07197) dated the 18th December 1995.
- 1.1.2 The aim of the contract was to measure the thickness of the arch barrel beneath the carriageway, the thickness of the abutments and the depth and type of fill beneath the carriageway.
- 1.1.3 This report contains the findings of the measurements made on 20th January 1996.
- 1.2 Location
- 1.2.1 Bluntisham Railway Bridge carries the A1123 over a disused railway track. It is situated to the south west of Bluntisham in Cambridgeshire. It is
- 1.3 Description of Structure
- 1.3.1 A four metre high single span brick arch bridge two lanes wide with nominal verges.

2. SAMPLING AND TEST METHODS
- 2.1 Small Diameter Drilling
- 2.1.1 The thickness of the brick arch barrel was measured at the crown and the springing of the arch by small diameter drilling and direct measurement.
- 2.2 Trial Pit
- 2.2.1 A trial pit was excavated at the crown of the bridge to determine the depth and type of fill beneath the carriageway.
- 2.3 Reinstatement
- 2.3.1 The drill holes were reinstated with Fosroc Renderoc HB polymer modified cementitious repair mortar.
- 2.3.2 Excavations in the carriageway were reinstated with Fosroc Renderoc HB polymer modified cementitious repair mortar and a 100mm layer of pre-bagged cold laying course.

3. RESULTS

WS Atkins - East Anglia

Bluntnisham Railway Bridge, Bluntnisham

3.2 Trial Pit Detail

3.2.1 A trial pit was excavated at the crown of the bridge to determine the depth and type of fill beneath the carriageway. The carriageway comprised 100mm layer of nominal 6mm size wearing course and 150mm layer of nominal 20mm size base course. The fill material beneath the carriageway was found to be 100mm layer medium dense general brick rubble fill on an asphalt waterproof membrane. The fill material was not penetrated on inspection of the client's representative on site. Full details of the trial pit are given in appendix A.

3.2.1.1 One trial pit was excavated at the crown of the bridge. Depth determinations by 25mm nominal diameter drilling were made at four locations.

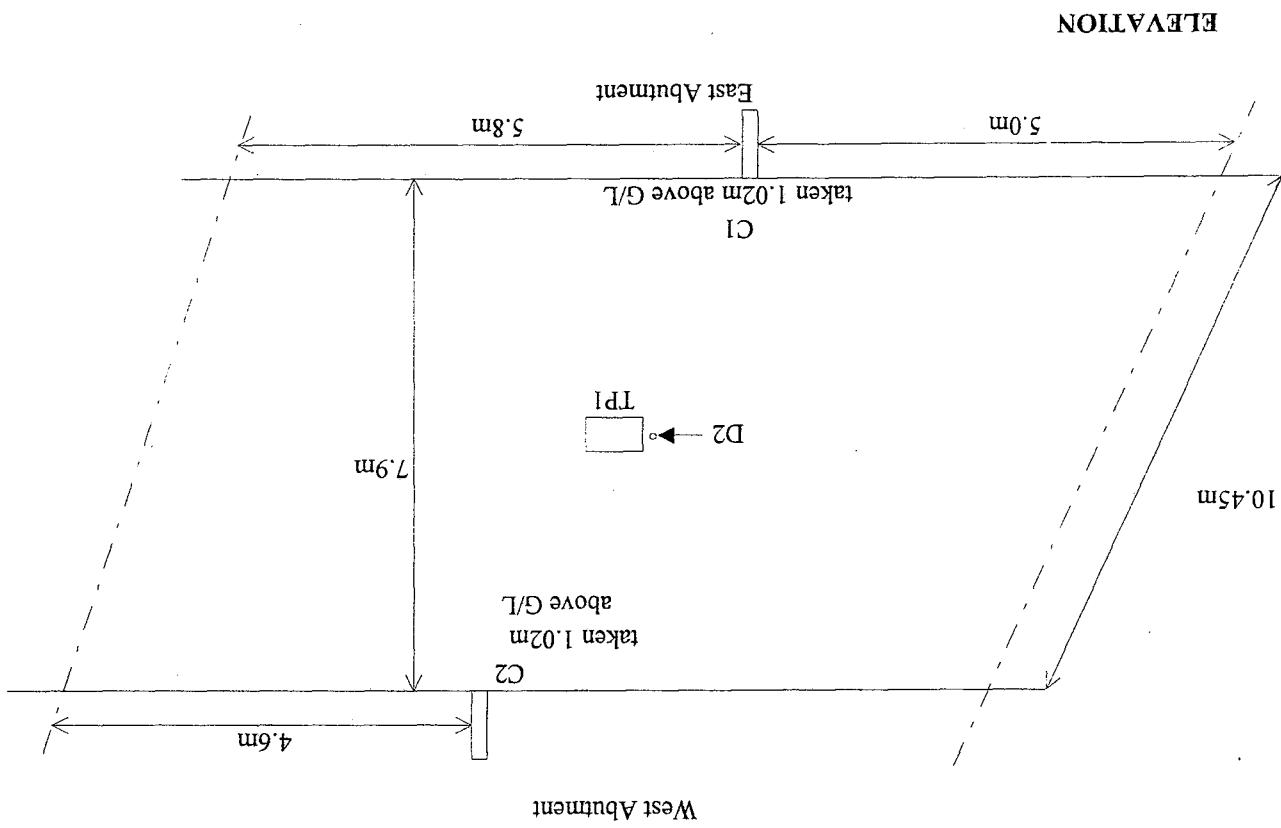
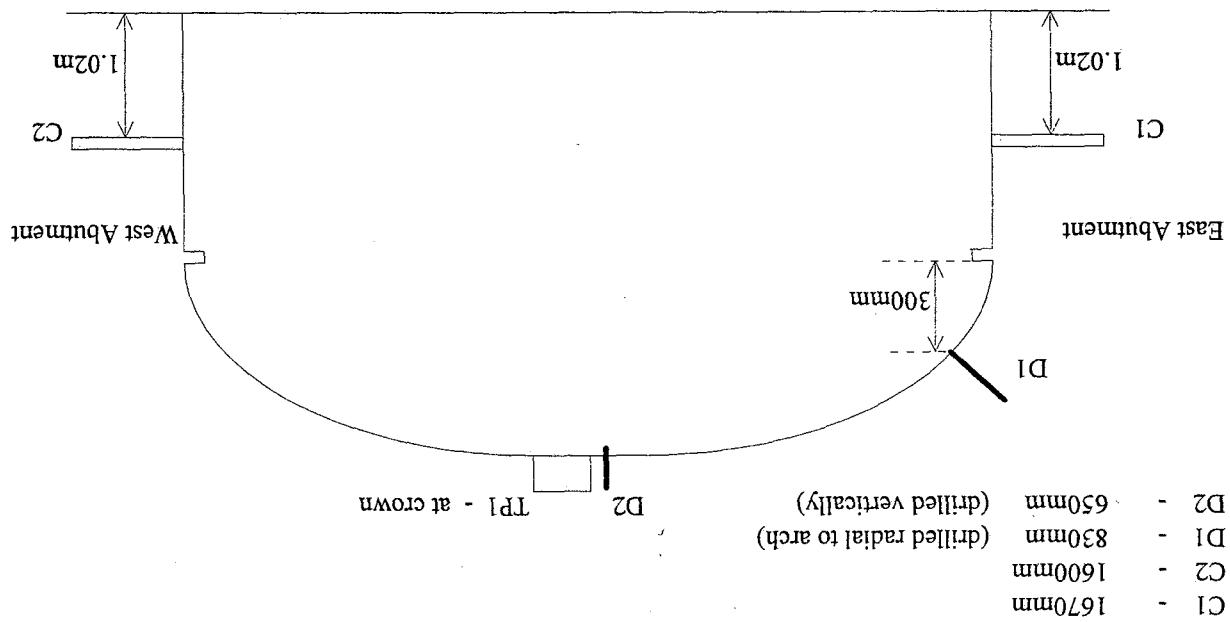
3.1 Extent of Testing

3.1.1 One trial pit was excavated at the crown of the bridge. Depth determinations by 25mm nominal diameter drilling were made at four locations.

3.3

Table 1: Summary of Small Diameter Drilling

Element	Location	Measured Thickness (mm)	
Fill beneath	Crown TPI	100	carriageway
Arch barrel beneath	Crown D2	650	carriageway
Springing	SPRINGING D1	830	carriageway
Abutment	East C1	1670	carriageway
Abutment	West C2	1600	carriageway

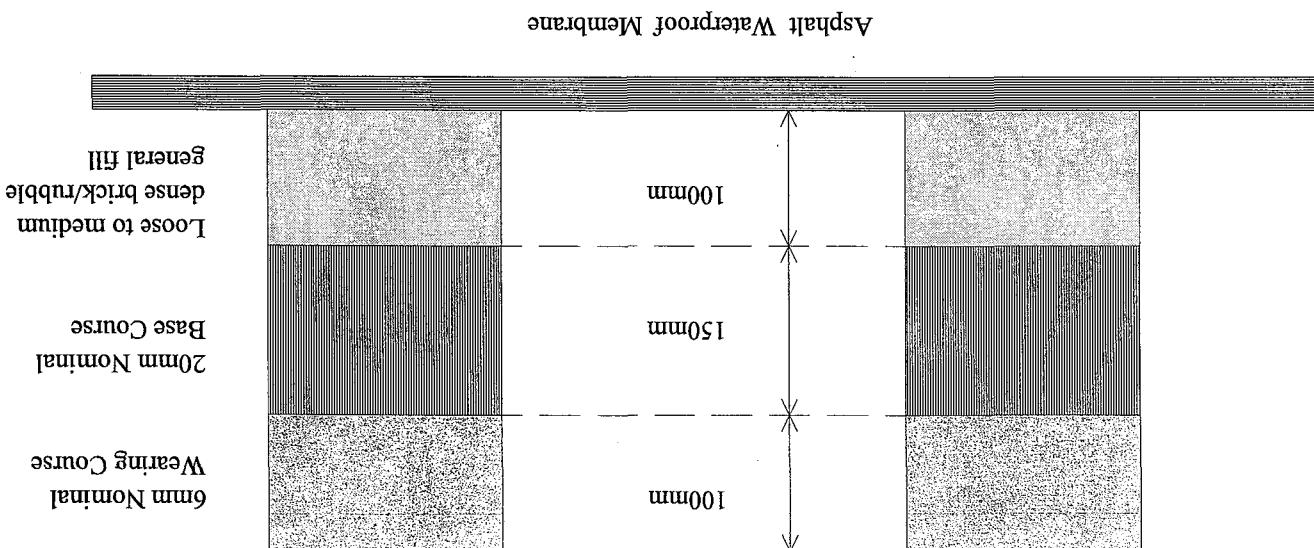


PLAN

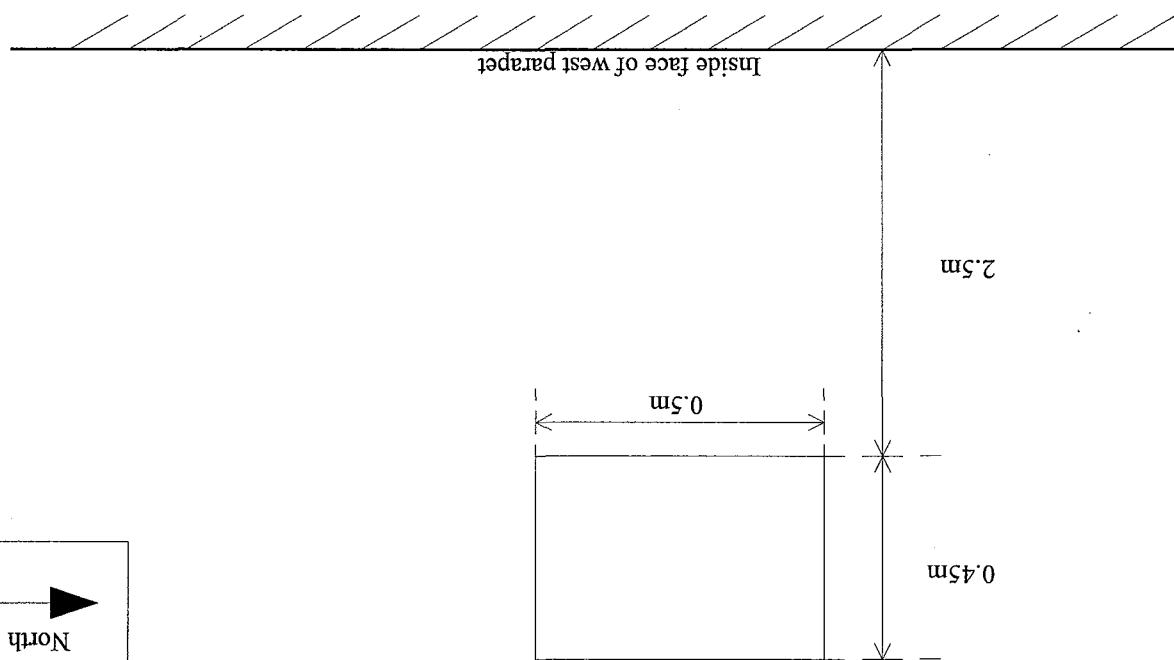
SITE:	Bluntisham Railway Bridge			TITLE:	Small Diameter Drilling		Drawing No.			
Job No.:	L.11141	Technician:	KL	Date:	20.01.96	Drawn By:	KW	Date:	31.01.96	Not to Scale

L11141/6 Bluntisham Railway Bridge, Bluntisham WS Atkins - East Anglia

APPENDIX A
Test Location Plan
Trial Pit Diagram
Photographs
and



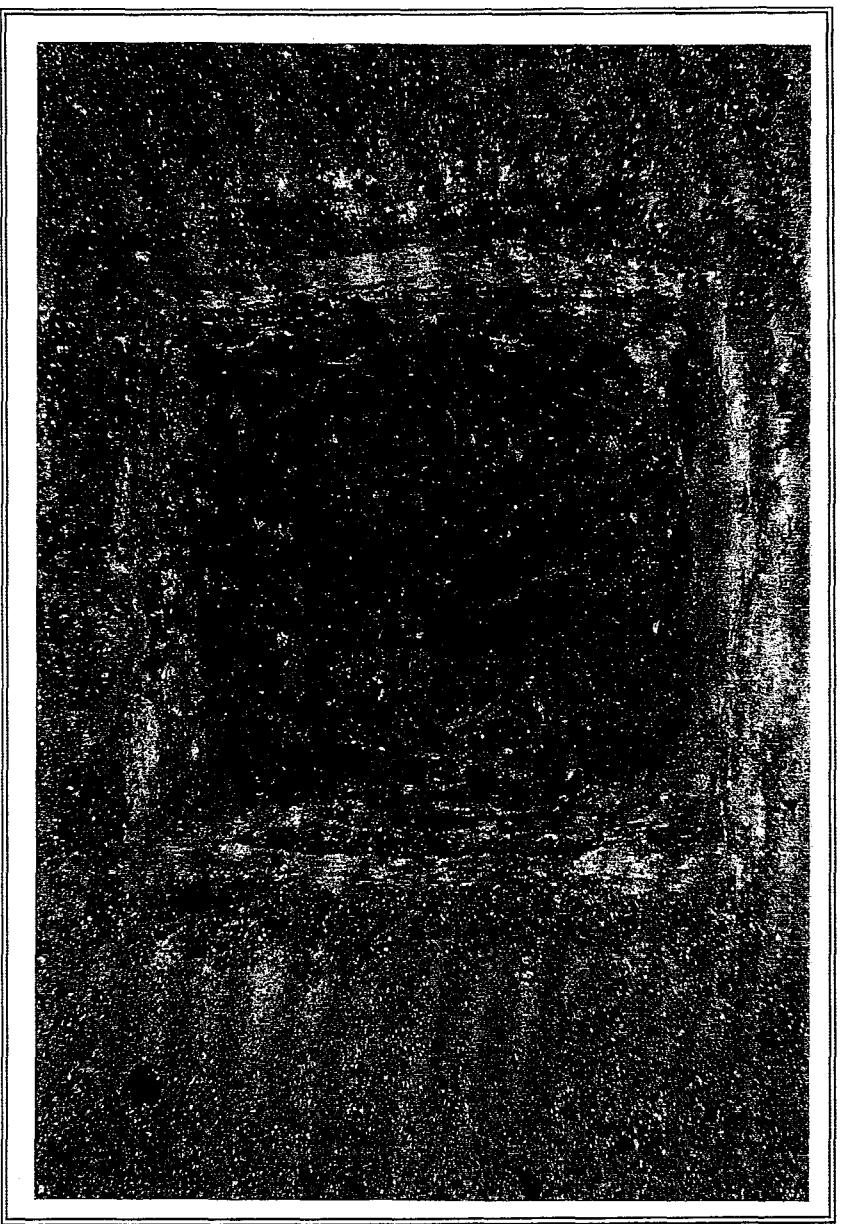
ELEVATION



PLAN

TRIAL PIT 1 - WEST CARRIAGEWAY AT MID-SPAN

CONTEST MELBOURNE WEEKS LIMITED		SITE: Bluntisham Railway Bridge		TITLE: Trial Pit 1 Detail		Drawing No.		1114/TPI	
Job No.: L.11141		Technician: KS	Date: 20.01.96	Drawn By: KW	Date: 30.01.96	Not to Scale			



Trial Pit 1

L11141/6

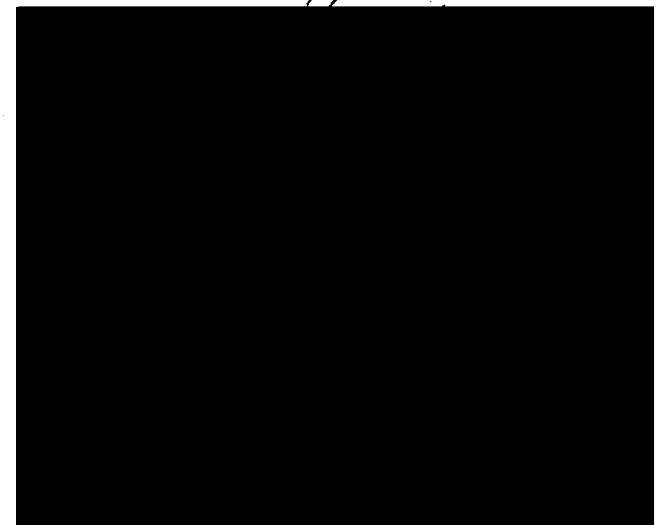
Bluntnisham Railway Bridge, Bluntnisham
WS Atkins - East Anglia

SIE/2289

**ASSESSMENT OF HIGHWAY STRUCTURES
PACKAGE No 25 (COUNTY)
BRIDGE ASSESSMENT**

**BLUNTISHAM RAILWAY BRIDGE
BRIDGE NUMBER 365743**

ASSESSMENT DATE: MARCH 1996



Cambridgeshire County Council
Bridge Client Section
Transportation Department
Shire Hall
Castle Hill
Cambridge CB3 OAP

WS Atkins - East Anglia
Wellbrook Court
Girton Road
Cambridge
CB3 0NA

Issue: Final

April 1996

BC6272/804/R1 Rev 1

SYNOPSIS

Bluntisham Railway Bridge

Bridge Number 365743

A single span brick arched bridge of 7.95m at a skew angle of 40°. Brick wingwalls and parapets.

The bridge carries the A1123 road over a disused railway line. At this point the speed limit on the road is 40 mph (64 kph).

The bridge is capable of carrying 40t assessment live load or 13' units of HB.

No weight restriction is required.

The parapets are capable of withstanding an impact to the County Surveyors Guidance Note for masonry parapets.

The north-west wingwall fails the qualitative assessment, repairs/strengthening is required.

BRIDGE CLIENT		BRIDGE No. 365743	
FILE	INITIAL	DATE	SUGGESTED CONDITION RATING
RECEPTION	DV	22-4-96	
INITIAL PERUSE	esf	29.4.96	
READ BY	JK	29.4.96	3 X
READ BY			
READ BY			
COMMENTS Given 3 X as wingwall fails qualitatively.			

INDEX

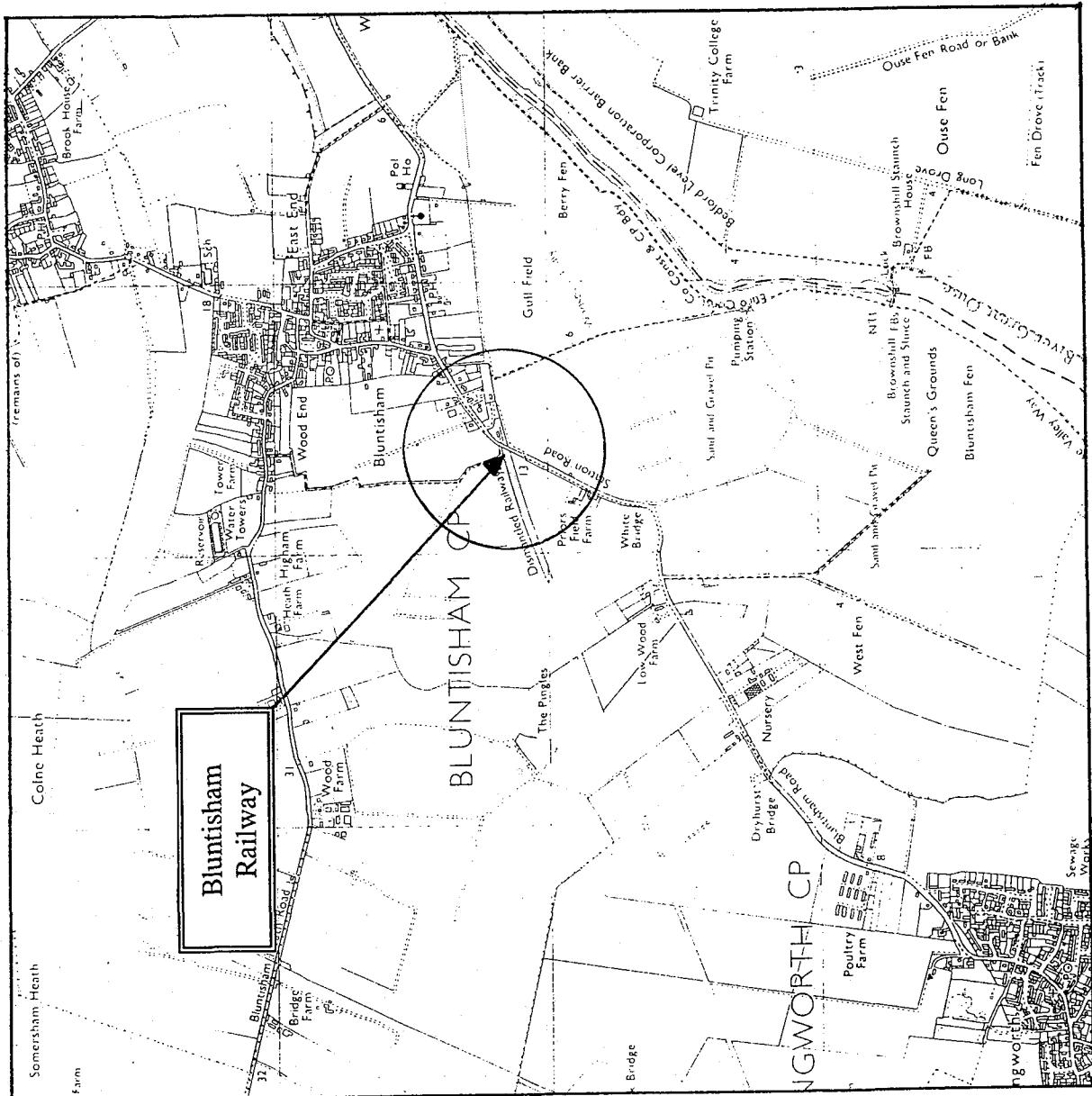
Section	Description	Page
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1. INTRODUCTION

- 1.1 Bluntisham Railway Bridge is a single 7.95m span brick arched bridge. The bridge carries the A1123 over a dismantled railway. The parapets are constructed in brick and the bridge is at a 40° skew angle.
- 1.2 A location plan R6272/704/Fig1 is included on page 2 and overall view photographs on page 3.
- 1.3 On Friday 8 September 1995 a principal inspection of the structure was undertaken. The results of this inspection are noted in a separate report (Reference 1).
- 1.4 The bridge has been assessed in accordance with the Department of Transport's Departmental Standard BD 21/93 (Reference 2) and the accompanying Advice Note BA 16/93 (Reference 3). The modified MEXE method and the computer mechanism method ARCHIE has been used to analyse the bridges arch. In addition the HB capacity has been assessed.
- 1.5 The bridge parapets have been assessed in accordance with the County Surveyors' Society Guidance Note "The Assessment and Design of Unreinforced Masonry Vehicle Parapets" (Reference 4).
- 1.6 The wingwalls have been assessed qualitatively.

WS/Atkins

DO NOT SCALE



WS Atkins - East Anglia
Wellbrook Court Telephone (01223) 276002
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Cambridge
CB3 0NA

Client

**CAMBRIDGESHIRE
COUNTY COUNCIL**

Project

**BLUNTISHAM
RAILWAY**

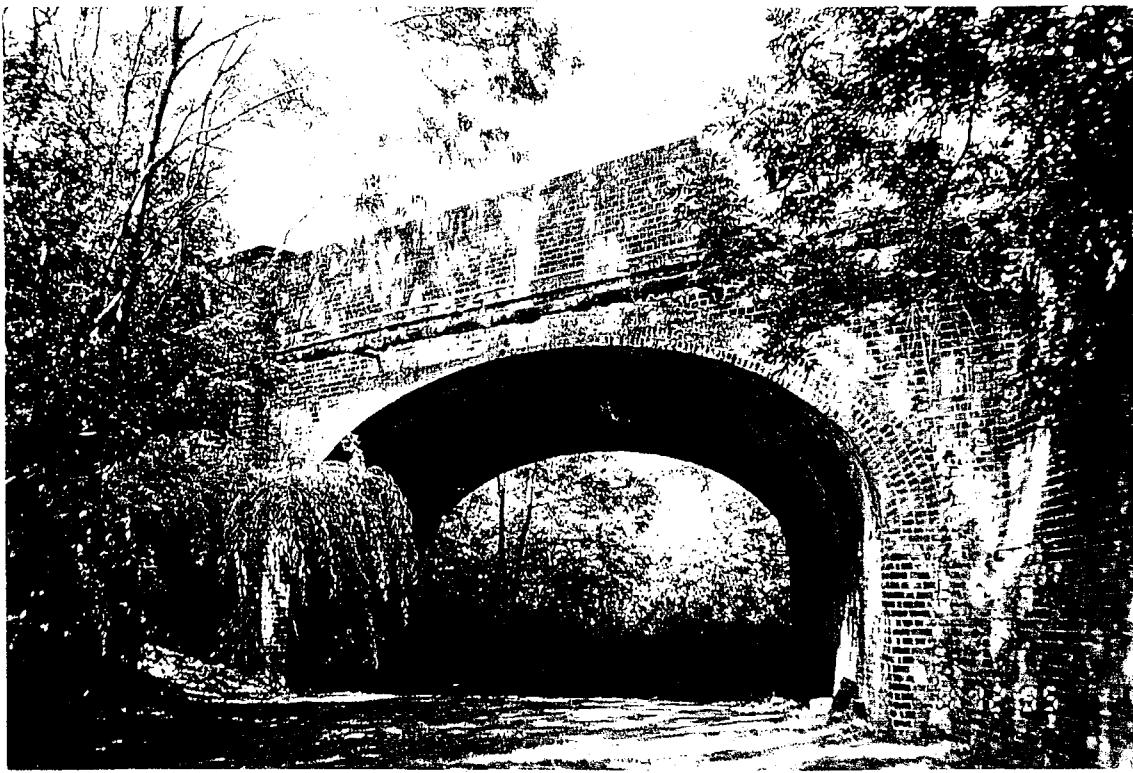
Title

LOCATION PLAN

Original Scale	Drawn	Checked	Authorised
NTS	25/1	25/2	25/3
	25/1	25/2	25/3
	Date 27/4/95	Date 8/5/95	Date 27/5/95

Figure Number
RG272/704/Fig 1
Rev. **-**

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F15/10 - Elevation of Bluntisham Railway Bridge.



F15/27 - A1123 crossing Bluntisham Railway Bridge.

2. GENERAL DESCRIPTION OF THE BRIDGE

Introduction

- 2.1 Bluntisham Railway Bridge comprises of a single span brick arch bridge. The arch is supported by brick abutments at either end. The spandrel and wingwalls are also of brick construction.

Dimensions

- 2.2 The bridge has a skew angle of 40°. The span is 7.95m. The overall width of the bridge is 7.9m with a carriageway width of 6.4m.

Parapets

- 2.3 The parapets consist of red bricks with a brick coping and are approximately 1m high.

Speed

- 2.4 The permitted speed for traffic on the A1123 where it crosses Bluntisham Railway Bridge is 40 mph (64 kph).

Services

- | | |
|-----------------------------|---|
| 2.5 Cambridge Water Company | 3" abandoned main along east side of bridge.
4" PVC main on east side of bridge. |
| Eastern Electricity | 1 No HV overhead line on west side of bridge. |
| British Gas | 180mm main runs to south side of bridge. |
| British Telecom | Buried cable running along bridge on west side. |

3. INFORMATION AND KEY DRAWINGS

Database for Assessment

- 3.1 A Principal Inspection was undertaken to determine the condition of the structure and ascertain the dimensions and levels. A summary of this report is included below. This was used to provide the database for the structural assessment of Bluntisham Railway Bridge.

General Condition Classification

- 3.2 The general condition of the structure, as inspected, is reasonable.
- 3.3 The abutments have vertical cracks near the ends and there are also extensive areas of spalling of various depths.
- 3.4 The arch barrel is not deformed in any way. There is a repaired longitudinal crack that is opening up again, as well as hairline cracks continuing from other longitudinal repairs. There are extensive areas of spalling on both elevations and areas of new brickwork from previous repairs.
- 3.5 The north-west wingwall has a large diagonal crack separating it into two sections, of which the upper one has moved forward by 25mm from its original line. The other wingwalls do not show any signs of movement, although they have extensive areas of spalling and some mortar loss.
- 3.6 The surfacing is in reasonable condition but with some loss of skid resistance and tracking. The parapets are brick construction and the south side shows signs of having been replaced with new brickwork. There are no serious defects on this side. On the north parapet there are vertical cracks, but they are not structurally significant.
- 3.7 A full dimensional survey was carried out and the diagrams are included in Appendix A.

- 3.8 Small diameter drilling was carried out at the springing and crown of the arch to ascertain the depth of the arch barrel in these locations. The thickness of the abutment was also determined by core drilling in each abutment.
- 3.9 The construction of the carriageway was ascertained via a trial pit.

Structural Layout

- 3.10 A layout plan and elevation of the bridge can be seen in Appendix A. For further dimensional information reference should be made to the Principal Inspection Report and the assessment calculations.

Cambridgeshire County Council Archive Drawings

- 3.11 No drawings were available for Bluntisham Railway Bridge.

4. ASSESSMENT CRITERIA

General

- 4.1 The assessment was carried out in accordance with the Department of Transport's Departmental Standard BD 21/93 and the accompanying Advice Note BA 16/93.

Material Properties

- 4.2 In the absence of materials testing the strength of the brick in the arch has been conservatively taken as 3 N/mm^2 , from figure 4/2 of BD 21/93.

Condition Factor

- 4.3 Based on the findings of the Principal Inspection, the overall condition factor for the bridge has been taken as 0.8. Individual component condition factors are recorded in Table 4.1 below, as taken from the Principal Inspection Report.

CONDITION FACTOR						
DESCRIPTION	Barrel	Fill	Width	Depth	Mortar	Span/Rise
SYMBOL	F_b	F_f	F_w	F_d	F_{mo}	F_{sr}
FACTOR	1.2	0.7	0.9	1.0	0.81	1.0

Method of Analysis

- 4.4 Firstly the arch ring has been assessed using the modified MEXE method.
- 4.5 The bridge has then been assessed using the computer mechanism method ARCHIE.
- 4.6 Finally, the HB capacity has been found using a simple hand calculation.

Parapet Assessment

- 4.7 The parapets have been assessed in accordance with the County Surveyor's Society Guidance Note "The Assessment and Design of Unreinforced Vehicle Parapets" 1995.

Wingwall Assessment

- 4.8 The wingwalls have been assessed qualitatively as they assume nominal highway loading.

5. ASSESSMENT RESULTS

DESCRIPTION	ALLOWABLE AXLE LOAD (Single Axle)	CAPACITY RATIO	GROSS VEHICLE WEIGHT	HB LOAD CAPACITY
Averaged Dimensions	33 tonnes	2.87	40 tonnes	16 units of HB
East Elevation				
Left side dimensions	30 tonnes	2.61	40 tonnes	14 units of HB
Right side dimensions	33 tonnes	2.87	40 tonnes	15 units of HB
West Elevation				
Left side dimensions	28 tonnes	2.43	40 tonnes	13 units of HB
Right side dimensions	41 tonnes	3.57	40 tonnes	20 units of HB

Table 5.1 : Assessment Summary

The results of the parapet assessment show that the parapet is capable of withstanding impact speeds up to 101 kph.

The north-west wingwall fails the qualitative assessment as a result of the significant cracking and separation of the wall. All other wingwalls are considered adequate.

6. CONCLUSIONS

- 6.1 The assessment showed that the bridge is capable of 40 tonnes assessment live load or 13 units of HB loading based on the MEXE analysis.
- 6.2 The capacity of the bridge based on the ARCHIE assessment is dependent on the masonry strength. However, the results of the ARCHIE assessment showed the capacity of the bridge to be lower than that for MEXE. Therefore in accordance with BD 21/93, paragraph 6.19(i), the MEXE results shall be used.
- 6.3 The parapets are capable of resisting the impact loading for the speed of the road, 40 mph (64 kph).
- 6.4 The north-west wingwall has signs of distress and accordingly is considered to be deficient structurally. This wall however assumes nominal highway loading. All other wingwalls are adequate.

7. RECOMMENDATIONS

- 7.1 The recommendations covered in the Principal Inspection Report should be considered within the scope of Cambridgeshire County Council's maintenance programme.
- 7.2 The north-west wingwall should be investigated with regard to strengthening the wall in conjunction with the above maintenance works. Whilst not taking significant highway loading the potential collapse of this wall would probably affect the carriageway and hence this work should carry a high priority.

8. REFERENCES

1. Cambridgeshire County Council, Principal Bridge Inspection, Bluntisham Railway Bridge, Bridge No 365743, September 1995, prepared by WS Atkins - East Anglia.
2. Department of Transport, Roads and Local Transport Directorate, The Assessment of Highway Bridges and Structures, Departmental Standard BD 21/93.
3. Department of Transport, Roads and Transport Directorate, The Assessment of Highway Bridges and Structures, Departmental Standard BA 16/93.
4. County Surveyors' Society Guidance Note "The Assessment and Design of Unreinforced Masonry Parapets", First Edition, 1995.
5. Bluntisham Railway Bridge Approval In Principle for Assessment, February 1996, Cambridgeshire County Council, Assessment of Highway Structures (County).

APPENDIX A

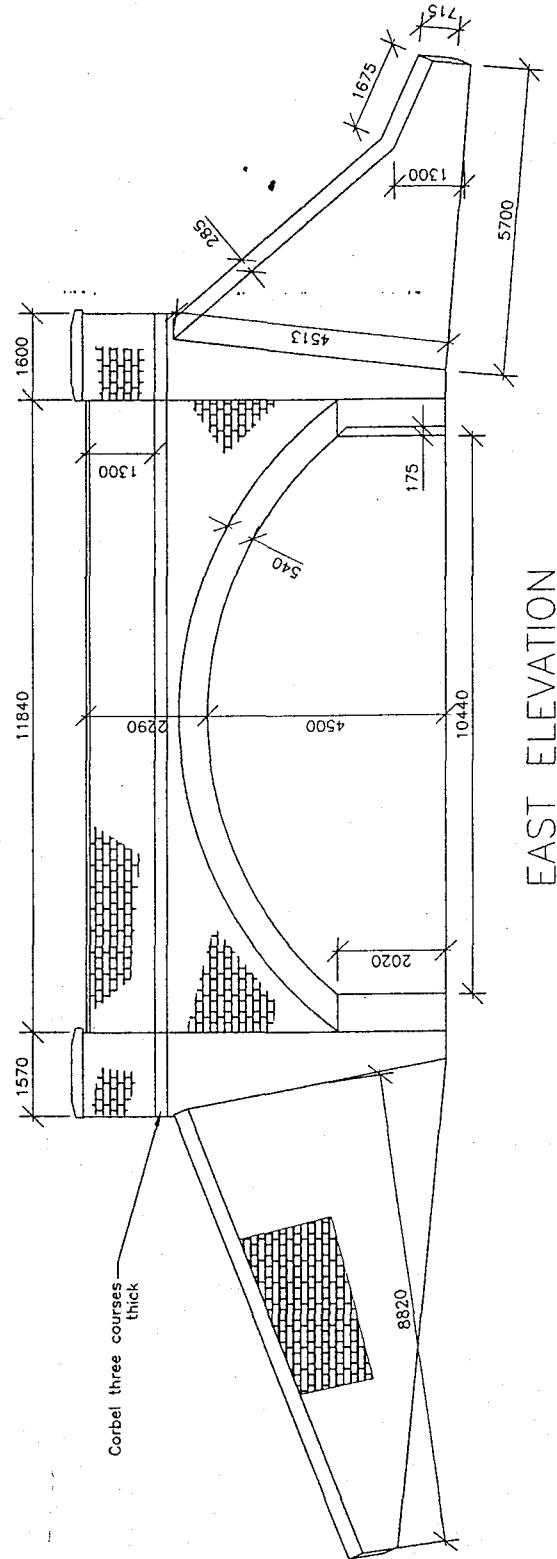
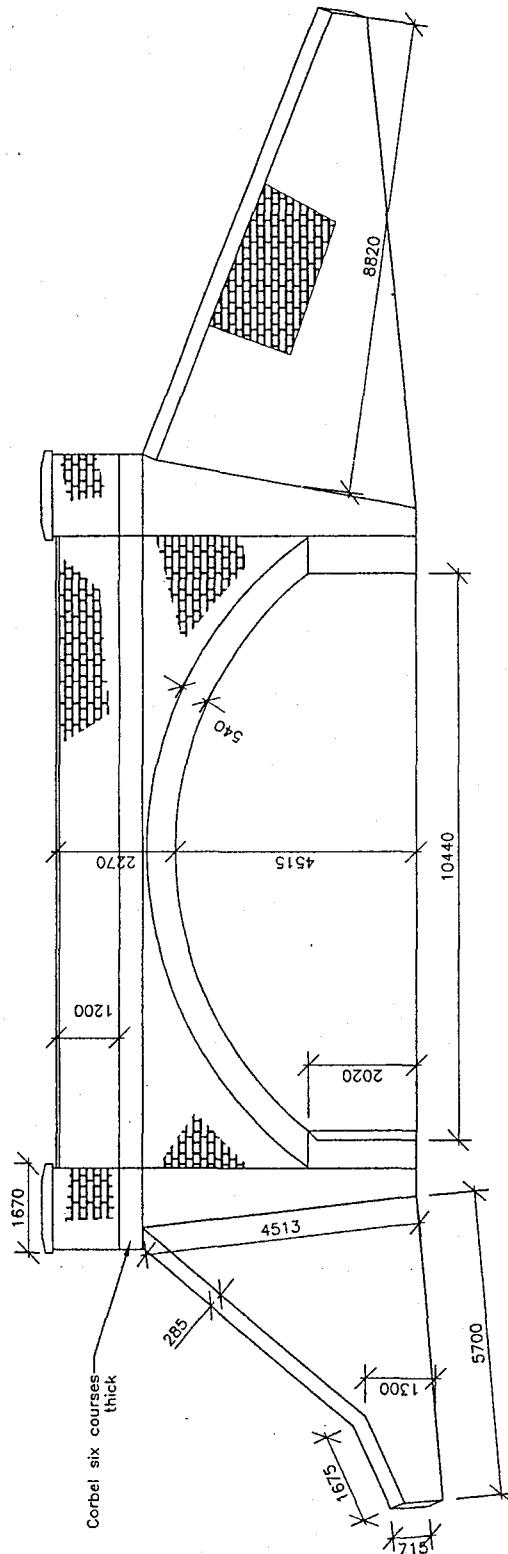
Plan and Elevation

Contents

Elevation - BC6272/704/FIG3

Plan - BC6272/704/FIG2

NOTES.



WS Atkins Consultants Ltd.

Cambridgeshire
County Council
Wellbrook Court, Girton Road Tel: 01223 276002
Cambridge, CB3 0NA Fax 01223 277529

Project
**ASSESSMENT OF HIGHWAY
STRUCTURES PACKAGE No.25**

Title

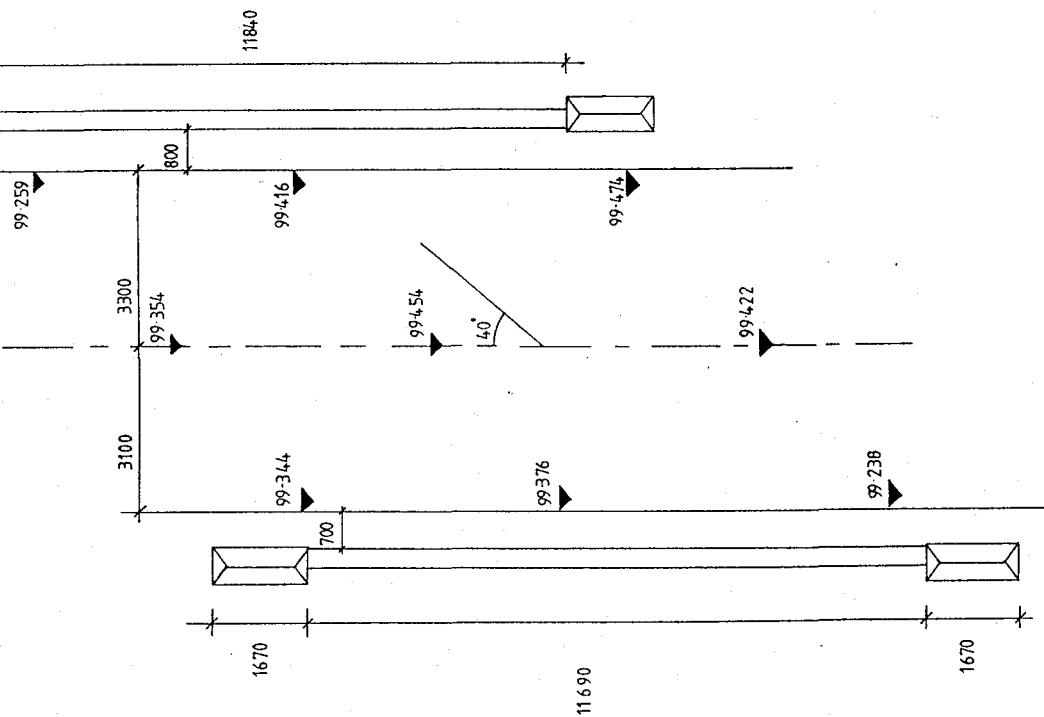
**BLUNTISHAM RAILWAY
BRIDGE - ELEVATIONS**

Original Scale	Drawn N.T.S.	Checked C/S	Authorised B/F
Drawing Number BC6272/704/FIG3	Date 22/02/96	Date 3/96	Rev 2

WS/Atkins

DO NOT SCALE

NOTES:

**Client:** Cambridgeshire County Council
WS Atkins Consultants Ltd.
Wellbrook Court, Girton Road
Cambridge, CB3 0NA
Tel. (01223) 2716002
Fax (01223) 277529Project ASSESSMENT OF HIGHWAY
STRUCTURES PACKAGE NO.25Title BLUNTISHAM RAILWAY BRIDGE
PLAN

Original Scale NTS	Drawn PPA	Checked Date 25/01/98	Authorised Date 25/01/98	Rev
Figure Number BC6272/704/ FIG2				/

APPENDIX B
Testing Report

**Pages 1 to 10 inclusive
(unnumbered)**



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Laboratory Services

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REPORT
on
STRUCTURAL INVESTIGATION OF
BLUNTISHAM RAILWAY BRIDGE - BLUNTISHAM
for
WS ATKINS - EAST ANGLIA



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Glasgow, Maidstone, Tamworth
Laboratories
Daventry, Glasgow, Hayes,
Leeds, Maidstone, Manchester,
Newark, Telford

Our Ref: L11141/6

REPORT
on
STRUCTURAL INVESTIGATION OF
BLUNTISHAM RAILWAY BRIDGE - BLUNTISHAM
for
WS ATKINS - EAST ANGLIA

Report Status : FINAL	Date of Issue:	23rd February 1996
Author:	Name	Signature & Date
Check & Approved:	[Redacted]	

This report is confidential to the Client and Contest Melbourne Weeks Limited accepts no responsibility whatsoever to third parties to whom this report or any part thereof, is made known. Any such party relies upon the report at their own risk.

This report shall not be used for engineering or contractual purposes unless signed above by the author and the checker/approver, and unless the report status is 'Final'.

CONTENTS

1. INTRODUCTION

- 1.1 General
- 1.2 Location
- 1.3 Description of Structure

2. INSPECTION AND TEST METHODS

- 2.1 Small Diameter Drilling
- 2.2 Reinstatement

3. RESULTS

- 3.1 Extent of Testing
- 3.2 Trial Pit Details
- 3.3 Table 1 : Summary of Small Diameter Drilling

Appendix A - Test Location Plan
 Trial Pit
 Photographs

1. INTRODUCTION

1.1 General

- 1.1.1 Following an invitation to tender dated 29th November 1995, for Cambridgeshire County Council Assessments Package No.25 (County), Contest Melbourne Weeks Limited was awarded the contract by WS Atkins - East Anglia by official order (number BC/07197) dated the 18th December 1995.
- 1.1.2 The aim of the contract was to measure the thickness of the arch barrel beneath the carriageway, the thickness of the abutments and the depth and type of fill beneath the carriageway.
- 1.1.3 This report contains the findings of the measurements made on 20th January 1996.

1.2 Location

- 1.2.1 Bluntisham Railway Bridge carries the A1123 over a disused railway track. It is situated to the south west of Bluntisham in Cambridgeshire.

1.3 Description of Structure

- 1.3.1 A four metre high single span brick arch bridge two lanes wide with nominal verges.

2. SAMPLING AND TEST METHODS

2.1 Small Diameter Drilling

2.1.1 The thickness of the brick arch barrel was measured at the crown and the springing of the arch by small diameter drilling and direct measurement.

2.2 Trial Pit

2.2.1 A trial pit was excavated at the crown of the bridge to determine the depth and type of fill beneath the carriageway.

2.3 Reinstatement

2.3.1 The drill holes were reinstated with Fosroc Renderoc HB polymer modified cementitious repair mortar.

2.3.2 Excavations in the carriageway were reinstated with Fosroc Renderoc HB polymer modified cementitious repair mortar and a 100mm layer of pre-bagged cold lay wearing course.

3. RESULTS

3.1 Extent of Testing

3.1.1 One trial pit was excavated at the crown of the bridge. Depth determinations by 25mm nominal diameter drilling were made at four locations.

3.2 Trial Pit Detail

3.2.1 A trial pit was excavated at the crown of the bridge to determine the depth and type of fill beneath the carriageway. The carriageway comprised 100mm layer of nominal 6mm size wearing course and 150mm layer of nominal 20mm size base course. The fill material beneath the carriageway was found to be 100mm layer medium dense general brick rubble fill on an asphalt waterproof membrane. The waterproof membrane was not penetrated on instruction of the clients representative on site. Full details of the trial pit are given in appendix A.

3.3 Table 1: Summary of Small Diameter Drilling

Element	Location	Measured Thickness (mm)
Fill beneath carriageway	Crown TP1	100
Arch barrel beneath carriageway	Crown D2	650
Arch barrel beneath carriageway	Springing D1	830
Abutment	East C1	1670
Abutment	West C2	1600

CONTEST MELBOURNE WEEKS LIMITED

SITE: Bluntisham Railway Bridge

TITLE: Small Diameter Drilling

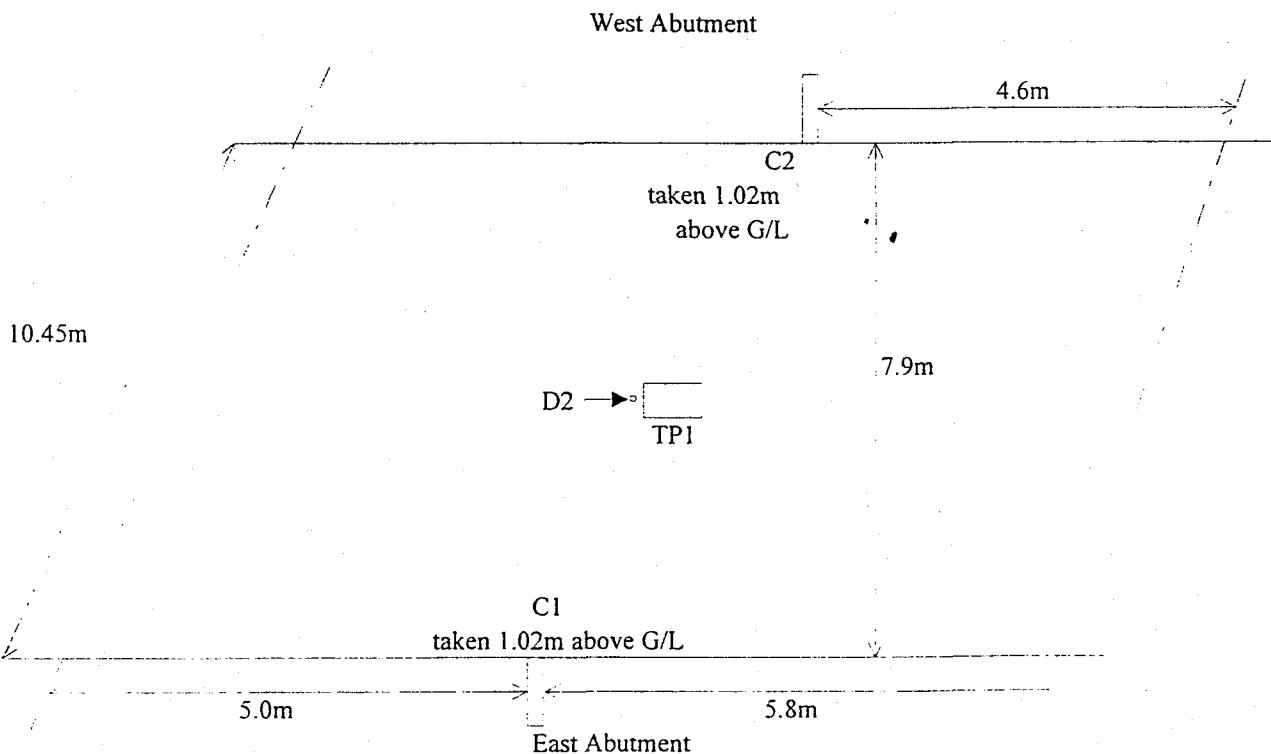
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Location Plan

11141/BL.loc

Job No.: L.11141	Technician: KL	Date: 20.01.96	Drawn By: KW	Date: 31.01.96	Not to Scale
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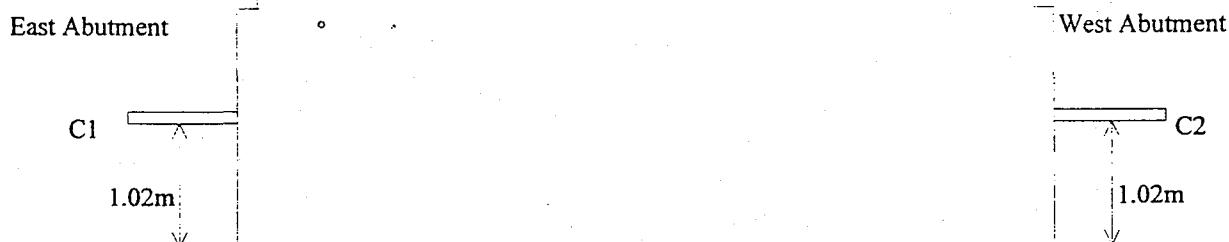
PLAN



ELEVATION

- C1 - 1670mm
- C2 - 1600mm
- D1 - 830mm (drilled radial to arch)
- D2 - 650mm (drilled vertically)

D2 TP1 - at crown



Bluntisham Railway Bridge , Bluntisham
WS Atkins - East Anglia

L11141/6

APPENDIX A

Test Location Plan
Trial Pit Diagram
and
Photographs

CONTEST MELBOURNE WEEKS LIMITED

SITE: Bluntisham Railway Bridge

TITLE: Trial Pit 1 Detail

Drawing No.

111141/TP1

Job No.: L.11141

Technician:

KS

Date:

20.01.96

Drawn By:

KW

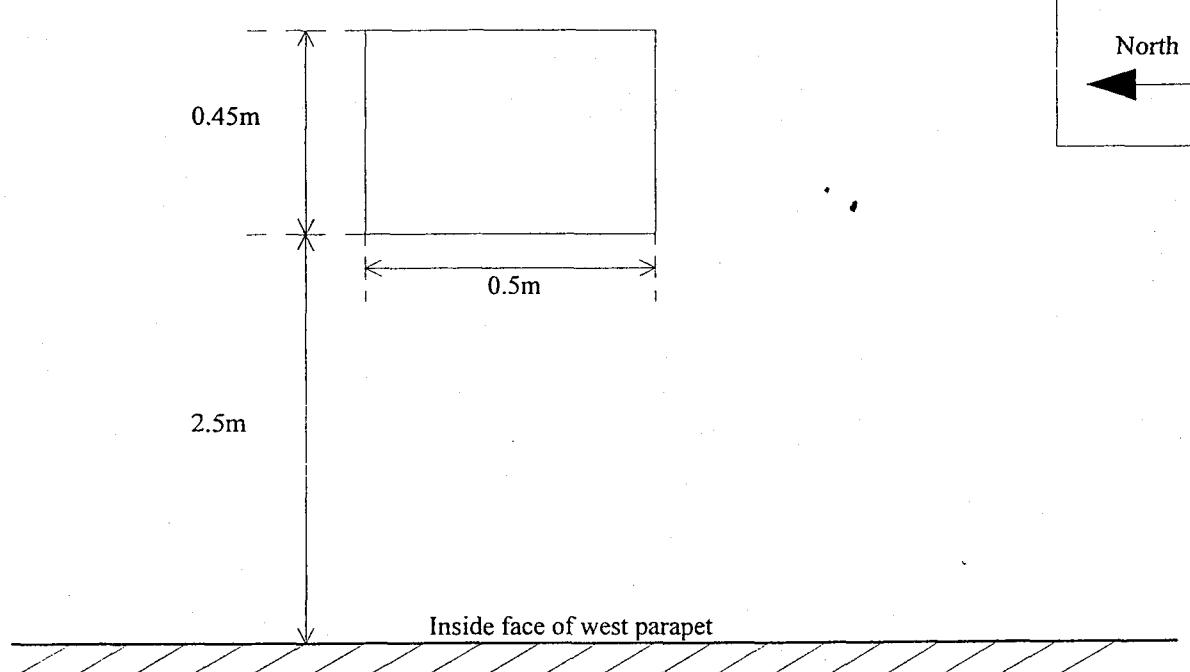
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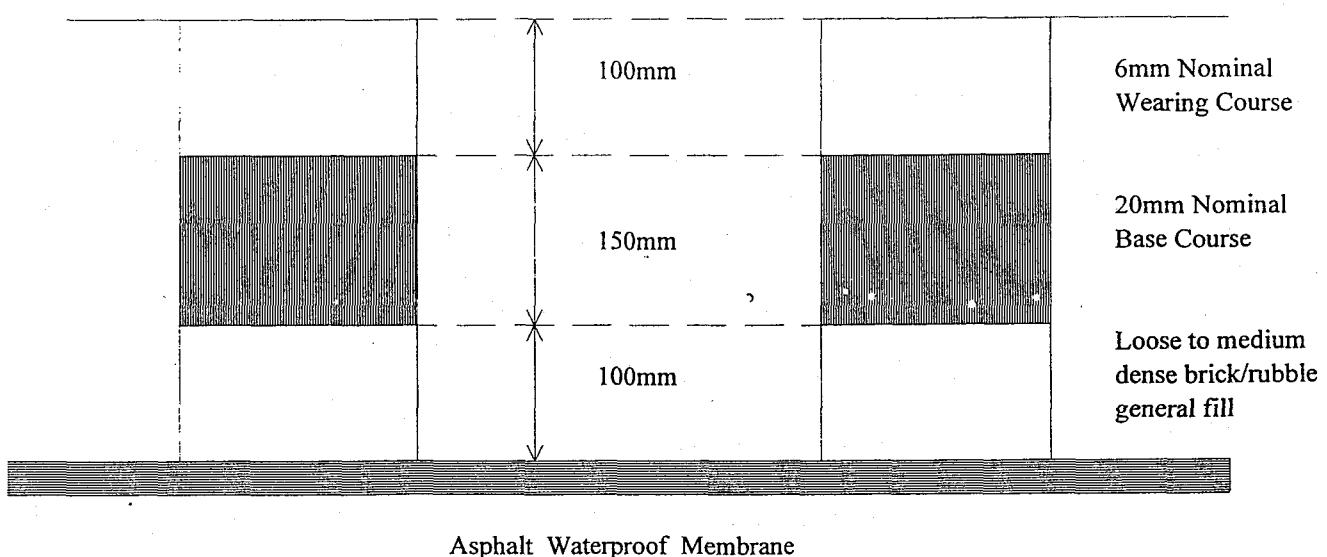
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TRIAL PIT 1 - WEST CARRIAGEWAY AT MID-SPAN

PLAN



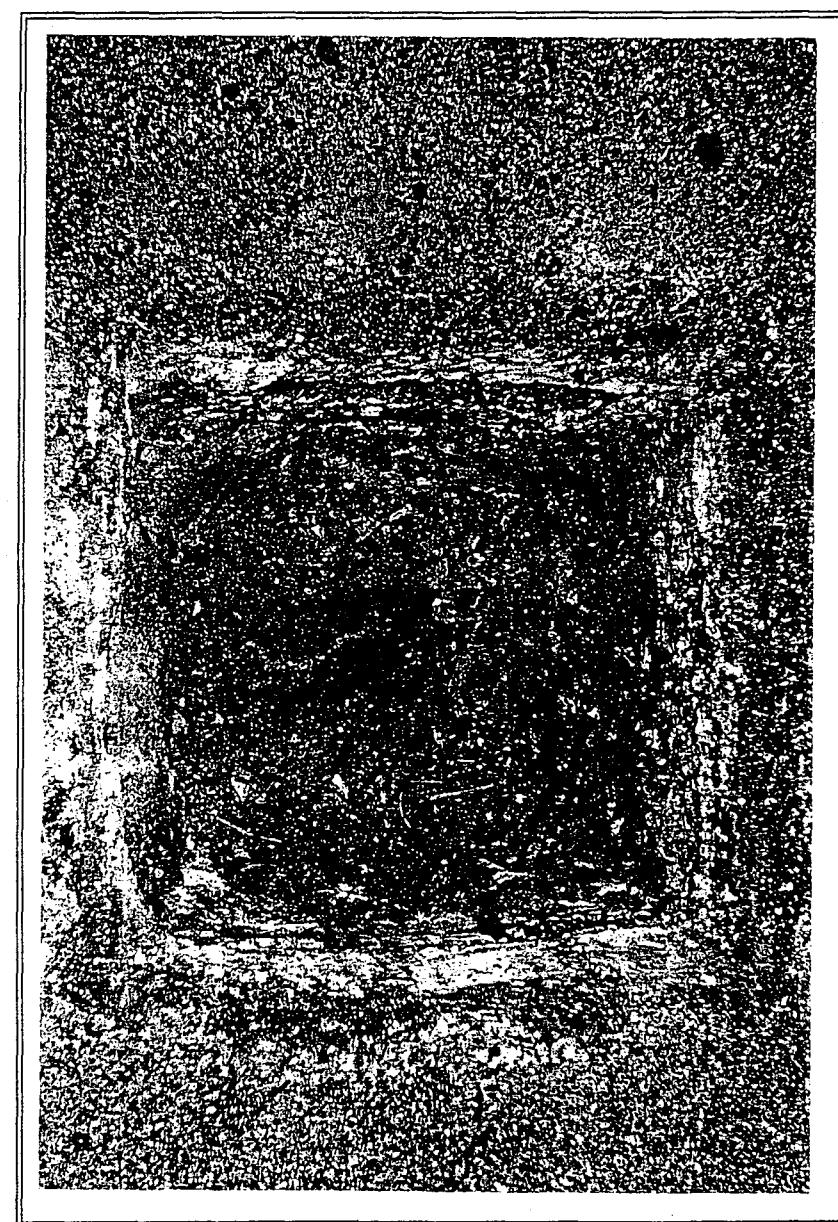
ELEVATION



Bluntisham Railway Bridge , Bluntisham
WS Atkins - East Anglia

L11141/6

Trial Pit 1



APPENDIX C
Assessment Calculations

Pages A, B and 1-86

Bluntisham Railway

MEXE Assessment of Bluntisham Railway Bridge

<u>ARCH DIMENSIONS</u>	<u>AVERAGE</u>	<u>WEST ELEVATION</u>		<u>EAST ELEVATION</u>	
		left	right	left	right
Clear span parallel to principle axis of arch	L	7.95	7.95	7.95	7.95
Rise of arch barrel at crown	Rc	2.45	2.42	2.5	2.41
Rise of arch barrel at quarter points	Rq	2.17	2.21	2.09	2.22
Thickness of arch barrel adjacent to keystone	d	0.54	0.54	0.54	0.54
Average depth of fill	h	0.49	0.49	0.49	0.49

MODIFYING FACTORS

	Fsr	1	1	1	1
Span/Rise Factor		0.89	0.91	0.84	0.91
Rq/Rc Ratio	Fp	0.67	0.56	0.87	0.59
Profile Factor	Fm	0.96	0.96	0.96	0.96
Material Factor	Fj	0.81	0.81	0.81	0.81
Joint Factor	Fc	0.8	0.8	0.8	0.8
Condition Factor					
<u>PROVISIONAL AXLE LOAD</u>	PAL	53.02	53.02	53.02	53.02
<u>MODIFIED AXLE FACTOR</u>		22.20	18.48	28.55	19.46
<u>PERMITTED GROSS AXLE AND BOGIE WEIGHT</u>					
Single Axle Factor	1.52	1.52	1.52	1.52	1.52
2 axle bogie factor	1	1	1	1	1
3 axle bogie factor	0.92	0.92	0.92	0.92	0.92
<u>WEIGHT RESTRICTION REQUIREMENTS</u>		NONE	NONE	NONE	NONE

Project ASSESSMENT OF HI/WAY JTR	Job ref R6272
Part of structure BLUNTISHAM RAILWAY	Calc sheet no rev 141
Drawing ref	Calc by Date S.C. 20.2.96
	Check by Date MSB

Ref	Calculations	Output
	<p style="text-align: center;">$\frac{r_q}{r_c}$</p> <p>Fig 3/4 Profile Factor</p> <p><u>PROFILE FACTOR (F_p)</u></p> <p>(i) From GRAPH , Fig 3/4</p> $\frac{r_q}{r_c} = \frac{2.17}{2.45} = 0.886 \Rightarrow F_p = 0.62$ <p>(ii) From EQUATION , $F_p = 2.3 \left\{ \frac{r_c - r_q}{r_c} \right\}^{0.6}$</p> $F_p = 2.3 \left(\frac{(2.45 - 2.17)}{2.45} \right)^{0.6} = 0.625$ <p><u>$F_p = 0.625$</u></p>	

ASSESSMENT OF HIGHWAY STR.

R16272

Part of structure

Calc sheet no rev

BLUNTISHAM RAILWAY

111

Drawing ref

Calc by

Date

S.C 20.2.96

Check by

MS

Date

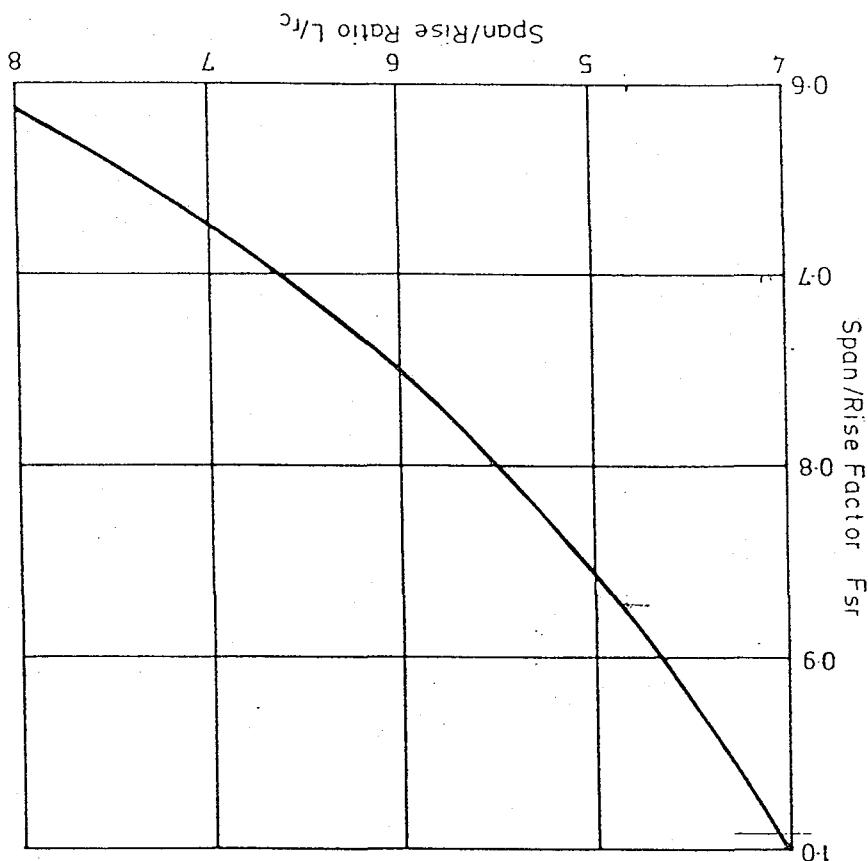
Ref	DIMENSIONS	Calculations	Output
1.2A	<p>W ELEVATION</p>	<p>DEPTHS FROM THE TOP OF THE PARAPET TO THE BASE OF THE ARCH BARREL.</p>	
1.3A	<p>E ELEVATION</p>	$A = (4.69 + 4.77 + 4.74 + 4.70) / 4$ $A = \underline{4.73 \text{ m}}$ $B = (2.48 + 2.68 + 2.52 + 2.56) / 4$ $B = \underline{2.56 \text{ m}}$ $C = (2.27 + 2.29) / 2$ $C = \underline{2.28 \text{ m}}$	
	<p>AVERAGES OF THE ABOVE E & W DIMENSIONS TO BE USED IN ANALYSIS</p>		

Ref	Calculations	Output
4.73	<p>ARCH DIMENSIONS</p> <p>Top of Parapet</p> <p>Road Surface</p> <p>1.25m</p> <p>h = 0.49</p> <p>d = 0.54 x 0.66</p> <p>See report</p> <p>ALL DIMENS IONS IN METRES</p> <p>$d = 4 \text{ times on edge} = 0.54 \text{ m}$</p> <p>$h = 2.28 - (1.25 + 0.54) = 0.49 \text{ m}$</p> <p>$r_c = 4.73 - 0.56 = 4.17 \text{ m}$</p> <p>$r_a = 4.73 - 2.28 = 2.45 \text{ m}$</p> <p>$L = 7.95 \text{ m}$</p> <p>$d = 0.54 \text{ m}$</p> <p>$h = 0.49 \text{ m}$</p> <p>$L = 2.17 \text{ m}$</p> <p>$r_c = 2.45 \text{ m}$</p> <p>$L = 7.95 \text{ m} ?$</p>	

Ref	Calculations	Output
	<p><u>MATERIAL FACTOR (Fm)</u></p> $F_m = \frac{(F_b \cdot d) + (F_f \cdot h)}{d+h}$ <p>Table 3/1 Table 3/2</p> <p>$F_b = \text{barrel factor} = 1.2$</p> <p>$F_f = \text{fill factor} = 0.7$</p> $F_m = \frac{(1.2 \times 0.54) + (0.7 \times 0.49)}{0.54 + 0.49}$ <p>$F_m = 0.962$</p>	
		<p>$F_m = 0.96$</p> <p><u>JOINT FACTOR (Fj)</u></p> <p>Table 3/3 Table 3/5 Table 3/4</p> <p>$F_j = F_w \times F_d \times F_{mo}$</p> <p>$F_w = \text{width factor} = 0.9$</p> <p>$F_d = \text{depth factor} = 1.0$</p> <p>$F_{mo} = \text{mortar factor} = 0.9$</p> $F_j = 0.9 \times 1.0 \times 0.9$ $\Rightarrow F_j = 0.81$
		<p>$F_j = 0.81$</p> <p><u>CONDITION FACTOR (Fc)</u></p> <p>$F_c = 0.8$</p>

$F_{SR} = 4.0$ $\Rightarrow F_{SR} = 1.0$

$$\text{Span/Rise Factor} = \frac{\text{Span/Rise Ratio (ESL)}}{\text{Span/Rise Ratio Lrc}} = \frac{7.95}{8.45} = 0.924$$



MATERIALS FACTORS

Project	Part of structure	Calc sheet no	Rev	Ref	Output
ASSESSMENT OF AIRPORT SITE R6272	PLANESHAFT AIRWAY	13	1		
Job ref	Drawing ref	Calc by	Date	Check by	Date
	R6272	G.C.	20.2.96	DRS	20.2.96

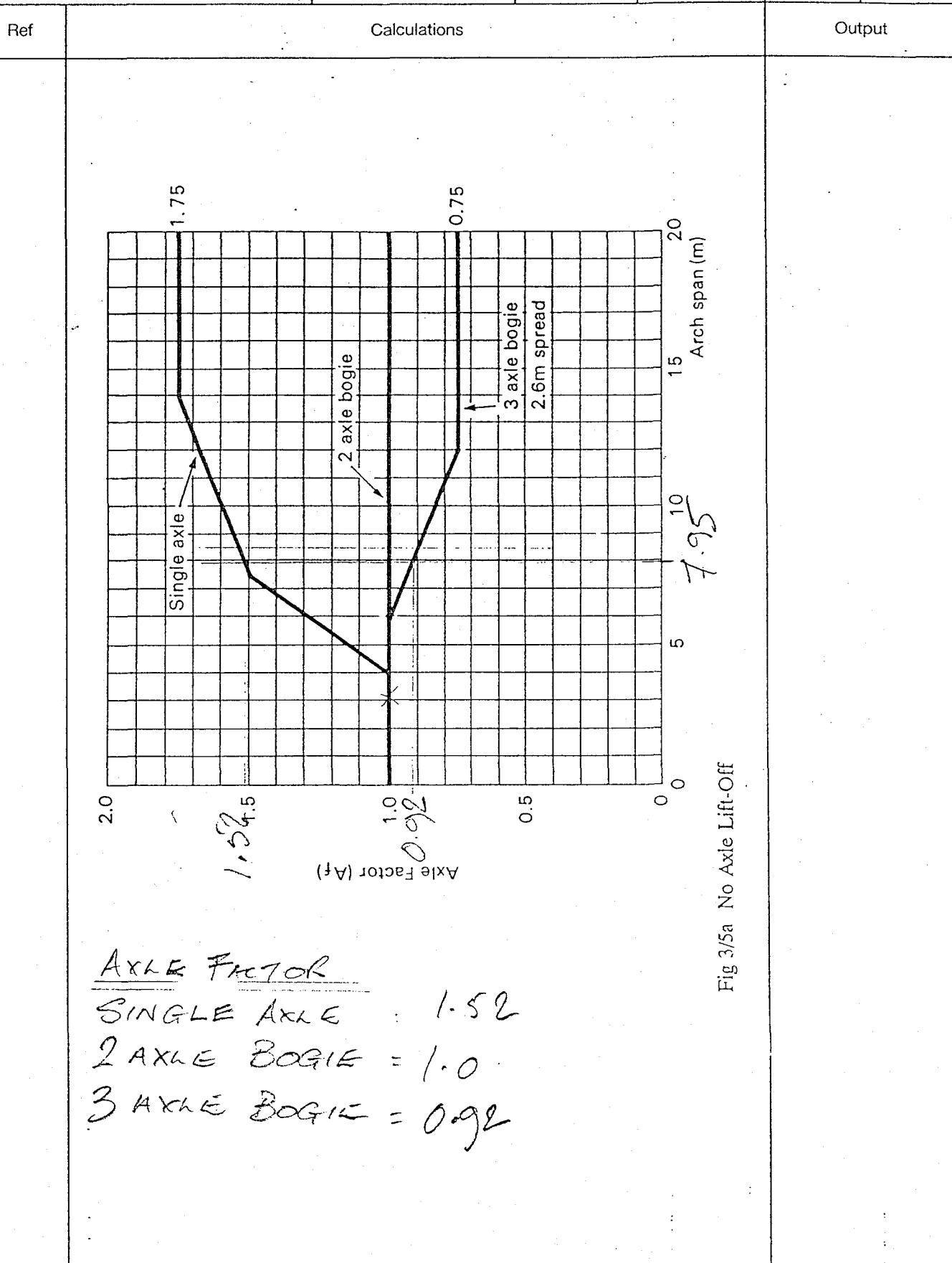
NOT
1993
18.84 mm
20.45 mm
51.08 mm
33.01

21.22 mm
16.45 mm
20.45 mm
55.02
 $f_c = 0.8$
 $f_y = 0.81$
 $f_u = 0.62$
 $f_v = 1.0$

$L = 7.95m$
Steel plate parallel to structural axis
Width of steel same as width of concrete
Effect of eccentricity same as eccentricity
 $f_y = 2.17m$
 $f_u = 2.45m$
 $f_v = 0.45m$
 $f_c = 0.45m$

STRUCTURE NAME : BUNNTISHAM RAILWAY
ASSESSMENT OF HIGHWAY SITE R6272
Job ref : 141
Calc sheet no : rev
Part of structure
Project : BUNNTISHAM RAILWAY
Drawing ref : Date : 20.2.96
Check by : Cal by : S.C.
SARIS : 8/15

Ref	Output	Calculations	Dimensions	Notes



ASSESSMENT OF HIGHWAY SITER6272

Part of structure

Calc sheet no rev

BUNCTSHAM RAILWAY181

Drawing ref

Calc by

Date

S.C. 20.2.96

Check by

PSS

Date

S/4

Ref	Calculations	Output
	<p>ALLOWABLE AXLE LOADS (TONNES)</p> <p>= AXLE FACTOR x MODIFIED AXLE LOAD</p> <p>SINGLE AXLE $\Rightarrow 1.52 \times 20.45 = 31.084$ tonnes</p> <p>2 AXLE BOGIE $\Rightarrow 1.0 \times 20.45 = 20.45$ tonnes.</p> <p>3 AXLE BOGIE $\Rightarrow 0.92 \times 20.45 = 18.84$ tonnes.</p> <p>Table 3/6 \Rightarrow from Table 3/6 no weight restriction is required?</p>	

ASSESSMENT OF H/WAY STR

R6272

BLUNTISHAM RAILWAY

191

Ref

Calculations

Output

ASSESSMENT OF HB CAPACITY

DESCRIPTION	ALLOWABLE AXLE LOAD FOR DOUBLE BOGEY (tonnes)	EQUIVALENT HB (units HB) (= ① x 10/10)	APPLYING SF FACTORS (Shear Sf ₁ = 1.3 Sf ₃ = 1.1 (unit ③ HB/86188))
Averaged dimensions	22.20	22.20	16
East Elevation L/H dimensions	19.46	19.46	14
East Elevation RH dimensions	21.91	23.24	15
West Elevation L/H dimensions	18.48	19.43	13
West Elevation RH dimensions	28.55	30.33	20

Project

Job ref

ASSESSMENT OF HIGHWAY STRR6272

Part of structure

Calc sheet no rev

BLUNTISHAM RAILWAY

110 /

Drawing ref

Calc by

Date

el.

4.3.96

Check by

Date

OBS

MAC 96

Ref	Calculations	Output
8021/96 6.1.9 (i)	<p><u>Summary of ARCHIE assessment</u></p> <p>From the ARCHIE assessment, the bridge capacity was found to be lower than that for MEKE. Therefore, in accordance with BD 21/96, para 6.1.9 (i) the MEKE assessment shall stand.</p>	

Project	ASSESSMENT OF HIGHWAY STR		Job ref	
Part of structure	BLUNTISHAM RAILWAY		Calc sheet no	rev
Drawing ref	Calc by	Date	Check by	Date
	SL	28.2.96		

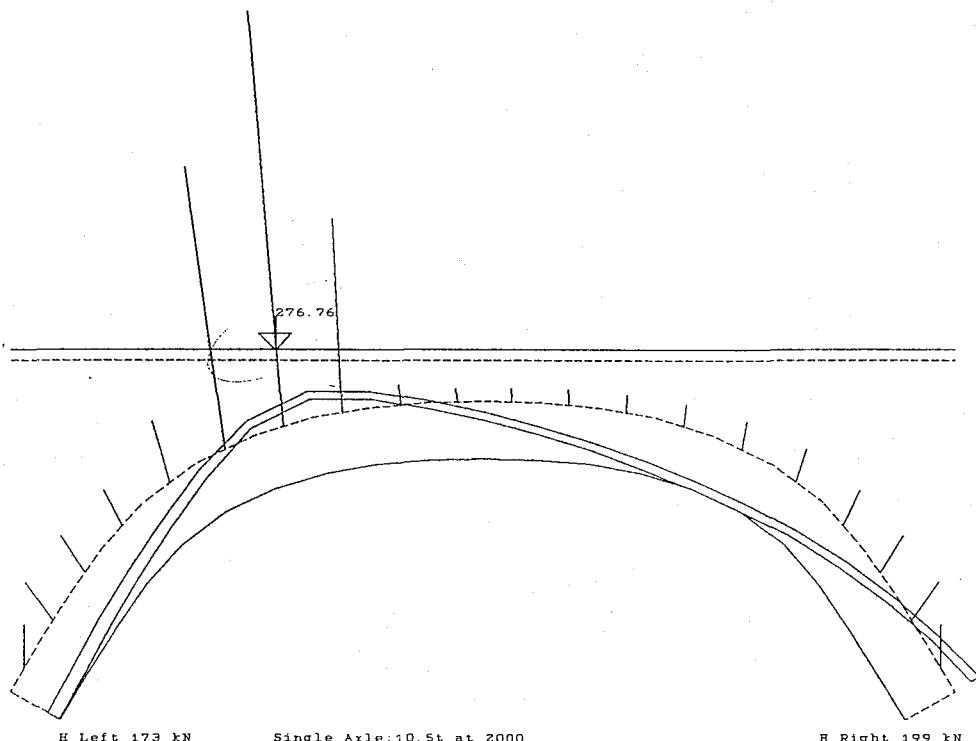
Ref	Calculations	Output
	<p>ARCHE ASSESSMENT 1 : Averaged Co-ordinates</p> <p>(3975, 2450) —————— (5963, 2170)</p> <p>— (1985, 2170) —————— (6957, 1500)</p> <p>* (994, 1600) —————— (7950,</p> <p>(070)</p> <p><u>TO SCALE 1:50</u> Co-ordinates</p> <p>Filename: - BLUNT</p> <p>estimated 2 further co-ordinates</p> <p>(1994, 1500) and (6957, 1500)</p> <p>Segments 20</p> <p>No. Survey pt 7 ✓</p> <p>(1 survey pt, B)</p> <p>Ring thickness (d) 540 ✓</p> <p>Gauge (h) 490 ✓</p> <p>Factors ✓</p> <p>D21/03T4/(1) material self weight 20 x 256 20.6 ✓</p> <p>fill 18 ✓</p> <p>35 ✓</p> <p>material self weight of fill 3 ✓ shows low</p> <p>depth of surface 100 ✓</p> <p>surface density 20 23t 22.5 ✗</p> <p>Ring thickness factor not included</p>	

Blunt			
Span	7950 mm	Rise	2450 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	26.20 kN/m ³
Surfacing density	23.6 20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 10.5t at 2000		
Required ring depth	794 mm	Geometric F.O.S	1.68
H Left	174 kN/m	H Right	199 kN/m
V Left	375 kN/m	V Right	204 kN/m
Comp. zone at hinge 2	76 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 8	3 AT 15	4 AT 21

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-14.1	0	0	0	0
2	-5.5	-12.7	8.7	0	0	0
3	-5.7	-11.9	7.3	0	0	0
4	-5.9	-11.6	5.6	0	0	0
5	-6	-11	3.6	-8.9	1.8	0
6	-6	-9.2	1.9	-82.2	10.6	0
7	-5.8	-7.3	.9	-127	10.3	0
8	-5.7	-6	.4	-56.9	2.7	0
9	-5.7	-5.2	.2	-1.9	0	0
10	-5.6	-4.8	0	0	0	0
11	-5.6	-4.8	0	0	0	0
12	-5.7	-5.2	-.2	0	0	0
13	-5.7	-6	-.4	0	0	0
14	-5.8	-7.3	-.9	0	0	0
15	-6	-9.2	-1.9	0	0	0
16	-6	-11	-3.6	0	0	0
17	-5.9	-11.6	-5.6	0	0	0
18	-5.7	-11.9	-7.3	0	0	0
19	-5.5	-12.7	-8.7	0	0	0
20	-5.5	-14.1	0	0	0	0

WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0NA

Project ASSESSMENT OF HILLYAY STR	Job ref EC 6272	
Part of Structure BLUNTISHAM RAILWAY	Calc sheet no. 128	
Designing ref SL	Calc by Date 28.2.96 DBA	Check by Date 28/2



H Left 173 kN Single Axle: 10.5t at 2000
V Left 374 kN

H Right 199 kN
V Right 204 kN

Actual ring depth 540 mm Required ring depth at crown 794 mm Geometric F.O.S .68
Passive pressure factor soil .1

Masonry 20 kN/m³ Fill 18 kN/m³ Surfacing 20 kN/m³
PHI 35 deg Material strength 3 N/mm²
C:\DOCUMENT\Blunt_A.4

J. BLUNT, WELLEROCK COURT, COTTON, CAMBLS, GBR 6

Project

Job ref

ASSESSMENT OF HIGHWAY STR BC6272

Part of Structure

BRITISH RAIL RAILWAY

Date

Check by

Drawing ref

Calc by

Date

28.2.96

DBB

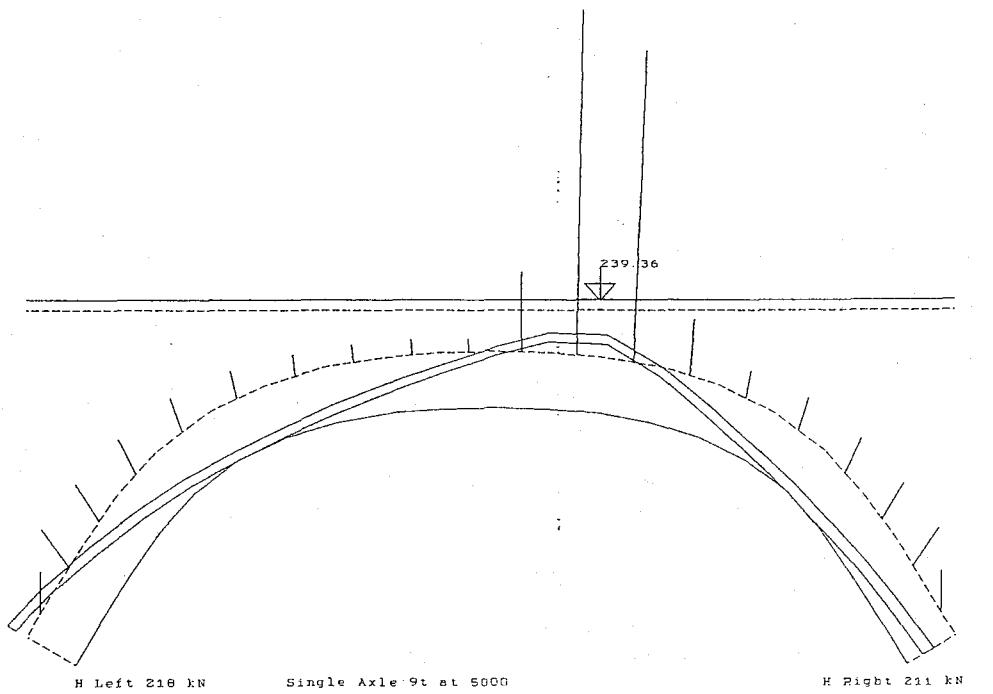
S/S

Blunt			
Span	7950 mm	Rise	2450 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 9t at 5000		
Required ring depth	746 mm	Geometric F.O.S	.72
H Left	219 kN/m	H Right	211 kN/m
V Left	226 kN/m	V Right	316 kN/m
Comp. zone at hinge 2	84 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 6	3 AT 13	4 AT 17

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-14.1	0	0	0	0
2	-5.5	-12.7	8.7	0	0	0
3	-5.7	-11.9	7.3	0	0	0
4	-5.9	-11.6	5.6	0	0	0
5	-6	-11	3.6	0	0	0
6	-6	-9.2	1.9	0	0	0
7	-5.8	-7.3	.9	0	0	0
8	-5.7	-6	.4	0	0	0
9	-5.7	-5.2	.2	0	0	0
10	-5.6	-4.8	0	0	0	0
11	-5.6	-4.8	0	-21.8	-.1	0
12	-5.7	-5.2	-.2	-109	-2.3	0
13	-5.7	-6	-.4	-97.2	-4.5	0
14	-5.8	-7.3	-.9	-11.4	-.9	0
15	-6	-9.2	-1.9	0	0	0
16	-6	-11	-3.6	0	0	0
17	-5.9	-11.6	-5.6	0	0	0
18	-5.7	-11.9	-7.3	0	0	0
19	-5.5	-12.7	-8.7	0	0	0
20	-5.5	-14.1	0	0	0	0

WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0NA

Project ASSESSMENT OF H/WAY STR	Job No. R6272
Type of Structure BLUNTSHAW RAILWAY	Calc st. 1/10/96 rev 14
Planning ref.	Date 28/2/96 DBR
Calc by SL	Check by SJS



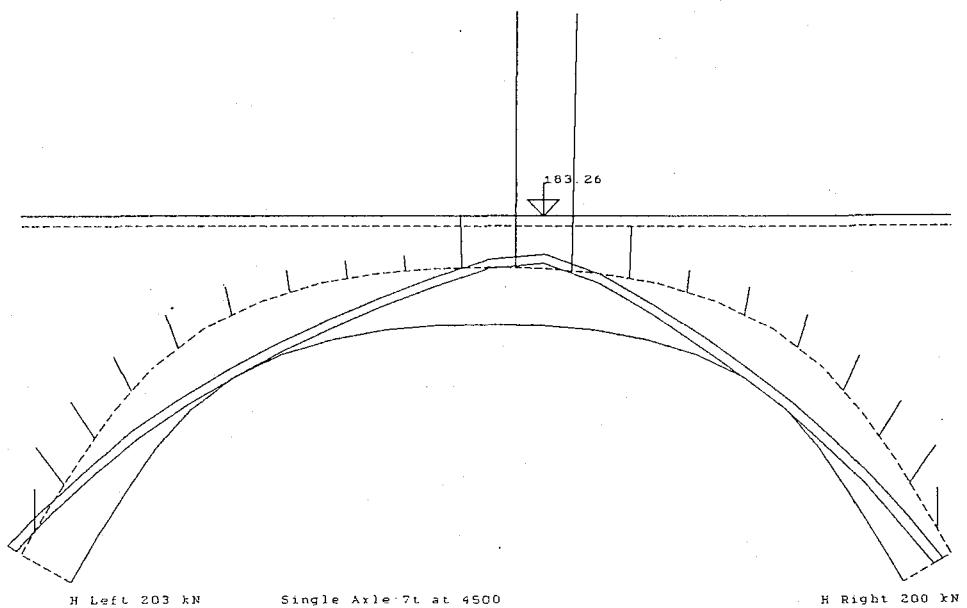
Actual ring depth 640 mm Required ring depth at crown 746 mm Geometric F.O.S 72
 Passive pressure factor soil 1
 Masonry 20 kN/m³ Fill 18 kN/m³ Surfacing 20 kN/m³
 PHI 35 deg Material strength 3 N/mm²
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ASSESSMENT OF HIGHWAY STABILITY		R6272
NAME OF STRUCTURE	BLUNTISHAM RAILWAY	DATE
DESIGNER	DR	28.2.96
CONTRACTOR	038	5/5

Blunt			
Span	7950 mm	Rise	2450 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 7t at 4500		
Required ring depth	670 mm	Geometric F.O.S	.81
H Left	203 kN/m	H Right	201 kN/m
V Left	224 kN/m	V Right	262 kN/m
Comp. zone at hinge 2	78 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 6	3 AT 12	4 AT 17

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-14.1	0	0	0	0
2	-5.5	-12.7	8.7	0	0	0
3	-5.7	-11.9	7.3	0	0	0
4	-5.9	-11.6	5.6	0	0	0
5	-6	-11	3.6	0	0	0
6	-6	-9.2	1.9	0	0	0
7	-5.8	-7.3	.9	0	0	0
8	-5.7	-6	.4	0	0	0
9	-5.7	-5.2	.2	0	0	0
10	-5.6	-4.8	0	-12.9	.1	0
11	-5.6	-4.8	0	-79.5	-.4	0
12	-5.7	-5.2	-.2	-79.6	-1.7	0
13	-5.7	-6	-.4	-11.3	-.5	0
14	-5.8	-7.3	-.9	0	0	0
15	-6	-9.2	-1.9	0	0	0
16	-6	-11	-3.6	0	0	0
17	-5.9	-11.6	-5.6	0	0	0
18	-5.7	-11.9	-7.3	0	0	0
19	-5.5	-12.7	-8.7	0	0	0
20	-5.5	-14.1	0	0	0	0

Assessment of Hwy Str R6272
 Bluntsbham Railway 1/6
 Se 28.2.96 MS 5/s



H Left 203 kN
V Left 223 kN

Single Axle 7t at 4500

H Right 200 kN
V Right 261 kN

Actual ring depth 540 mm Required ring depth at crown 670 mm Geometric F O S .81
Passive pressure factor soil .1

Masonry 20 kN/m³
PHI 35 deg

Fill 18 kN/m³
Material strength 3 N/mm²

Surfacing 20 kN/m³

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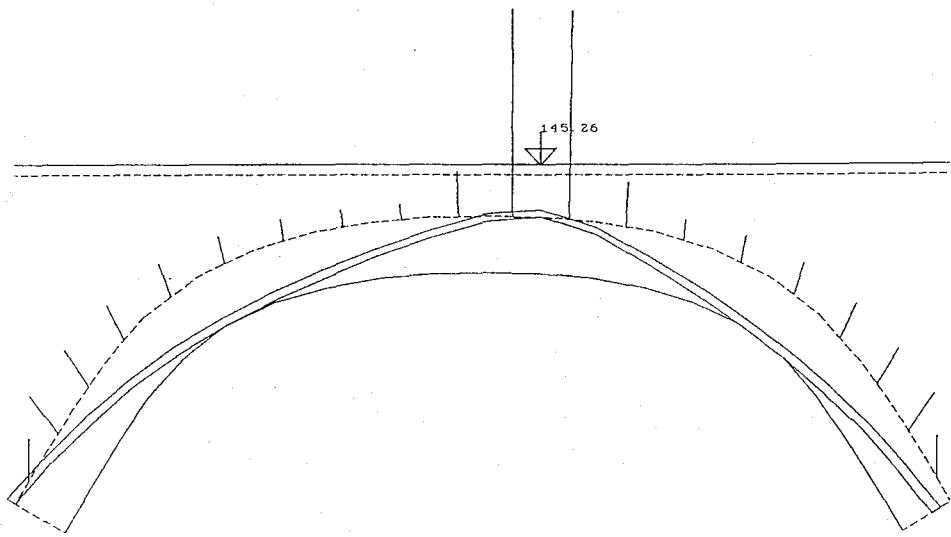
Assessment of 4 Way Site R6272
Bluntisham Railway 17
SL 28.7.96 MSS S/S

Blunt				
Span				
Depth of fill	7950 mm	Rise		2450 mm
Ring depth	490 mm	Depth of surfacing		100 mm
Position of backing	540 mm	Ring depth factor		1
	1	Depth of mortar loss		0 mm
Fill density				
Surfacing density	18 kN/m ³	Masonry density		20 kN/m
Phi for fill	20 kN/m ³	Masonry strength		3 N/mm ²
Load				
Required ring depth	Single Axle: 5.5t at 4500			
H Left	611 mm	Geometric F.O.S		.88
V Left	177 kN/m	H Right		174 kN/m
Comp. zone at hinge 2	209 kN/m	V Right		239 kN/m
	69 mm	Factor on pass. press.		.1
Hinges				
1 AT 1				
	2 AT 6		3 AT 12	
				4 AT 16

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-14.1	0	0	0	0
2	-5.5	-12.7	8.7	0	0	0
3	-5.7	-11.9	7.3	0	0	0
4	-5.9	-11.6	5.6	0	0	0
5	-6	-11	3.6	0	0	0
6	-6	-9.2	1.9	0	0	0
7	-5.8	-7.3	.9	0	0	0
8	-5.7	-6	.4	0	0	0
9	-5.7	-5.2	.2	0	0	0
10	-5.6	-4.8	0	-10.2	.1	0
11	-5.6	-4.8	0	-63	-.3	0
12	-5.7	-5.2	-.2	-63.1	-1.4	0
13	-5.7	-6	-.4	-8.9	-.4	0
14	-5.8	-7.3	-.9	0	0	0
15	-6	-9.2	-1.9	0	0	0
16	-6	-11	-3.6	0	0	0
17	-5.9	-11.6	-5.6	0	0	0
18	-5.7	-11.9	-7.3	0	0	0
19	-5.5	-12.7	-8.7	0	0	0
20	-5.5	-14.1	0	0	0	0

WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0NN

Project	Assessment to Hwy St	Job ref
Part of Structure	Bluntsbham Railway	Date st. 15/10/96
Drawing ref	Calc by	Date 28/2/96
		Check 030 5/S



H Left 176 kN
V Left 208 kN

Single Axle 5.5t at 4500

H Right 174 kN
V Right 238 kN

Actual ring depth 540 mm Required ring depth at crown 611 mm Geometric F.O.S 1.88
 Passive pressure factor soil 1
 Masonry 20 kN/m³ Fill 18 kN/m³ Surfacing 20 kN/m³
 PHI 35 deg Material strength 3 N/mm²
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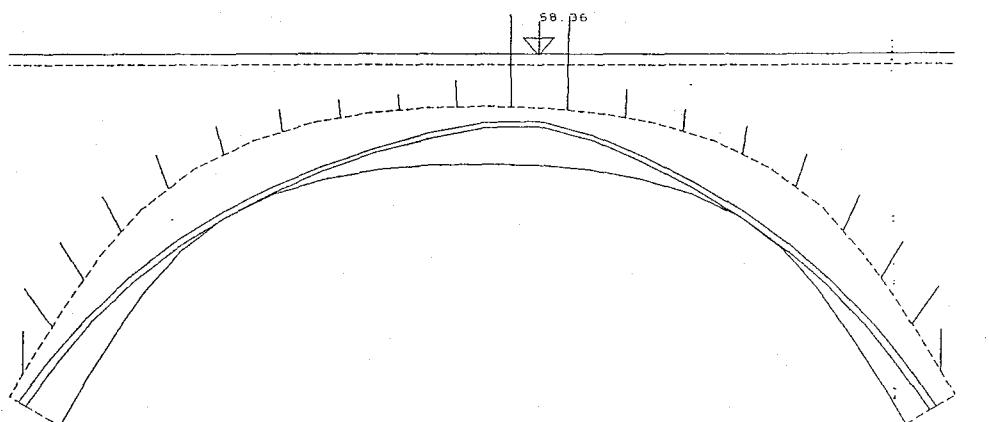
WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0M.

Project	Assessment of 4/Well Str		Job no	26272
Part of Structure	Blundstone Railways		Calc by	191
Drawing ref	Date	28.9.96	Check by	W.D.
		006		5/1

Blunt			
Span	7950 mm	Rise	2450 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 2t at 4500		
Required ring depth	415 mm	Geometric F.O.S	1.3
H Left	114 kN/m	H Right	113 kN/m
V Left	174 kN/m	V Right	186 kN/m
Comp. zone at hinge 2	48 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 6	3 AT 12	4 AT 16

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-14.1	0	0	0	0
2	-5.5	-12.7	8.7	0	0	0
3	-5.7	-11.9	7.3	0	0	0
4	-5.9	-11.6	5.6	0	0	0
5	-6	-11	3.6	0	0	0
6	-6	-9.2	1.9	0	0	0
7	-5.8	-7.3	.9	0	0	0
8	-5.7	-6	.4	0	0	0
9	-5.7	-5.2	.2	0	0	0
10	-5.6	-4.8	0	-4.1	0	0
11	-5.6	-4.8	0	-25.3	-.1	0
12	-5.7	-5.2	-.2	-25.4	-.5	0
13	-5.7	-6	-.4	-3.6	-.2	0
14	-5.8	-7.3	-.9	0	0	0
15	-6	-9.2	-1.9	0	0	0
16	-6	-11	-3.6	0	0	0
17	-5.9	-11.6	-5.6	0	0	0
18	-5.7	-11.9	-7.3	0	0	0
19	-5.5	-12.7	-8.7	0	0	0
20	-5.5	-14.1	0	0	0	0

Assessment of Wall St 26272
 Blewitts Railway 20
 d. 28.2.96 1113 55



H Left 113 kN
V Left 174 kN

Single Axle: 2t at 4500

H Right 113 kN
V Right 186 kN

Actual ring depth 540 mm Required ring depth at crown 415 mm Geometric F G S 1 3
Passive pressure factor soil 1

Masonry 20 kN/m³

Fill 18 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

Material strength 3 N/mm²

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Assessment of M/Way St R6272
Blunsham Railway 21.
SL 28.2.96

WS/Atkins

Project

ASSESSMENT OF HIGHWAY STR

Job ref

BC6272/8

Part of structure

BLUNTISHAM RAILWAY

Calc sheet no rev

1221

Drawing ref

2

Date

28-2-96

Check by

Date

Ref	Calculations	Output
	<p>(0,0)</p> <p>1988, 2220</p> <p>1694, 31650</p> <p>3975, 2450</p> <p>5963, 2220</p> <p>TO SCALE 1:50</p> <p>BLUNTISHAM RAILWAY</p> <p>BLUNT 2</p> <p>[East - Left]</p> <p>(0,0)</p> <p>(7950, 0)</p> <p>6957</p> <p>estimated to further coordinate (994, 1650) and (6957, 1650)</p> <p>BLUNT 2</p> <p>segment 20</p> <p>nose down</p> <p>d = 540</p> <p>h = 490</p> <p>f = 7</p> <p>max sag f = 20</p> <p>max sag f = 18</p> <p>max sag f = 35</p> <p>post of hill = 3</p> <p>depth of cut = 150</p> <p>levl. f = 20</p>	

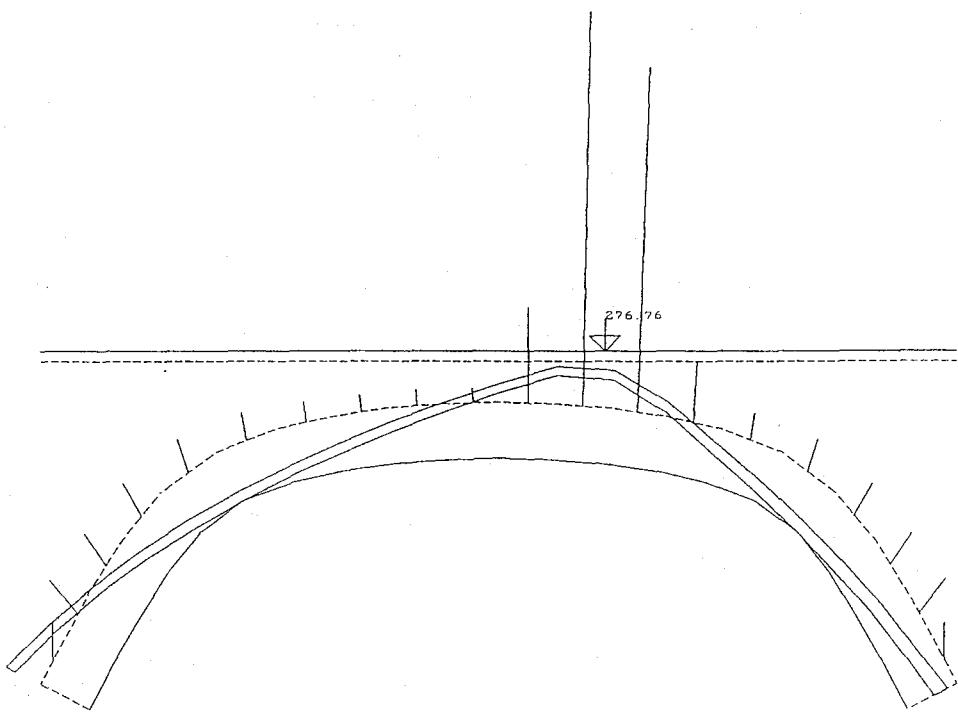
Blunt2

Span	7950 mm	Rise	2450 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	(20) kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 10.5t at 5000		
Required ring depth	910 mm	Geometric F.O.S	(59)
H Left	243 kN/m	H Right	234 kN/m
V Left	236 kN/m	V Right	337 kN/m
Comp. zone at hinge 2	92 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 6	3 AT 13	4 AT 17

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-13.1	0	0	0	0
2	-5.6	-11.7	9.1	0	0	0
3	-5.8	-11	7.6	0	0	0
4	-6.1	-11.1	5.9	0	0	0
5	-6.3	-11.1	3.5	0	0	0
6	-6.1	-9.2	1.5	0	0	0
7	-5.8	-7	.7	0	0	0
8	-5.7	-5.8	.4	0	0	0
9	-5.7	-5.2	.2	0	0	0
10	-5.7	-4.9	.1	0	0	0
11	-5.7	-4.9	-.1	-26.9	-.2	0
12	-5.7	-5.2	-.2	-126.5	-2.9	0
13	-5.7	-5.8	-.4	-109.7	-4.3	0
14	-5.8	-6.9	-.7	-13.7	-.8	0
15	-6.1	-9.1	-1.5	0	0	0
16	-6.3	-11.1	-3.5	0	0	0
17	-6.1	-11.2	-5.9	0	0	0
18	-5.8	-11	-7.6	0	0	0
19	-5.6	-11.8	-9.1	0	0	0
20	-5.5	-13.1	0	0	0	0

WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0E

Project	Assessment of Bluntsbury		Job ref
Part of Structure	Bluntsbury Railway		R6272
Drawing ref	Date calc'd	Date	Calculation by
	28.2.98	163	W.A.



H Left 242 kN Single Axle 10.5t at 5000
V Left 236 kN

H Right 234 kN
V Right 337 kN

Actual ring depth 540 mm Required ring depth at crown 910 mm Geometric F.O.S. 5.9
Passive pressure factor soil .1
Masonry 20 kN/m³ Fill 18 kN/m³ Surfacing 20 kN/m³
PHI 35 deg Material strength 3 N/mm²
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Assessment of Highway Site Q6272

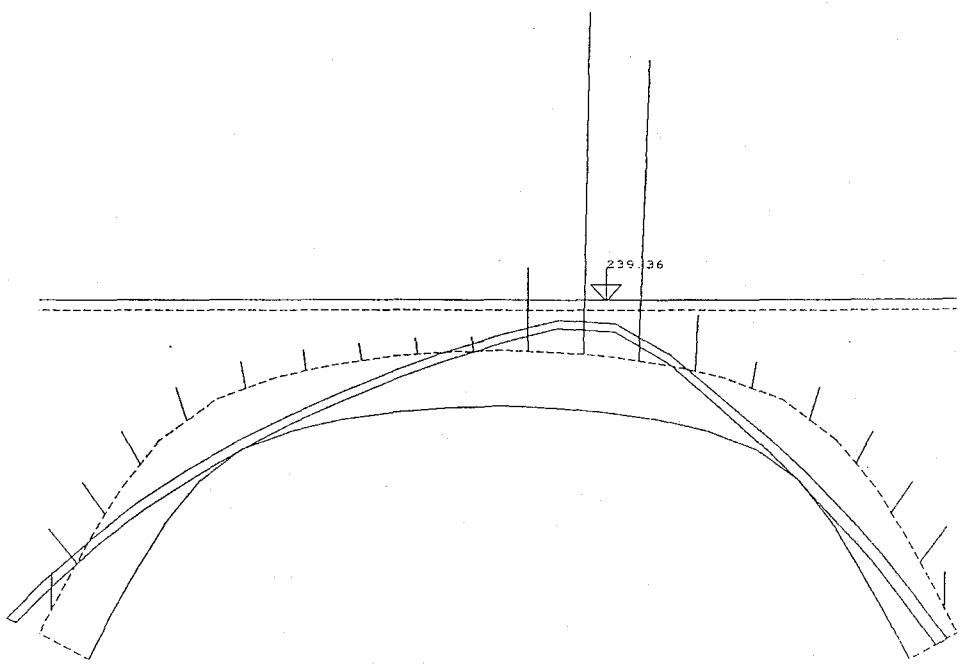
Bluntness Railway	24/
Drawing ref.	Sl
Date	28.2.86

Blunt2			
Span	7950 mm	Rise	2450 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load		Single Axle: 9t at 5000	
Required ring depth	865 mm	Geometric F.O.S	.62
H Left	220 kN/m	H Right	213 kN/m
V Left	224 kN/m	V Right	312 kN/m
Comp. zone at hinge 2	84 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 6	3 AT 13	4 AT 17

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-13.1	0	0	0	0
2	-5.6	-11.7	9.1	0	0	0
3	-5.8	-11	7.6	0	0	0
4	-6.1	-11.1	5.9	0	0	0
5	-6.3	-11.1	3.5	0	0	0
6	-6.1	-9.2	1.5	0	0	0
7	-5.8	-7	.7	0	0	0
8	-5.7	-5.8	.4	0	0	0
9	-5.7	-5.2	.2	0	0	0
10	-5.7	-4.9	.1	0	0	0
11	-5.7	-4.9	-.1	-23.2	-.2	0
12	-5.7	-5.2	-.2	-109.4	-2.5	0
13	-5.7	-5.8	-.4	-94.9	-3.8	0
14	-5.8	-6.9	-.7	-11.9	-.7	0
15	-6.1	-9.1	-1.5	0	0	0
16	-6.3	-11.1	-3.5	0	0	0
17	-6.1	-11.2	-5.9	0	0	0
18	-5.8	-11	-7.6	0	0	0
19	-5.6	-11.8	-9.1	0	0	0
20	-5.5	-13.1	0	0	0	0

MS ATKINS, WELLBROOK COURT, CIRTON, CAMBS. CB3 0JL

Assessment of H/Way Str R6272
 Blunckham Railway 25
 Sl 28.2.96



H Left 219 kN
V Left 224 kN

Single Axle: 9t at 5000

H Right 212 kN
V Right 211 kN

Actual ring depth 540 mm Required ring depth at crown 865 mm Geometric F 0.5 : 62
 Passive pressure factor soil .1
 Masonry 20 kN/m³ Fill 18 kN/m³ Surfacing 20 kN/m³
 PHI 35 deg Material strength 3 N/mm²
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Assessment No. 86272
 Bluntsbank Railway 26
 29.2.96

Blunt2			
Span	7950 mm	Rise	2450 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 7t at 4500		
Required ring depth	787 mm	Geometric F.O.S	.69
H Left	204 kN/m	H Right	201 kN/m
V Left	222 kN/m	V Right	259 kN/m
Comp. zone at hinge 2	78 mm	Factor on pass. press.	.1

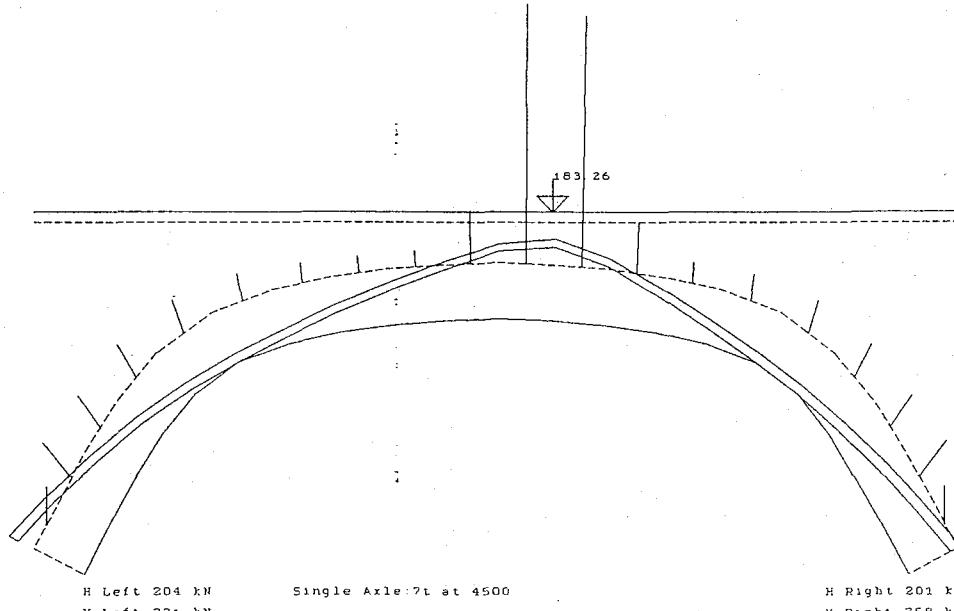
Hinges

1 AT 1	2 AT 6	3 AT 12	4 AT 17
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Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-13.1	0	0	0	0
2	-5.6	-11.7	9.1	0	0	0
3	-5.8	-11	7.6	0	0	0
4	-6.1	-11.1	5.9	0	0	0
5	-6.3	-11.1	3.5	0	0	0
6	-6.1	-9.2	1.5	0	0	0
7	-5.8	.7	.7	0	0	0
8	-5.7	-5.8	.4	0	0	0
9	-5.7	-5.2	.2	0	0	0
10	-5.7	-4.9	.1	-13	.1	0
11	-5.7	-4.9	-.1	-81.3	-.6	0
12	-5.7	-5.2	-.2	-78.2	-1.8	0
13	-5.7	-5.8	-.4	-10.8	-.4	0
14	-5.8	-6.9	-.7	0	0	0
15	-6.1	-9.1	-1.5	0	0	0
16	-6.3	-11.1	-3.5	0	0	0
17	-6.1	-11.2	-5.9	0	0	0
18	-5.8	-11	-7.6	0	0	0
19	-5.6	-11.8	-9.1	0	0	0
20	-5.5	-13.1	0	0	0	0

WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0RA

Project	Assessment of Highway etc	R6272
Part of Structure	Bluehsham Railway	Date started
Drawing ref	Ref	Date
	28296	Charter date



H Left 204 kN Single Axle: 7t at 4500
 V Left 221 kN

H Right 201 kN
 V Right 258 kN

Actual ring depth 540 mm Required ring depth at crown 786 mm Geometric F.O.S. 6.9

Passive pressure factor soil 1

Masonry 20 kN/m³

Fill 16 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

Material strength 3 N/mm²

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ASSESSMENT OF RAILWAY EMBANKMENT AT BLUNTHAM

Assessment of Bluntham Railway 28.2.95

Bluntham Railway 28

Sk 28.2.95

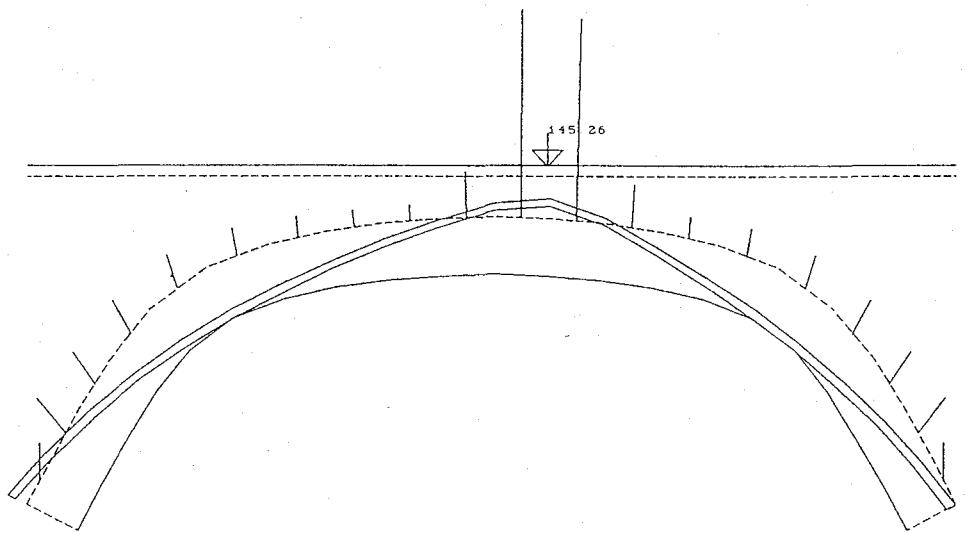
Blunt2

Span	7950 mm	Rise	2450 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 5.5t at 4500		
Required ring depth	725 mm	Geometric F.O.S	.74
H Left	177 kN/m	H Right	175 kN/m
V Left	206 kN/m	V Right	236 kN/m
Comp. zone at hinge 2	69 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 6	3 AT 12	4 AT 17

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-13.1	0	0	0	0
2	-5.6	-11.7	9.1	0	0	0
3	-5.8	-11	7.6	0	0	0
4	-6.1	-11.1	5.9	0	0	0
5	-6.3	-11.1	3.5	0	0	0
6	-6.1	-9.2	1.5	0	0	0
7	-5.8	-7	.7	0	0	0
8	-5.7	-5.8	.4	0	0	0
9	-5.7	-5.2	.2	0	0	0
10	-5.7	-4.9	.1	-10.3	.1	0
11	-5.7	-4.9	-.1	-64.4	-.5	0
12	-5.7	-5.2	-.2	-62	-1.4	0
13	-5.7	-5.8	-.4	-8.5	-.3	0
14	-5.8	-6.9	-.7	0	0	0
15	-6.1	-9.1	-1.5	0	0	0
16	-6.3	-11.1	-3.5	0	0	0
17	-6.1	-11.2	-5.9	0	0	0
18	-5.8	-11	-7.6	0	0	0
19	-5.6	-11.8	-9.1	0	0	0
20	-5.5	-13.1	0	0	0	0

WS RINGWOOD

Erectment of M1125 - R6272
 Blunsham Railway 29
 St 28.2.96



H Left 177 kN Single Axle: S 5t at 4500 H Right 174 kN
 V Left 206 kN V Right 235 kN

Actual ring depth 540 mm Required ring depth at crown 725 mm Geometric F.O.S. 74
 Passive pressure factor soil 1
 Masonry 20 kN/m³ Fill 18 kN/m³ Surfacing 20 kN/m³
 PHI 35 deg Material strength 3 N/mm²
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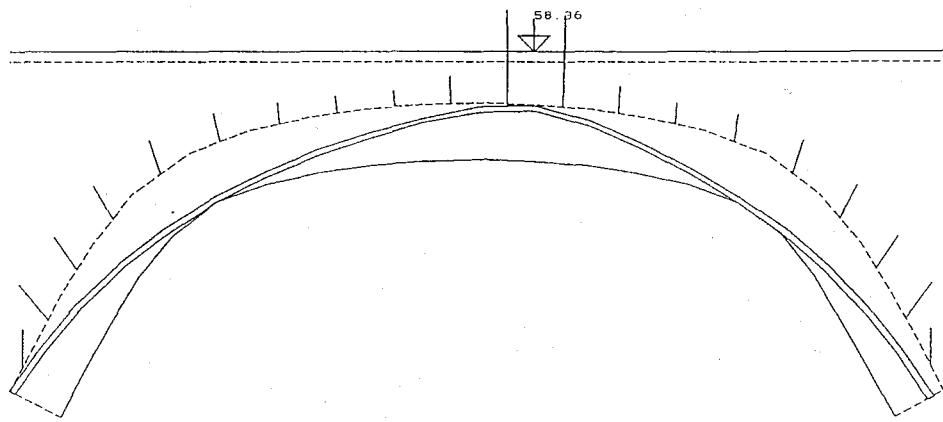
Assessment of Hwy 2 & R6272
 Blunckham Railway 20
 28.2.96

Blunt2			
Span	7950 mm	Rise	2450 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 2t at 4500		
Required ring depth	524 mm	Geometric F.O.S	1.03
H Left	115 kN/m	H Right	114 kN/m
V Left	172 kN/m	V Right	184 kN/m
Comp. zone at hinge 2	48 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 6	3 AT 12	4 AT 16

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-13.1	0	0	0	0
2	-5.6	-11.7	9.1	0	0	0
3	-5.8	-11	7.6	0	0	0
4	-6.1	-11.1	5.9	0	0	0
5	-6.3	-11.1	3.5	0	0	0
6	-6.1	-9.2	1.5	0	0	0
7	-5.8	-7	.7	0	0	0
8	-5.7	-5.8	.4	0	0	0
9	-5.7	-5.2	.2	0	0	0
10	-5.7	-4.9	.1	-4.1	0	0
11	-5.7	-4.9	-.1	-25.9	-.2	0
12	-5.7	-5.2	-.2	-24.9	-.6	0
13	-5.7	-5.8	-.4	-3.4	-.1	0
14	-5.8	-6.9	-.7	0	0	0
15	-6.1	-9.1	-1.5	0	0	0
16	-6.3	-11.1	-3.5	0	0	0
17	-6.1	-11.2	-5.9	0	0	0
18	-5.8	-11	-7.6	0	0	0
19	-5.6	-11.8	-9.1	0	0	0
20	-5.5	-13.1	0	0	0	0

WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0N

Project	Assessment of A14/A146	Job ref	86272
Part of Structure	Blunt2 on Railway	Calc. by	131
Drawing ref		Date	28.2.96
		Check by	



H Left 114 kN
V Left 171 kN

Single Axle: 2t at 4500

H Right 113 kN
V Right 163 kN

Actual ring depth 540 mm Required ring depth at crown 524 mm Geometric F.O.S 1.03

Passive pressure factor soil 1

Masonry 20 kN/m³

Fill 18 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

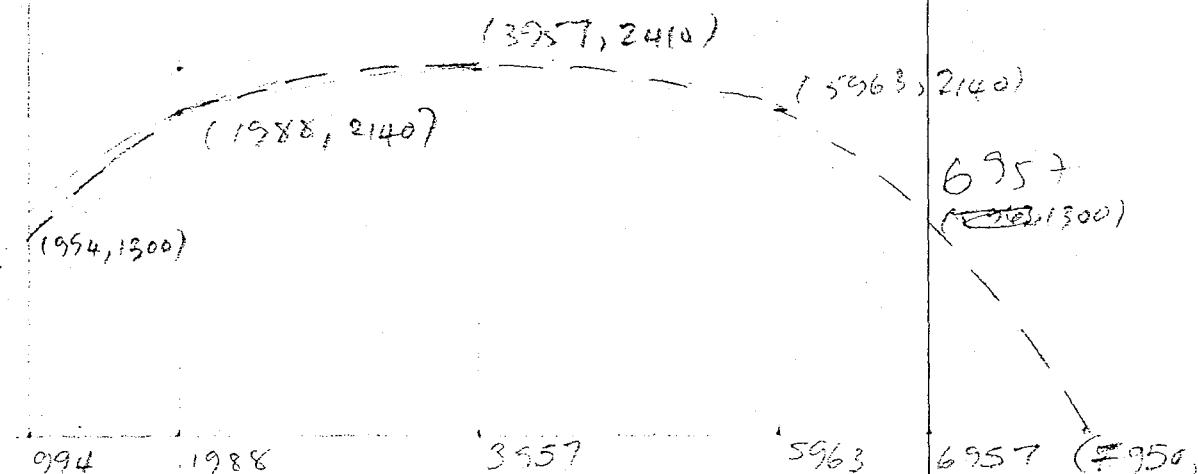
Material strength 3 N/mm²

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W.S. ATKINS, WELBROOK COURT, CIRENCESTER, GLASSON

Project	<i>Reinforced concrete</i>	R627
Part of Structure	<i>Bridgeman Railway</i>	Calc sheet no 100
Drawing ref	St	1321
Calc by	Date 28.2.96	Check by Date

Project	ASSESSMENT OF H/WAY ST.		Job ref	BC 6272/80L	
Part of structure	BLUNTISHAM RAILWAY		Calc sheet no'	rev 1331	
Drawing ref	Calc by el	Date 28.2.96	Check by	Date	
Ref	Calculations		Output		



Scale 1:50

BLUNT 3
[East - Right]

$$R_g = 2140$$

$$R_c = 2210$$

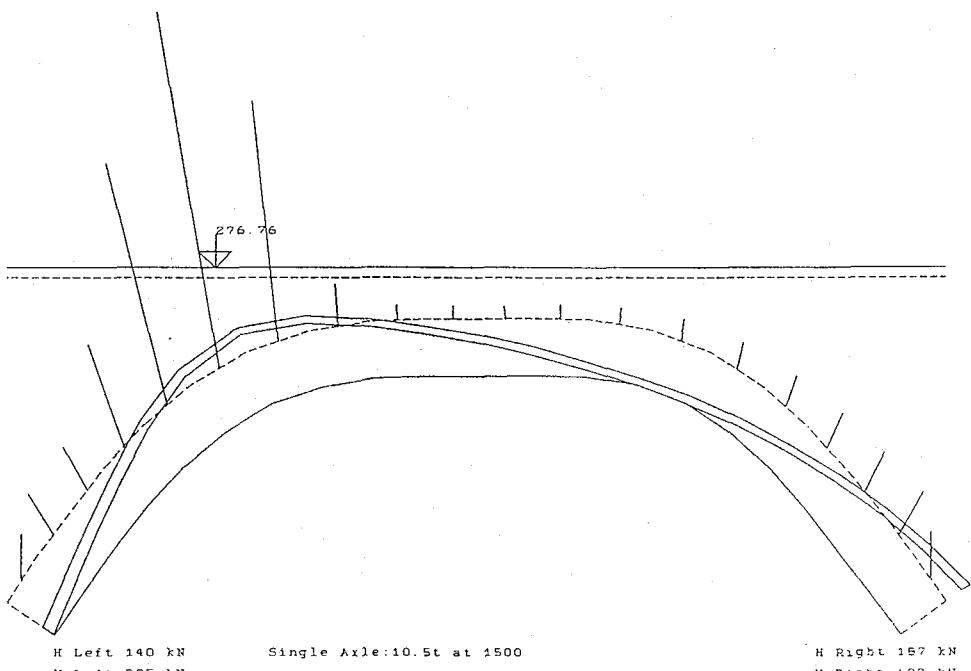
Segments = 20
Survey pts = 7
d = 540
h = 470
f = 1
g = 20
f = 18
g = 35
m = 3
part of hill = 1
depth of surface = 100
d_s = 20

Blunt3

Span	7950 mm	Rise	2410 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m^3	Masonry density	20 kN/m^3
Surfacing density	20 kN/m^3		
Phi for fill	35 deg	Masonry strength	3 N/mm^3
Load	Single Axle: 10.5t at 1500		
Required ring depth	787 mm	Geometric F.O.S	.69
H Left	140 kN/m	H Right	187 kN/m
V Left	386 kN/m	V Right	193 kN/m
Comp. zone at hinge 2	74 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 7	3 AT 14	4 AT 21

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.4	-15.2	0	0	0	0
2	-5.5	-13.7	8.2	0	0	0
3	-5.6	-12.3	6.7	-1.8	.6	0
4	-5.6	-11.3	5.2	-21.8	6.4	0
5	-5.8	-10.2	3.7	-68.1	15.7	0
6	-5.9	-8.9	2.3	-106.2	17.3	0
7	-5.9	-7.2	1.1	-70.8	6.7	0
8	-5.8	-5.8	.4	-8.1	.3	0
9	-5.6	-4.9	.1	0	0	0
10	-5.4	-4.5	0	0	0	0
11	-5.4	-4.5	0	0	0	0
12	-5.6	-4.9	0	0	0	0
13	-5.9	-5.7	-.4	0	0	0
14	-6	-7.2	-1.2	0	0	0
15	-5.9	-8.8	-2.4	0	0	0
16	-5.7	-10	-3.8	0	0	0
17	-5.6	-11.2	-5.2	0	0	0
18	-5.5	-12.5	-6.7	0	0	0
19	-5.5	-14	-8	0	0	0
20	-5.4	-15.6	0	0	0	0

Assessment of Hwy 56272
 Blundsham, Ontario
 El 28.2.96



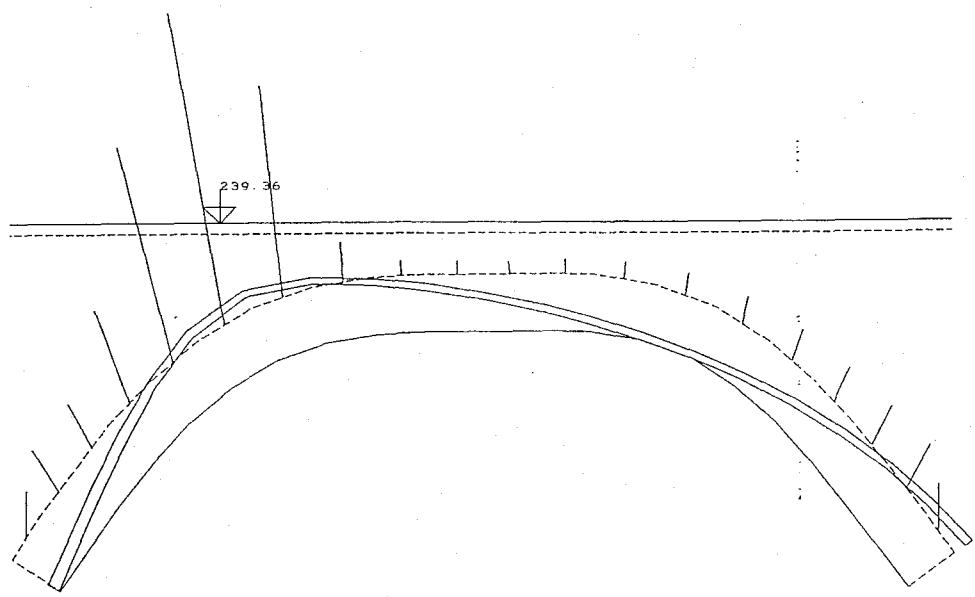
Actual ring depth 540 mm Required ring depth at crown 787 mm Geometric F.O.S. 6.9
 Passive pressure factor soil .1
 Masonry 20 kN/m³ Fill 18 kN/m³ Surfacing 20 kN/m³
 PHI 35 deg Material strength 3 N/mm²
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Assessment of Highway No R6272
 Blunsham Railway 35
 28/2/96

Blunt3			
Span	7950 mm	Rise	2410 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 9t at 1500		
Required ring depth	729 mm	Geometric F.O.S	.74 ×
H Left	130 kN/m	H Right	171 kN/m
V Left	354 kN/m	V Right	187 kN/m
Comp. zone at hinge 2	69 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 7	3 AT 14	4 AT 21

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.4	-15.2	0	0	0	0
2	-5.5	-13.7	8.2	0	0	0
3	-5.6	-12.3	6.7	-1.5	.5	0
4	-5.6	-11.3	5.2	-18.8	5.5	0
5	-5.8	-10.2	3.7	-58.9	13.6	0
6	-5.9	-8.9	2.3	-91.9	15	0
7	-5.9	-7.2	1.1	-61.2	5.8	0
8	-5.8	-5.8	.4	-7	.3	0
9	-5.6	-4.9	.1	0	0	0
10	-5.4	-4.5	0	0	0	0
11	-5.4	-4.5	0	0	0	0
12	-5.6	-4.9	0	0	0	0
13	-5.9	-5.7	-.4	0	0	0
14	-6	-7.2	-1.2	0	0	0
15	-5.9	-8.8	-2.4	0	0	0
16	-5.7	-10	-3.8	0	0	0
17	-5.6	-11.2	-5.2	0	0	0
18	-5.5	-12.5	-6.7	0	0	0
19	-5.5	-14	-8	0	0	0
20	-5.4	-15.6	0	0	0	0

Assessment of Highway Str 26272
 Blunsdon Railway 36
 28.2.96



H Left 130 kN
V Left 354 kN

Single Axle 9t at 1500

H Right 170 kN
V Right 186 kN

Actual ring depth 540 mm Required ring depth at crown 728 mm Geometric F.O.S .74
Passive pressure factor soil .1

Masonry 20 kN/m³

Fill 18 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

Material strength 3 N/mm²

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WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0NA

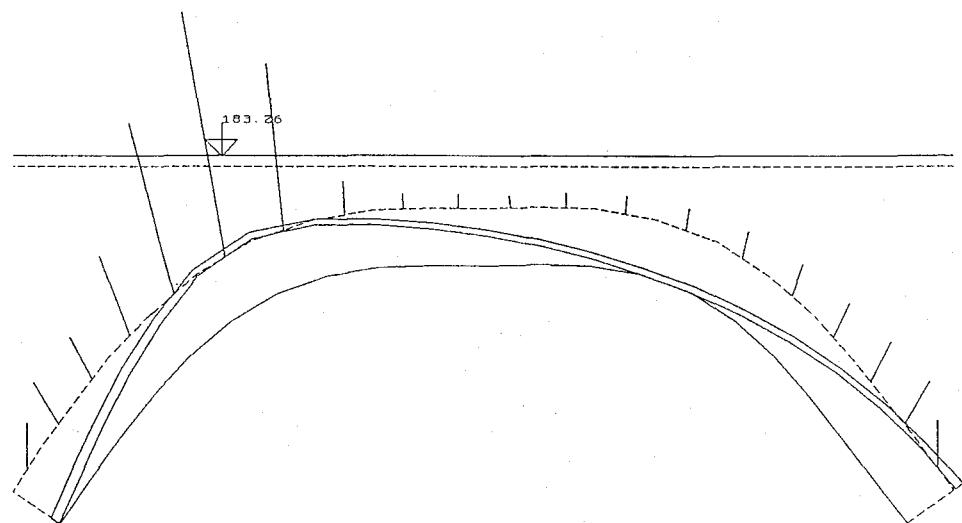
Project	Assessment of Hwy/Way Str	Job ref	R6272
Name of Structure	Bunsham Pav/Way	Calc sheet no	rev
Drawing ref	SC	Date	28.2.96
Calcd by	Check by	Date	

Blunt3			
Span	7950 mm	Rise	2410 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m^3	Masonry density	20 kN/m^3
Surfacing density	20 kN/m^3		
Phi for fill	35 deg	Masonry strength	3 N/mm^3
Load	Single Axle: 7t at 1500		
Required ring depth	626 mm	Geometric F.O.S	.86
H Left	115 kN/m	H Right	146 kN/m
V Left	307 kN/m	V Right	178 kN/m
Comp. zone at hinge 2	60 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 7	3 AT 14	4 AT 21

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.4	-15.2	0	0	0	0
2	-5.5	-13.7	8.2	0	0	0
3	-5.6	-12.3	6.7	-1.2	.4	0
4	-5.6	-11.3	5.2	-14.4	4.2	0
5	-5.8	-10.2	3.7	-45.1	10.4	0
6	-5.9	-8.9	2.3	-70.3	11.5	0
7	-5.9	-7.2	1.1	-46.9	4.4	0
8	-5.8	-5.8	.4	-5.3	.2	0
9	-5.6	-4.9	.1	0	0	0
10	-5.4	-4.5	0	0	0	0
11	-5.4	-4.5	0	0	0	0
12	-5.6	-4.9	0	0	0	0
13	-5.9	-5.7	-.4	0	0	0
14	-6	-7.2	-1.2	0	0	0
15	-5.9	-8.8	-2.4	0	0	0
16	-5.7	-10	-3.8	0	0	0
17	-5.6	-11.2	-5.2	0	0	0
18	-5.5	-12.5	-6.7	0	0	0
19	-5.5	-14	-8	0	0	0
20	-5.4	-15.6	0	0	0	0

17 NOV 1992, KELLCROOK COAST, SINKING OF THE BRIDGE

Project ref	Assessment of Hwy Str 262/92	Date
Part of Structure	Brakehouse Lane bridge	calc sheet no
Drawing ref	SC 28/2/96	rev
Calc by	Check by	Date



H Left 114 kN
V Left 306 kN

Single Axle 7t at 1500

H Right 146 kN
V Right 178 kN

Actual ring depth 540 mm Required ring depth at crown 625 mm Geometric F.O.S 66

Passive pressure factor soil 1

Masonry 20 kN/m³

Fill 18 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

Material strength 3 N/mm²

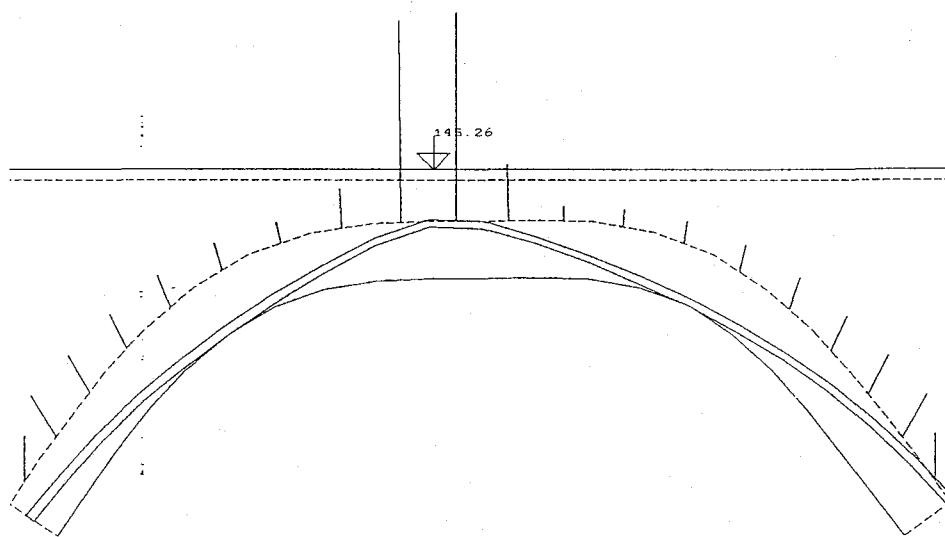
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Assessment of Holloway Str R6272
Buntingham Railway 139
SC 28.2.96

Blunt3			
Span	7950 mm	Rise	2410 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 5.5t at 3500		
Required ring depth	566 mm	Geometric F.O.S	.95
H Left	176 kN/m	H Right	177 kN/m
V Left	239 kN/m	V Right	208 kN/m
Comp. zone at hinge 2	68 mm	Factor on pass. press.	.1
Hinges			
1 AT 6	2 AT 10	3 AT 15	4 AT 21

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.4	-15.2	0	0	0	0
2	-5.5	-13.7	8.2	0	0	0
3	-5.6	-12.3	6.7	0	0	0
4	-5.6	-11.3	5.2	0	0	0
5	-5.8	-10.2	3.7	0	0	0
6	-5.9	-8.9	2.3	0	0	0
7	-5.9	-7.2	1.1	0	0	0
8	-5.8	-5.8	.4	-7.3	.3	0
9	-5.6	-4.9	.1	-60.3	.6	0
10	-5.4	-4.5	0	-63.5	0	0
11	-5.4	-4.5	0	-14.1	.1	0
12	-5.6	-4.9	0	0	0	0
13	-5.9	-5.7	-.4	0	0	0
14	-6	-7.2	-1.2	0	0	0
15	-5.9	-8.8	-2.4	0	0	0
16	-5.7	-10	-3.8	0	0	0
17	-5.6	-11.2	-5.2	0	0	0
18	-5.5	-12.5	-6.7	0	0	0
19	-5.5	-14	-8	0	0	0
20	-5.4	-15.6	0	0	0	0

Assessment of Waggon R6272
 Blenkinsop Railway 40
 28-2-96



H Left 175 kN
V Left 239 kN

Single Axle S.St at 3500

H Right 176 kN

V Right 207 kN

Actual ring depth 540 mm Required ring depth at crown 565 mm Geometric F.O.S .95
Passive pressure factor soil .1

Masonry 20 kN/m³

Fill 18 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

Material strength 3 N/mm²

C:\DOCUMENT\Blunt_D.7

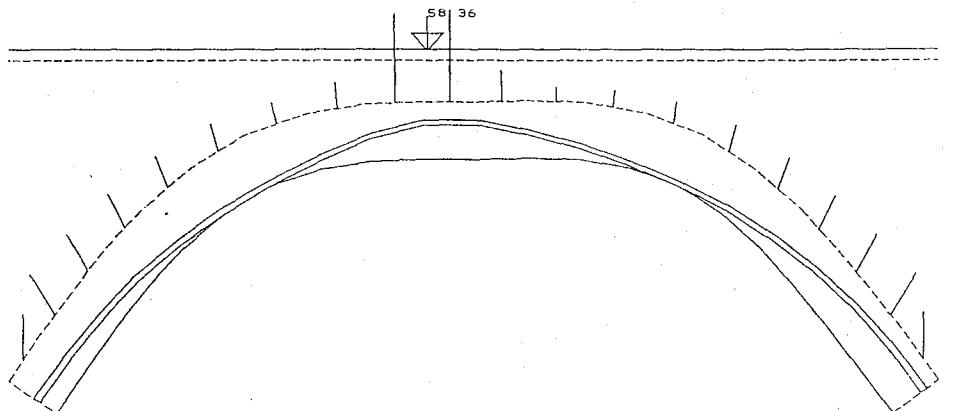
Assessment of 4, May St R6272
Bunkham Railway 41
d 28.2.96

Blunt3			
Span	7950 mm	Rise	2410 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m^3	Masonry density	20 kN/m^3
Surfacing density	20 kN/m^3		
Phi for fill	35 deg	Masonry strength	3 N/mm^3
Load	Single Axle: 2t at 3500		
Required ring depth	388 mm	Geometric F.O.S	1.39
H Left	113 kN/m	H Right	113 kN/m
V Left	187 kN/m	V Right	173 kN/m
Comp. zone at hinge 2	47 mm	Factor on pass. press.	.1
Hinges			
1 AT 6	2 AT 10	3 AT 15	4 AT 21

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.4	-15.2	0	0	0	0
2	-5.5	-13.7	8.2	0	0	0
3	-5.6	-12.3	6.7	0	0	0
4	-5.6	-11.3	5.2	0	0	0
5	-5.8	-10.2	3.7	0	0	0
6	-5.9	-8.9	2.3	0	0	0
7	-5.9	-7.2	1.1	0	0	0
8	-5.8	-5.8	.4	-2.9	.1	0
9	-5.6	-4.9	.1	-24.2	.2	0
10	-5.4	-4.5	0	-25.5	0	0
11	-5.4	-4.5	0	-5.7	0	0
12	-5.6	-4.9	0	0	0	0
13	-5.9	-5.7	-.4	0	0	0
14	-6	-7.2	-1.2	0	0	0
15	-5.9	-8.8	-2.4	0	0	0
16	-5.7	-10	-3.8	0	0	0
17	-5.6	-11.2	-5.2	0	0	0
18	-5.5	-12.5	-6.7	0	0	0
19	-5.5	-14	-8	0	0	0
20	-5.4	-15.6	0	0	0	0

WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0NA

Project	Assessment of 4 Way St	Job no.	R6272
Part of Structure	Bluntisham railway	Calc. Sh. for	142
Drawing ref	Calc by	Date	28.2.98
		Check by	



H Left 112 kN
V Left 186 kN

Single Axle 2t at 3500

H Right 113 kN
V Right 173 kN

Actual ring depth 540 mm Required ring depth at crown 387 mm Geometric F.O.S 1.39
Passive pressure factor soil 1

Masonry 20 kN/m³

Fill 18 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

Material strength 3 N/mm²

C:\DOCUMENT\Blunt_E.7

WS ATKINS, WELLBROOK CO. LTD., LONDON, ENGLAND

Project	Kingsmen Rd & New St 26272	
Ref of Structure	Blunsdon Railway	
Drawing ref	Date	Check by
	28.2.86	DM

Project ASSESSMENT OF 2 WAY STR	Job ref RC6272/804
Part of structure BRITISH RAILWAY	Calc sheet no rev 1441
Drawing ref	Calc by Date <i>L</i> 28.2.96
	Check by Date

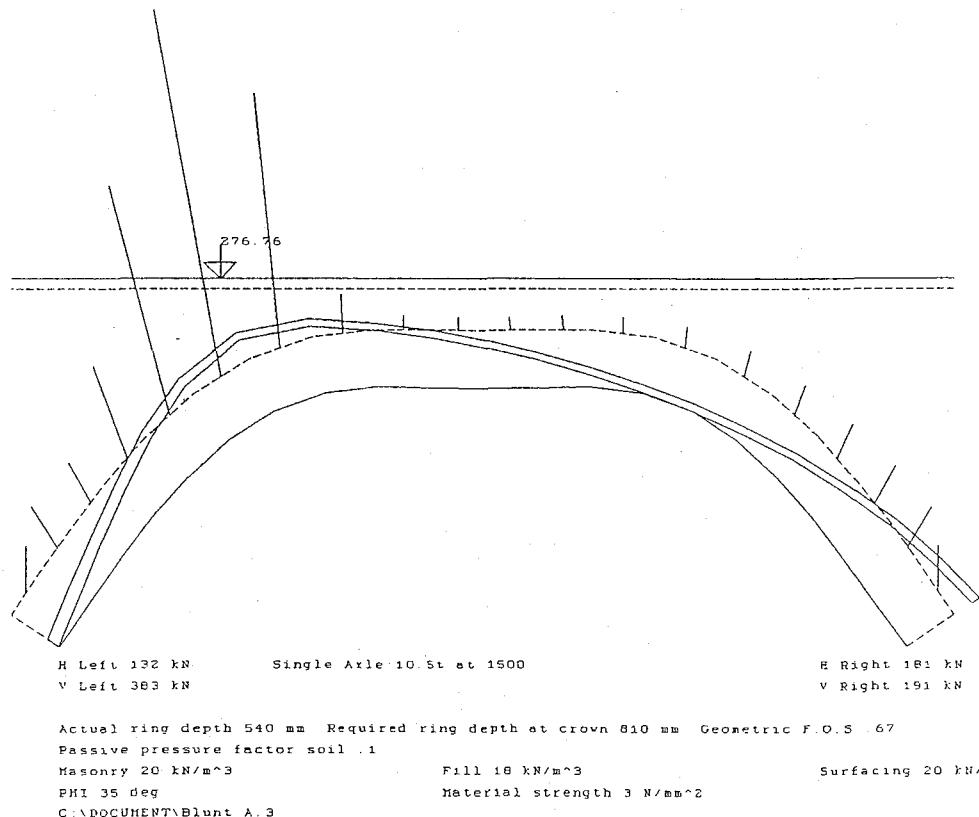
Ref	Calculations	Output																
	<p><u>Secte 1:50</u></p> <p>file name BUNT 4 (West - Left)</p> <p>Segments 20 Ne Slope 7</p> <table> <tbody> <tr><td>d</td><td>540</td></tr> <tr><td>h</td><td>490</td></tr> <tr><td>fm</td><td>20</td></tr> <tr><td>ft</td><td>18</td></tr> <tr><td>mat str</td><td>35</td></tr> <tr><td>pass h</td><td>3</td></tr> <tr><td>depth s</td><td>100</td></tr> <tr><td>s</td><td>20</td></tr> </tbody> </table>	d	540	h	490	fm	20	ft	18	mat str	35	pass h	3	depth s	100	s	20	
d	540																	
h	490																	
fm	20																	
ft	18																	
mat str	35																	
pass h	3																	
depth s	100																	
s	20																	

Blunt4

Span	7950 mm	Rise	2420 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 10.5t at 1500		
Required ring depth	811 mm	Geometric F.O.S	.67
H Left	133 kN/m	H Right	181 kN/m
V Left	383 kN/m	V Right	191 kN/m
Comp. zone at hinge 2	72 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 7	3 AT 15	4 AT 21

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-15.2	0	0	0	0
2	-5.6	-13.6	8.3	0	0	0
3	-5.6	-12.1	6.8	-1.1	.4	0
4	-5.6	-11	5.3	-18.6	5.7	0
5	-5.8	-9.9	3.8	-64.7	15.9	0
6	-6	-8.6	2.3	-109.9	19	0
7	-6.1	-7	1	-75.4	7.2	0
8	-5.9	-5.5	.3	-7.1	.2	0
9	-5.6	-4.7	0	0	0	0
10	-5.4	-4.4	-.1	0	0	0
11	-5.4	-4.4	.1	0	0	0
12	-5.6	-4.7	0	0	0	0
13	-5.9	-5.5	-.3	0	0	0
14	-6.1	-7	-1	0	0	0
15	-6	-8.6	-2.3	0	0	0
16	-5.8	-9.9	-3.8	0	0	0
17	-5.8	-11.2	-5.4	0	0	0
18	-5.6	-12.2	-6.9	0	0	0
19	-5.4	-13.2	-8.1	0	0	0
20	-5.5	-15.2	0	0	0	0

Assessment by Walter R6272
 Banksia Railways
 28.2.96

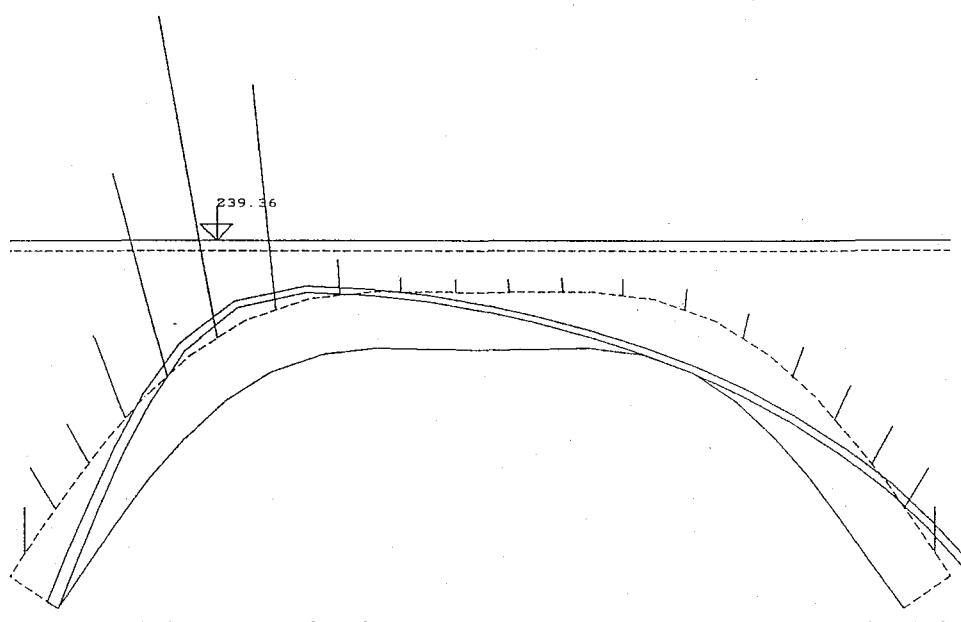


Assessment of Highway En R6272
 Blundstone Railway 46
 d/d 28.2.96

Blunt4			
Span	7950 mm	Rise	2420 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 9t at 1500		
Required ring depth	751 mm	Geometric F.O.S	.72
H Left	123 kN/m	H Right	165 kN/m
V Left	352 kN/m	V Right	185 kN/m
Comp. zone at hinge 2	67 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 7	3 AT 15	4 AT 21

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-15.2	0	0	0	0
2	-5.6	-13.6	8.3	0	0	0
3	-5.6	-12.1	6.8	-.9	.3	0
4	-5.6	-11	5.3	-16.1	4.9	0
5	-5.8	-9.9	3.8	-.56	13.7	0
6	-6	-8.6	2.3	-.95	16.4	0
7	-6.1	-7	1	-65.2	6.2	0
8	-5.9	-5.5	.3	-6.2	.2	0
9	-5.6	-4.7	0	0	0	0
10	-5.4	-4.4	-.1	0	0	0
11	-5.4	-4.4	.1	0	0	0
12	-5.6	-4.7	0	0	0	0
13	-5.9	-5.5	-.3	0	0	0
14	-6.1	-7	-1	0	0	0
15	-6	-8.6	-2.3	0	0	0
16	-5.8	-9.9	-3.8	0	0	0
17	-5.8	-11.2	-5.4	0	0	0
18	-5.6	-12.2	-6.9	0	0	0
19	-5.4	-13.2	-8.1	0	0	0
20	-5.5	-15.2	0	0	0	0

Assessment of Highway - 6272
 Blenheim Highway 47
 10/10/96



H Left 123 kN Single Axle 9t at 1500 H Right 165 kN
 V Left 351 kN V Right 185 kN

 Actual ring depth 540 mm Required ring depth at crown 750 mm Geometric F.O.S .72
 Passive pressure factor soil .1
 Masonry 20 kN/m³ Fill 18 kN/m³ Surfacing 20 kN/m³
 PHI 35 deg Material strength 3 N/mm²
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WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0NN.

Project	Assessment of Hwy 1	Job ref
Part of Structure	Blundstone Culvert	calc sheet no
Drawing ref	Calc by	Date
	SJL	28-7-82

Blunt 4

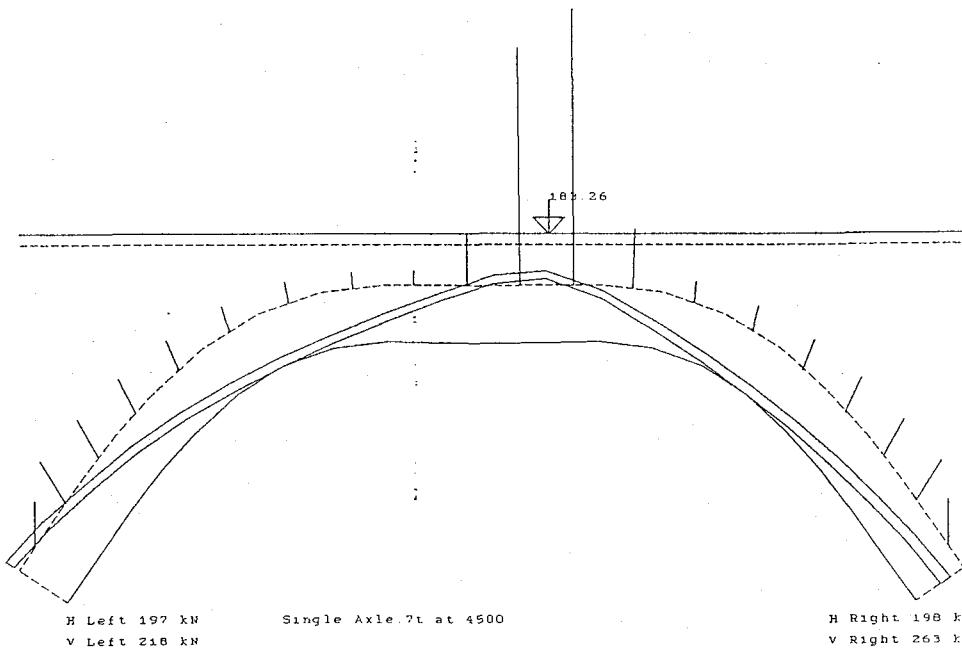
Span	7950 mm	Rise	2420 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 7t at 4500		
Required ring depth	674 mm	Geometric F.O.S	.8
H Left	198 kN/m	H Right	198 kN/m
V Left	218 kN/m	V Right	263 kN/m
Comp. zone at hinge 2	75 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 7	3 AT 12	4 AT 16

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-15.2	0	0	0	0
2	-5.6	-13.6	8.3	0	0	0
3	-5.6	-12.1	6.8	0	0	0
4	-5.6	-11	5.3	0	0	0
5	-5.8	-9.9	3.8	0	0	0
6	-6	-8.6	2.3	0	0	0
7	-6.1	-7	1	0	0	0
8	-5.9	-5.5	.3	0	0	0
9	-5.6	-4.7	0	0	0	0
10	-5.4	-4.4	-.1	-12.2	-.1	0
11	-5.4	-4.4	.1	-72.9	.6	0
12	-5.6	-4.7	0	-84.6	.2	0
13	-5.9	-5.5	-.3	-13.6	-.4	0
14	-6.1	-7	-1	0	0	0
15	-6	-8.6	-2.3	0	0	0
16	-5.8	-9.9	-3.8	0	0	0
17	-5.8	-11.2	-5.4	0	0	0
18	-5.6	-12.2	-6.9	0	0	0
19	-5.4	-13.2	-8.1	0	0	0
20	-5.5	-15.2	0	0	0	0

J S ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB8 9HE

Project No.: 1 Way SV 26272

Design of Structure	Date	Site Surveyor
Blundsham Railway	22 Dec 1996	Mr. J. S. Atkins
Planning ref.	Date	Survey by



Actual ring depth 540 mm Required ring depth at crown 674 mm Geometric F.O.S .8
 Passive pressure factor soil 1

Masonry 20 kN/m³

Fill 18 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

Material strength 3 N/mm²

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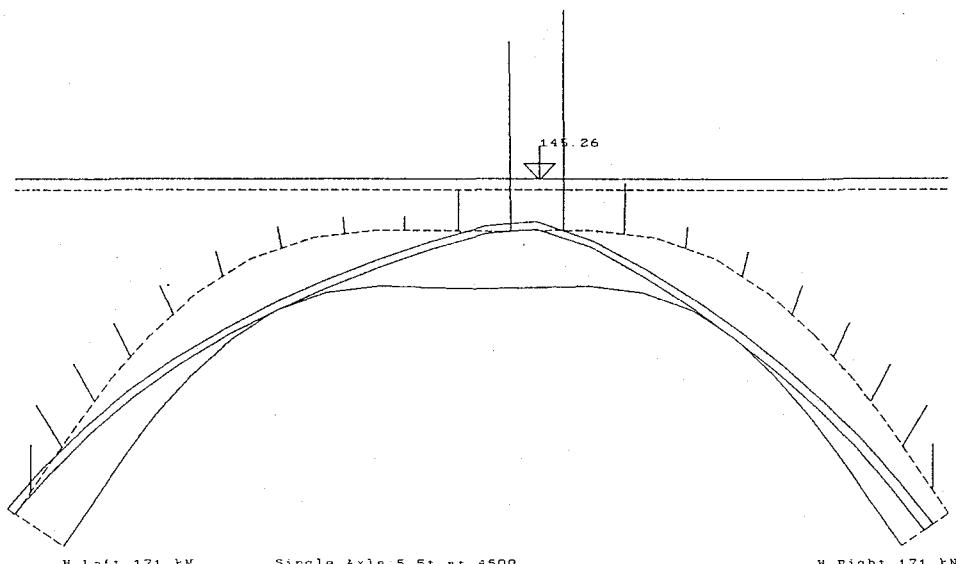
Assessment of Highway No 26272
 Blundsham Railway 50
 SC 28.2.96

Blunt4

Span	7950 mm	Rise	2420 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 5.5t at 4500		
Required ring depth	616 mm	Geometric F.O.S	.88
H Left	171 kN/m	H Right	172 kN/m
V Left	204 kN/m	V Right	240 kN/m
Comp. zone at hinge 2	66 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 7	3 AT 12	4 AT 16

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-15.2	0	0	0	0
2	-5.6	-13.6	8.3	0	0	0
3	-5.6	-12.1	6.8	0	0	0
4	-5.6	-11	5.3	0	0	0
5	-5.8	-9.9	3.8	0	0	0
6	-6	-8.6	2.3	0	0	0
7	-6.1	-7	1	0	0	0
8	-5.9	-5.5	.3	0	0	0
9	-5.6	-4.7	0	0	0	0
10	-5.4	-4.4	-.1	-9.6	-.1	0
11	-5.4	-4.4	.1	-57.8	.4	0
12	-5.6	-4.7	0	-67.1	.2	0
13	-5.9	-5.5	-.3	-10.8	-.4	0
14	-6.1	-7	-1	0	0	0
15	-6	-8.6	-2.3	0	0	0
16	-5.8	-9.9	-3.8	0	0	0
17	-5.8	-11.2	-5.4	0	0	0
18	-5.6	-12.2	-6.9	0	0	0
19	-5.4	-13.2	-8.1	0	0	0
20	-5.5	-15.2	0	0	0	0

Assessment of Masonry 88272
 Blundell Railway 51
 d. 28.2.96



H Left 171 kN Single Axle 5.5t at 4500
V Left 203 kN

H Right 171 kN
V Right 239 kN

Actual ring depth 540 mm Required ring depth at crown 616 mm Geometric F.O.S .88

Passive pressure factor soil .1

Masonry 20 kN/m³

Fill 16 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

Material strength 3 N/mm²

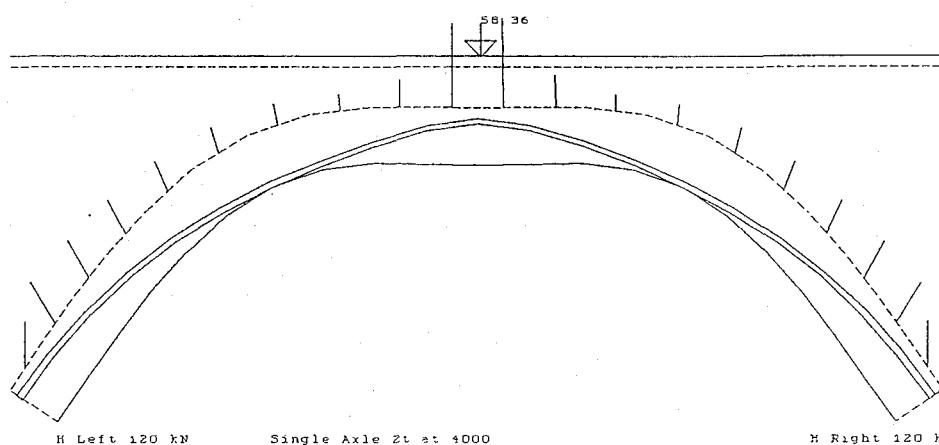
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Assessment of Highway on R6272
Blennishan railway 52
d 28.2.96

Blunt4				
Span	7950 mm	Rise	2420 mm	
Depth of fill	490 mm	Depth of surfacing	100 mm	
Ring depth	540 mm	Ring depth factor	1	
Position of backing	1	Depth of mortar loss	0 mm	
Fill density	18 kN/m^3	Masonry density	20 kN/m^3	
Surfacing density	20 kN/m^3			
Phi for fill	35 deg	Masonry strength	3 N/mm^3	
Load	Single Axle: 2t at 4000			
Required ring depth	441 mm	Geometric F.O.S	1.22	
H Left	121 kN/m	H Right	121 kN/m	
V Left	178 kN/m	V Right	179 kN/m	
Comp. zone at hinge 2	49 mm	Factor on pass. press.	.1	
Hinges				
1 AT 1	2 AT 7	3 AT 11	4 AT 15	

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.5	-15.2	0	0	0	0
2	-5.6	-13.6	8.3	0	0	0
3	-5.6	-12.1	6.8	0	0	0
4	-5.6	-11	5.3	0	0	0
5	-5.8	-9.9	3.8	0	0	0
6	-6	-8.6	2.3	0	0	0
7	-6.1	-7	1	0	0	0
8	-5.9	-5.5	.3	0	0	0
9	-5.6	-4.7	0	-4.2	0	0
10	-5.4	-4.4	-.1	-23.4	-.2	0
11	-5.4	-4.4	.1	-25	.2	0
12	-5.6	-4.7	0	-5.7	0	0
13	-5.9	-5.5	-.3	0	0	0
14	-6.1	-7	-1	0	0	0
15	-6	-8.6	-2.3	0	0	0
16	-5.8	-9.9	-3.8	0	0	0
17	-5.8	-11.2	-5.4	0	0	0
18	-5.6	-12.2	-6.9	0	0	0
19	-5.4	-13.2	-8.1	0	0	0
20	-5.5	-15.2	0	0	0	0

Assessment of Blunsham R6272
 Blunsham Railway 53
 Sl 282.86



H Left 120 kN Single Axle Zt at 4000
V Left 177 kN

H Right 120 kN
V Right 178 kN

Actual ring depth 540 mm Required ring depth at crown 441 mm Geometric F 0.5 1.22

Passive pressure factor soil .1

Masonry 20 kN/m³

Fill 18 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

Material strength 3 N/mm²

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WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0NA

Project	Assessment of Highway		Job ref	26272
Part of Structure	Blunshay Railway		Calc sheet no	154
Drafter ref	Date	28/2/98	Check by	Dave
Calcs				

WS/Atkins

(- upto 16 March)
- alt methods

Project	Job ref	
ASSESSMENT OF HIGHWAY STR.	BC 6272 / 80L	
Part of structure	Calc sheet no	rev
BLUNTISHAM RAILWAY	1551	
Drawing ref	Calc by	Date
	<i>sl</i>	28-2-96
Check by	Date	

Ref	Calculations	Output																								
	<p>ARCHIE ASSESSMENT (West - Right).</p> <p>To Scale 1:50</p> <p>Dimensions in BLUNT 5</p> <table><tbody><tr><td>Ground level</td><td>20</td></tr><tr><td>1st Layer soil</td><td>7</td></tr><tr><td>d</td><td>540</td></tr><tr><td>h</td><td>490</td></tr><tr><td>Slopes</td><td>1</td></tr><tr><td>PM</td><td>20</td></tr><tr><td>PS</td><td>18</td></tr><tr><td>PS</td><td>20</td></tr><tr><td>Material strip</td><td>3</td></tr><tr><td>Soil of</td><td>1</td></tr><tr><td>depth of surf</td><td>100</td></tr><tr><td>Pd</td><td>20</td></tr></tbody></table>	Ground level	20	1st Layer soil	7	d	540	h	490	Slopes	1	PM	20	PS	18	PS	20	Material strip	3	Soil of	1	depth of surf	100	Pd	20	
Ground level	20																									
1st Layer soil	7																									
d	540																									
h	490																									
Slopes	1																									
PM	20																									
PS	18																									
PS	20																									
Material strip	3																									
Soil of	1																									
depth of surf	100																									
Pd	20																									

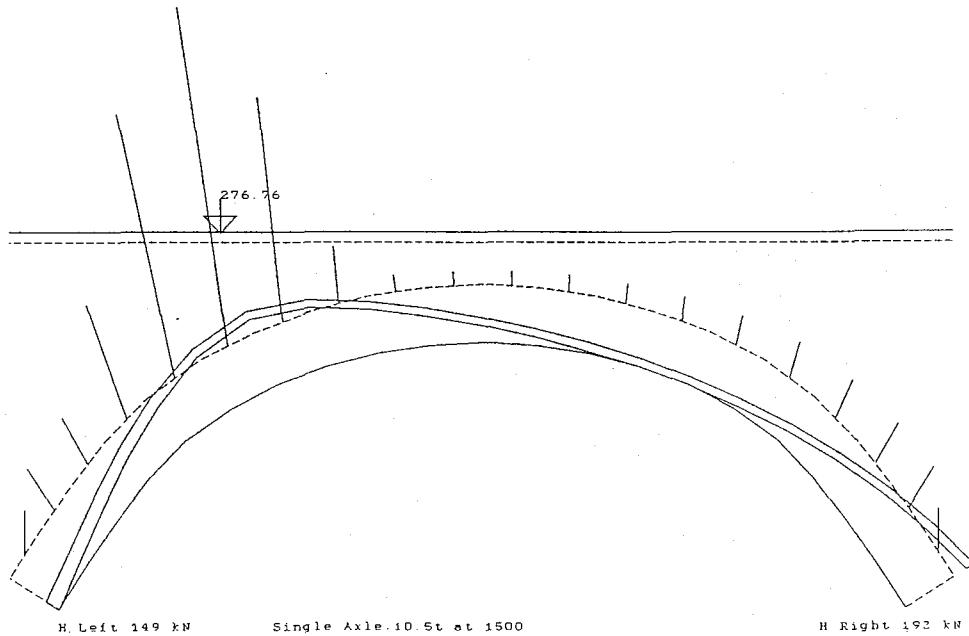
Blunt5			
Span	7950 mm	Rise	2500 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 10.5t at 1500		
Required ring depth	746 mm	Geometric F.O.S	.72
H Left	149 kN/m	H Right	192 kN/m
V Left	392 kN/m	V Right	199 kN/m
Comp. zone at hinge 2	76 mm	Factor on pass. press.	.1

Hinges
 1 AT 1 2 AT 7 3 AT 14 4 AT 21

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.4	-14.9	0	0	0	0
2	-5.5	-13.6	8.6	0	0	0
3	-5.6	-12.9	7.3	-2.4	.9	0
4	-5.8	-12.6	5.6	-24.5	6.9	0
5	-5.9	-11.7	3.7	-73.3	14.6	0
6	-5.8	-9.8	2.1	-100	13.7	0
7	-5.7	-7.9	1.2	-64.5	6.5	0
8	-5.7	-6.5	.7	-12.1	.8	0
9	-5.7	-5.6	.3	0	0	0
10	-5.7	-5.1	.1	0	0	0
11	-5.7	-5.1	-.1	0	0	0
12	-5.7	-5.6	-.3	0	0	0
13	-5.7	-6.5	-.7	0	0	0
14	-5.7	-7.9	-1.2	0	0	0
15	-5.8	-9.8	-2.1	0	0	0
16	-5.9	-11.7	-3.7	0	0	0
17	-5.8	-12.6	-5.6	0	0	0
18	-5.6	-12.9	-7.3	0	0	0
19	-5.5	-13.6	-8.6	0	0	0
20	-5.4	-14.9	0	0	0	0

ATKINS, WELLBROOK COURT, CIRTON, CAMBS. CB3 0NA

Assessment of Highway 26272
 Blundell's Quarry 156
 28.2.96



H Left 149 kN Single Axle 10 St at 1500
V Left 392 kN

H Right 192 kN
V Right 199 kN

Actual ring depth 540 mm Required ring depth at crown 746 mm Geometric F.O.S .72

Passive pressure factor soil .1

Masonry 20 kN/m³

PHI 35 deg

C:\DOCUMENT\Blunt_A3

Fill 16 kN/m³

Material strength 3 N/mm²

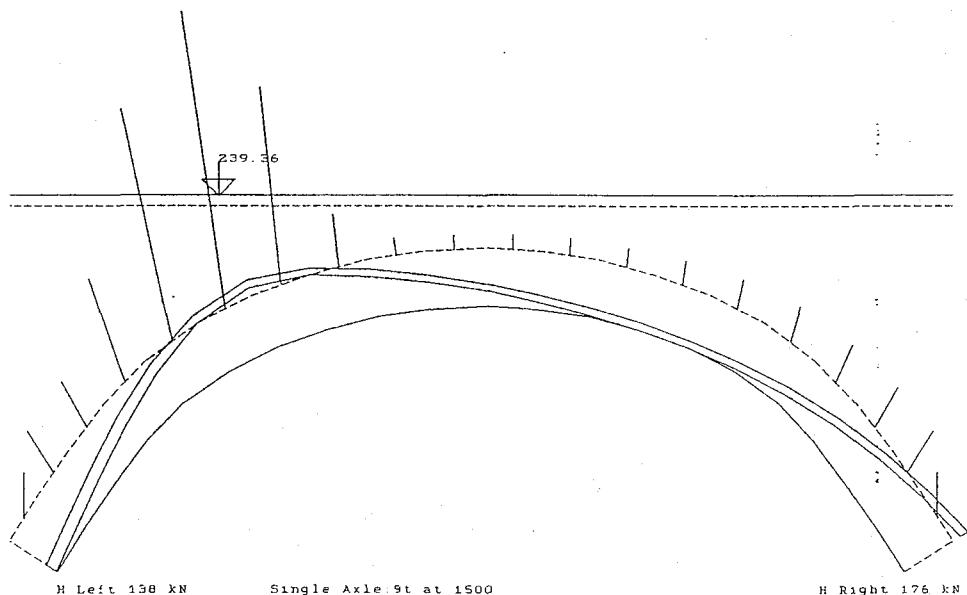
Surfacing 20 kN/m³

*Assessment of Highway 34 26252
Blunsham Railway St
Sc. 28.2.96*

Blunt5			
Span	7950 mm	Rise	2500 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 9t at 1500		
Required ring depth	689 mm	Geometric F.O.S	.78
H Left	139 kN/m	H Right	176 kN/m
V Left	361 kN/m	V Right	193 kN/m
Comp. zone at hinge 2	71 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 7	3 AT 14	4 AT 21

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.4	-14.9	0	0	0	0
2	-5.5	-13.6	8.6	0	0	0
3	-5.6	-12.9	7.3	-2.1	.8	0
4	-5.8	-12.6	5.6	-21.2	6	0
5	-5.9	-11.7	3.7	-63.4	12.6	0
6	-5.8	-9.8	2.1	-86.5	11.9	0
7	-5.7	-7.9	1.2	-55.7	5.6	0
8	-5.7	-6.5	.7	-10.5	.7	0
9	-5.7	-5.6	.3	0	0	0
10	-5.7	-5.1	.1	0	0	0
11	-5.7	-5.1	-.1	0	0	0
12	-5.7	-5.6	-.3	0	0	0
13	-5.7	-6.5	-.7	0	0	0
14	-5.7	-7.9	-1.2	0	0	0
15	-5.8	-9.8	-2.1	0	0	0
16	-5.9	-11.7	-3.7	0	0	0
17	-5.8	-12.6	-5.6	0	0	0
18	-5.6	-12.9	-7.3	0	0	0
19	-5.5	-13.6	-8.6	0	0	0
20	-5.4	-14.9	0	0	0	0

Assessment of Blunt5 R6272
 Dunsham Railway 58
 £ 382.96



H Left 138 kN
V Left 360 kN

Single Axle St at 1500

H Right 176 kN
V Right 193 kN

Actual ring depth 540 mm Required ring depth at crown 689 mm Geometric F.O.S .78
Passive pressure factor soil .1

Masonry 20 kN/m³

Fill 18 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

Material strength 3 N/mm²

C:\DOCUMENT\Blunt_B.3

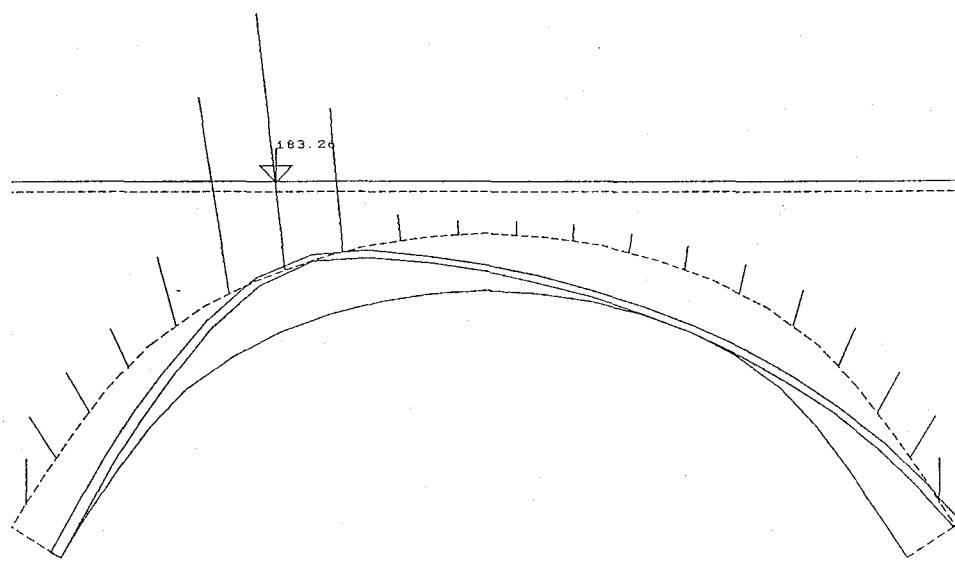
Assessment of Highway No 26272
Buntham Railway 59
d/c 28.2.96

Blunt5				
Span				
Depth of fill	7950 mm	Rise		2500 mm
Ring depth	490 mm	Depth of surfacing		100 mm
Position of backing	540 mm	Ring depth factor		1
	1	Depth of mortar loss		0 mm
Fill density				
Surfacing density	18 kN/m ³	Masonry density		20 kN/m ³
	20 kN/m ³			
Phi for fill	35 deg	Masonry strength		3 N/mm ³
Load				
Required ring depth	Single Axle: 7t at 2000			
H Left	594 mm	Geometric F.O.S		.91 ✓
V Left	144 kN/m	H Right		164 kN/m
Comp. zone at hinge 2	305 kN/m	V Right		193 kN/m
	64 mm	Factor on pass. press.		.1
Hinges				
1 AT 1				
	2 AT 8		3 AT 15	4 AT 21

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.4	-14.9	0	0	0	0
2	-5.5	-13.6	8.6	0	0	0
3	-5.6	-12.9	7.3	0	0	0
4	-5.8	-12.6	5.6	0	0	0
5	-5.9	-11.7	3.7	-10.9	2.2	0
6	-5.8	-9.8	2.1	-54	7.4	0
7	-5.7	-7.9	1.2	-75.1	7.5	0
8	-5.7	-6.5	.7	-40.2	2.8	0
9	-5.7	-5.6	.3	-3	.1	0
10	-5.7	-5.1	.1	0	0	0
11	-5.7	-5.1	-.1	0	0	0
12	-5.7	-5.6	-.3	0	0	0
13	-5.7	-6.5	-.7	0	0	0
14	-5.7	-7.9	-1.2	0	0	0
15	-5.8	-9.8	-2.1	0	0	0
16	-5.9	-11.7	-3.7	0	0	0
17	-5.8	-12.6	-5.6	0	0	0
18	-5.6	-12.9	-7.3	0	0	0
19	-5.5	-13.6	-8.6	0	0	0
20	-5.4	-14.9	0	0	0	0

WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0NA

Project	Assessment for 11/Jan/S	Job ref	86272
Part of Structure	Blunshane Railtrack	calc shear stress	160
Running ref	Date	Check by	DLW
	16/12/96		



H Left 143 kN Single Axle 7t at 2000
V Left 304 kN

H Right 163 kN
V Right 193 kN

Actual ring depth 540 mm Required ring depth at crown 594 mm Geometric F.O.S .91
Passive pressure factor soil 1

Masonry 20 kN/m³
PHI 35 deg

Fill 18 kN/m³
Material strength 3 N/mm²

Surfacing 20 kN/m³

C:\DOCUMENT\Blunt_C 4

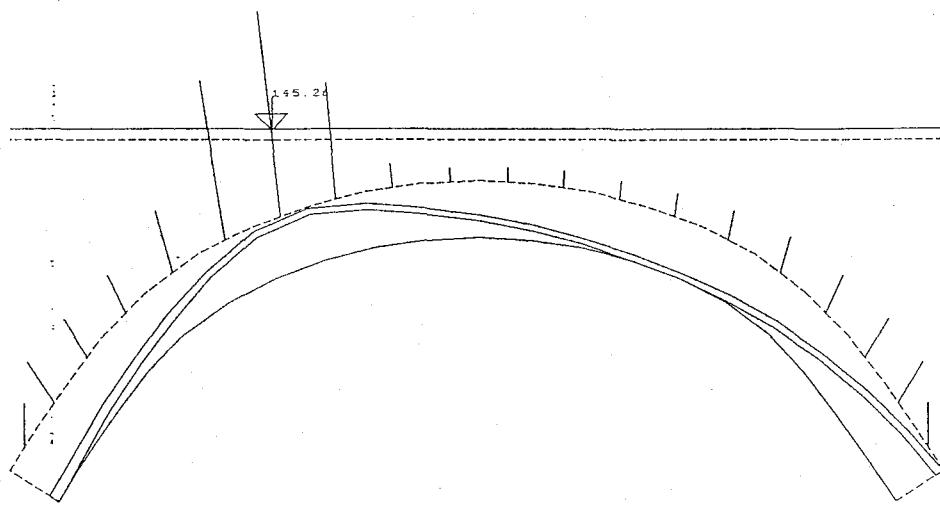
ASSESSMENT BY MR. JAMES CERONA

Assessment of bridge at 26272
Blunton railway 61
K 282.96

Blunt 5			
Span	7950 mm	Rise	2500 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 5.5t at 2000		
Required ring depth	518 mm	Geometric F.O.S	1.04 ✓
H Left	128 kN/m	H Right	144 kN/m
V Left	274 kN/m	V Right	185 kN/m
Comp. zone at hinge 2	58 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 8	3 AT 15	4 AT 21

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.4	-14.9	0	0	0	0
2	-5.5	-13.6	8.6	0	0	0
3	-5.6	-12.9	7.3	0	0	0
4	-5.8	-12.6	5.6	0	0	0
5	-5.9	-11.7	3.7	-8.6	1.7	0
6	-5.8	-9.8	2.1	-42.8	5.9	0
7	-5.7	-7.9	1.2	-59.6	6	0
8	-5.7	-6.5	.7	-31.8	2.2	0
9	-5.7	-5.6	.3	-2.4	.1	0
10	-5.7	-5.1	.1	0	0	0
11	-5.7	-5.1	-.1	0	0	0
12	-5.7	-5.6	-.3	0	0	0
13	-5.7	-6.5	-.7	0	0	0
14	-5.7	-7.9	-1.2	0	0	0
15	-5.8	-9.8	-2.1	0	0	0
16	-5.9	-11.7	-3.7	0	0	0
17	-5.8	-12.6	-5.6	0	0	0
18	-5.6	-12.9	-7.3	0	0	0
19	-5.5	-13.6	-8.6	0	0	0
20	-5.4	-14.9	0	0	0	0

Assessment of 4 New St 26272
 Bunkham Railway 62
 All 28.2.98



H Left 128 kN
V Left 274 kN

Single Axle: 5.5t at 2000

H Right 144 kN
V Right 185 kN

Actual ring depth 540 mm Required ring depth at crown 518 mm Geometric F.O.S 1.04
Passive pressure factor soil .1

Masonry 20 kN/m³

Fill 18 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

Material strength 3 N/mm²

C:\DOCUMENT\Blunt_D.4

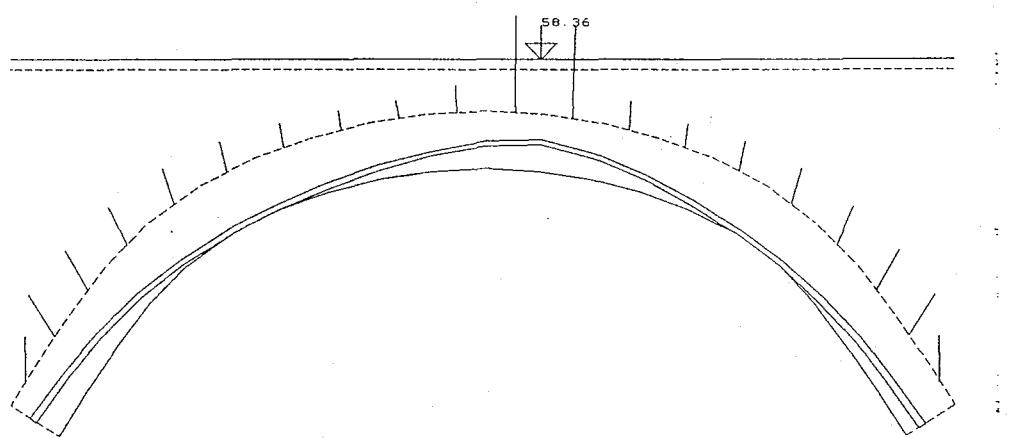
Assessment of +1/Way SR 26272
Blunham Railway 63
CC 28-2-96

Blunt5			
Span	7950 mm	Rise	2500 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	540 mm	Ring depth factor	1
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20 kN/m ³
Surfacing density	20 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 2t at 4500		
Required ring depth	300 mm	Geometric F.O.S	1.8
H Left	113 kN/m	H Right	112 kN/m
V Left	180 kN/m	V Right	192 kN/m
Comp. zone at hinge 2	48 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 6	3 AT 12	4 AT 17

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.4	-14.9	0	0	0	0
2	-5.5	-13.6	8.6	0	0	0
3	-5.6	-12.9	7.3	0	0	0
4	-5.8	-12.6	5.6	0	0	0
5	-5.9	-11.7	3.7	0	0	0
6	-5.8	-9.8	2.1	0	0	0
7	-5.7	-7.9	1.2	0	0	0
8	-5.7	-6.5	.7	0	0	0
9	-5.7	-5.6	.3	0	0	0
10	-5.7	-5.1	.1	-4.2	.1	0
11	-5.7	-5.1	-.1	-26.4	-.3	0
12	-5.7	-5.6	-.3	-24.5	-.1	0
13	-5.7	-6.5	-.7	-3.1	-.2	0
14	-5.7	-7.9	-1.2	0	0	0
15	-5.8	-9.8	-2.1	0	0	0
16	-5.9	-11.7	-3.7	0	0	0
17	-5.8	-12.6	-5.6	0	0	0
18	-5.6	-12.9	-7.3	0	0	0
19	-5.5	-13.6	-8.6	0	0	0
20	-5.4	-14.9	0	0	0	0

WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB2 8NN

Project	Assessment of Blunt5		Date
Part of Structure	Blunt5 Stage 1		Calc by
Drawing ref	Calc by	Date	Check by Date



H Left 113 kN
V Left 180 kN

Single Axle: Zt at 4500

H Right 111 kN
V Right 192 kN

Actual ring depth 540 mm Required ring depth at crown 300 mm Geometric F.O.S 1.8
Passive pressure factor soil .1

Masonry 20 kN/m³

Fill 18 kN/m³

Surfacing 20 kN/m³

PHI 35 deg

Material strength 3 N/mm²

C:\DOCUMENT\Blunt_E.9

WE WORKING WELL WITHIN OURSELF, GIVING & GAINING. C.H.C.C.N.

Assessment of 1/10/2012 26272			
Part of Structure	Date	Calculated by	Check by Date
Bluntnham Railway	1651	6/8/08	6/8/08
Drawing ref			

Assessment of H/Way St
Bluntsham Reservoir

R6272

Part of structure

Calc sheet no rev
1671

Drawing ref

Calc by

Date

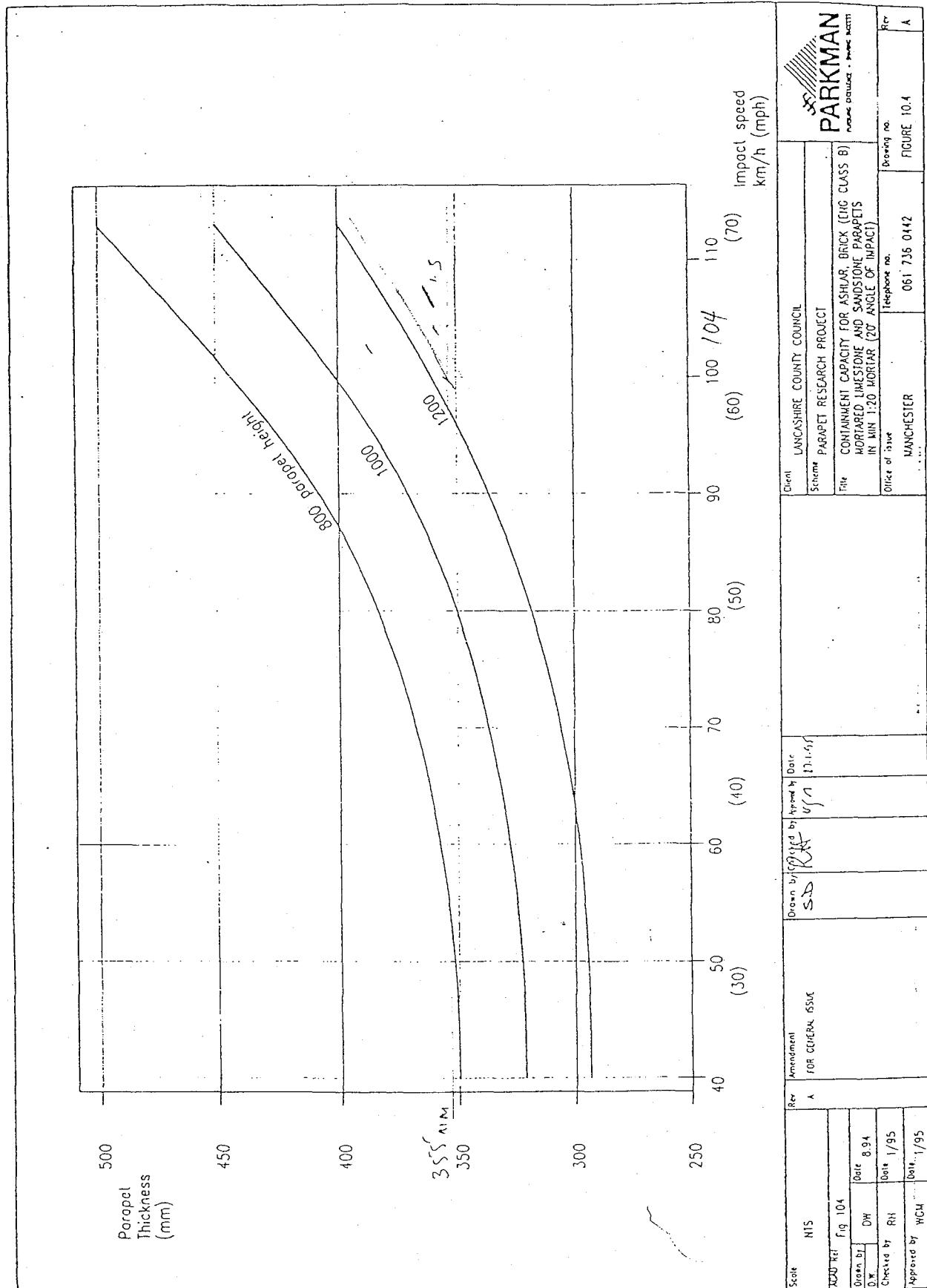
SL 7-3-26

Check by

Date

See Maxx

Ref	Calculations	Output
	<p>Ref. C85 Guidance Note:-</p> <p>"The assessment and design of unenclosed moving vehicle parapets."</p> <p><u>Parapet type</u></p> <p>Bioch parapet; cracking; spalling; efflorescence; mortar loss; subsidence; unsightly protection; vegetation growth.</p> <p><u>Parapet height</u> East = 1.3m West = 1.2m</p> <p><u>Parapet thickness</u> East = 355mm and 580mm plastered West = 345mm</p> <p><u>Impact speed</u> and 585mm plastered from figure 10.4 : EAST</p> <p>Impact speed = 104 km/h Traffic speed on road = <u>64</u> km/h</p> <p><u>Impact speed</u> WEST = 101.5 km/h Traffic speed on road = <u>64</u> km/h</p>	



Amend No.0

51

January 1995

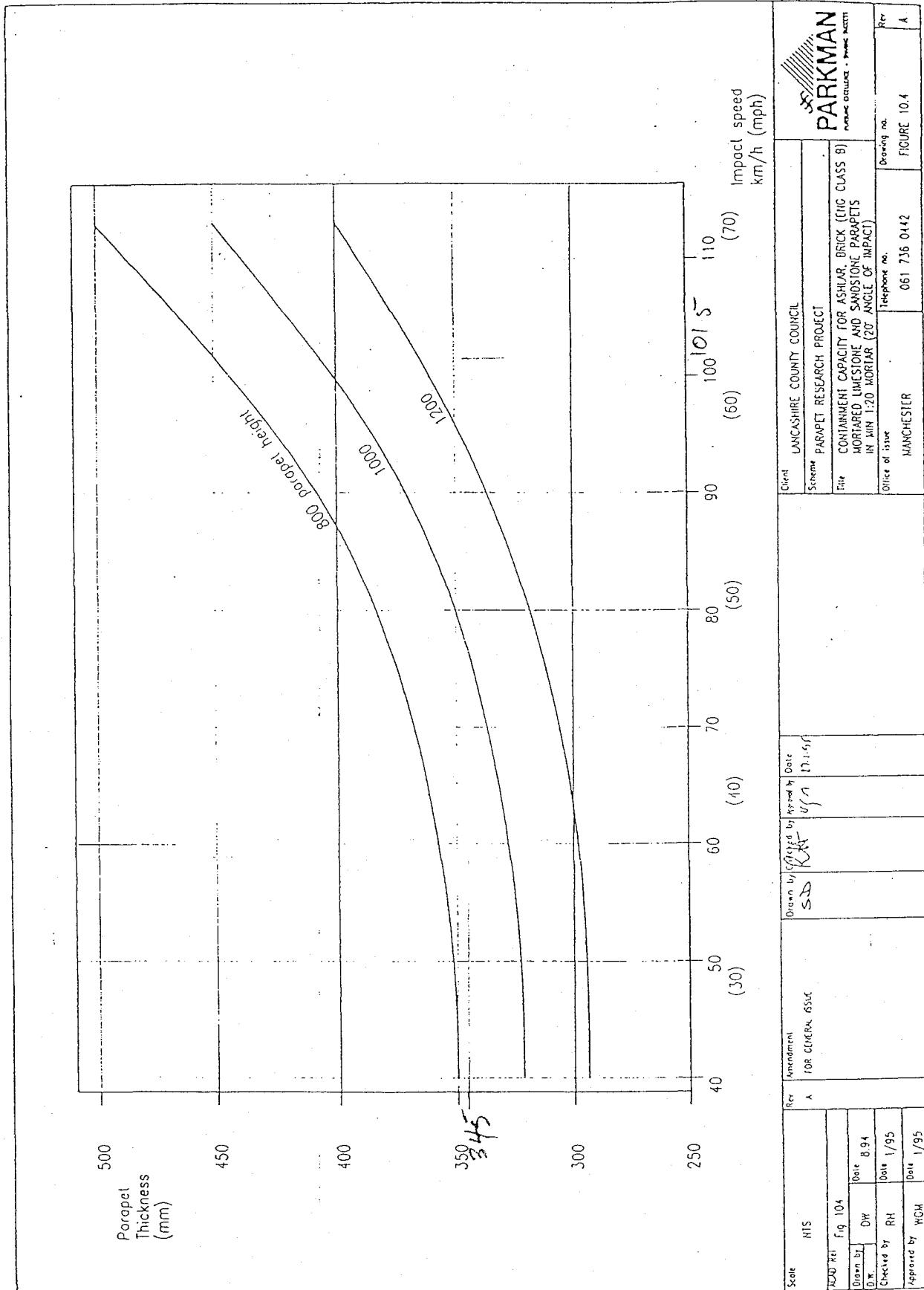
Ref.	N15	Rev.	A	Amendment	Drawn by	Checked by	Date
1000 Ref. fig 104				FOR CERTIFICATION	S.D.	R.H.	17.1.95
Drawn by	DW	Date	8.94				
Checked by	RH	Date	1/95				
Approved by	WCH	Date	1/95				
Client	LANCASHIRE COUNTY COUNCIL	Scheme	PARAPET RESEARCH PROJECT	Title	CONTAINMENT CAPACITY FOR ASHLAR, BRICK (INC CLASS B) MORTARED LIMESTONE AND SANDSTONE PARAPETS IN 1:10 MORTAR (20° ANGLE OF IMPACT)		
Office of	MANCHESTER	Telephone no.	061 736 0142	Drawing no.	FIGURE 104	For	A

68
OBB Mex 96

BK CANT / STRENGTH • ENGLIST

69

066 M/xx 96



Amend No.0

51

January 1995

Scale	NIS	Rev	Amendment	Drawn by	Checked by	Date	Client
1:20 R.R.	Fig 104	A	FOR CEMENT ISSUE	S.D.	K.K.	4/7/95	LANCASHIRE COUNTY COUNCIL
Drawn by	DW						Scheme: PARAPET RESEARCH PROJECT
Checked by	RH						Title: CONTAINMENT CAPACITY FOR ASHLAR, BRICK (ENG. CLASS B) MORTARED LIMESTONE AND SANDSTONE PARAPETS IN 1:20 MORTAR (20 DEGREE OF IMPACT)
Approved by	WCH						Office of Site: MANCHESTER Telephone no.: 061 736 0142 Drawing no.: FIGURE 104 Rev A

BLUNTMAN : WEST

Ref	Calculations	Output
	<p><u>Summary of PARAPET assessment</u></p> <p>Providing the parapet defects are rectified, as detailed in the Principal Inspection, the parapets are capable of resisting the impact loading for the speed of the road</p>	

LIVE LOAD

Lane width = 2.5 m
 Condition Factor = 1.5

CEU Loading Description	Axe Weight	Conversion factor	Conver-	Factored Load	Factored Load	Condition
			Unfactored Load	x1.5	x1.1x1.5	Factored Load
NO LIFT OFF						
Single axle 10.5 t	10.5	1.8	74	111	122	183
Twin axle bogie 16.3 t 1.02 m spread	8.15	1.8	58	86	95	142
	8.15	1.0	32	48	53	79
Twin axle bogie 20.3 t 1.85 m spread	10.15	1.8	72	107	118	177
	10.15	1.0	40	60	66	98
Triple axle bogie 18 t 1.40 m spread	6	1.0	24	35	39	58
	6	1.8	42	64	70	105
	6	1.0	24	35	39	58
Triple axle bogie 22.5 t 2.70 m spread	7.5	1.0	29	44	49	73
	7.5	1.8	53	79	87	131
	7.5	1.0	29	44	49	73

EC Loading Description	Axe Weight	Conversion factor	Conver-	Factored Load	Factored Load	Condition
			Unfactored Load	x1.5	x1.1x1.5	Factored Load
NO LIFT OFF						
Single axle 11.5 t	11.5	1.8	81	122	134	201
Twin axle bogie 16 t 1.0 m spread	8	1.8	56	85	93	140
	8	1.0	31	47	52	78
Twin axle bogie 18 t 1.3 m spread	9	1.8	64	95	105	157
	9	1.0	35	53	58	87
Twin axle bogie 20 t 1.80 m spread	10	1.8	71	106	116	175
	10	1.0	39	59	65	97
Triple axle bogie 24 t 2.60 m spread	8	1.0	31	47	52	78
	8	1.8	56	85	93	140
	8	1.0	31	47	52	78

RESTRICTED ASSESSMENT LIVE LOADINGS	Axe Weight	Conversion factor	Conver-	Factored Load	Factored Load	Condition
			Unfactored Load	x1.5	x1.1x1.5	Factored Load
NO LIFT OFF						
Single axle 10.5 t	10.5	1.8	74	111	122	
Single axle 9 t	9	1.8	64	95	105	
Single axle 7 t	7	1.8	49	74	81	
Single axle 5.5 t	5.5	1.8	39	58	64	
Single axle 2 t	2	1.8	14	21	23	

Sl.05

So

1.35 x 1.1

(From the Oxford Office)

HS 4.7.2	Assessment of Highway PTR	R6272
Blundell Road bridge	Date by	Check by
1.0m spread	Date	Check

General load will be
as original flat, without
any lateral deflection
or 16 factors applied
unless arches are tested
and to be calculated as
permanent loads

1.0m spread
226.76 used in
239.36 arches
163.26 addition
145.86
58.36

WS ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB3 0NQ

Project	<i>Assessment of Hwy for</i>		Job ref
Part of Structure	<i>Bluntisham Railway</i>		calc sheet no rev
Drawing ref	Calcs by	Date	Check by Date

MEXE Assessment of Bluntisham Railway Bridge

	AVERAGE	WEST ELEVATION		EAST ELEVATION	
		left	right	left	right
Clear span parallel to principle axis of arch	L	7.95	7.95	7.95	7.95
Rise of arch barrel at crown	Rc	2.45	2.42	2.5	2.45
Rise of arch barrel at quarter points	Rq	2.17	2.21	2.09	2.22
Thickness of arch barrel adjacent to keystone	d	0.65	0.65	0.65	0.65
Average depth of fill	h	0.38	0.38	0.38	0.38
<u>MODIFYING FACTORS</u>					
Span/Rise Ratio	Fsr	3.2	3.3	3.2	3.3
Span/Rise Factor	1	1	1	1	1
Rq/Rc Ratio	Fp	0.89	0.91	0.84	0.91
Profile Factor	Fb	0.63	0.53	0.78	0.56
Barrel Factor	Ff	1.20	1.20	1.20	1.20
Fill Factor	Fm	0.70	0.70	0.70	0.70
Material Factor	Fj	1.02	1.02	1.02	1.02
Joint Factor	Fc	0.81	0.81	0.81	0.81
Condition Factor	PAL	0.8	0.8	0.8	0.8
PROVISIONAL AXLE LOAD		53.02	53.02	53.02	53.02
MODIFIED AXLE FACTOR		21.84	18.51	27.12	19.41
<u>PERMITTED GROSS AXLE AND BOGIE WEIGHT</u>					
Single Axle Factor	1.52	1.52	1.52	1.52	1.52
2 axle bogie factor	1	1	1	1	1
3 axle bogie factor	0.92	0.92	0.92	0.92	0.92
Single axle - permitted weight	33.19	28.14	41.23	29.50	32.80
2 axle bogie - permitted weight	21.84	18.51	27.12	19.41	21.58
3 axle bogie - permitted weight	20.09	17.03	24.95	17.85	19.85
WEIGHT RESTRICTION REQUIREMENTS	NONE	NONE	NONE	NONE	NONE

Project

ASSESSMENT OF HIGHWAY STR

Part of structure

BLUNTISHAM RAILWAY

Job ref

BC 6272/804

Calc sheet no rev

C111

Drawing ref

Calc by Date

el

28.2.96

Check by Date

PBB

28.2.96

Ref

Calculations

7.3.96

Output

AVERAGE ASSESSMENT 1 : Averaged Co-ordinates

(3975, 2450)

(5963, 2170)

(1588, 2170)

* (994, 1600)

(6957, 1500)

(0)0)

(7950,

TO SCALE 1:50

Co-ordinates

Filename: - BLUNT

estimated 2 further co-ordinates

(994, 1500) and (6957, 1500)

segments 20

n-survey pt 7

1 survey pt 8

ring thickness (d) 540 - 650

cover, (h) 490 - 380

factor 23

masonry self weight 20 - 20.6

fill 18

masonry eff 35

post or fill 3

depth of surface 1

surface density 200

22.5

From Structurel
Report

falls, changing to

BA16 193

spall => q. soft

- how to do

mortar strength

arches.

Blunt			
Span	7950 mm	Rise	2450 mm
Depth of fill	380 mm	Depth of surfacing	100 mm
Ring depth	650 mm	Ring depth factor	1.23
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20.3 kN/m
Surfacing density	22 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 10.5t at 5000		
Required ring depth	721 mm	Geometric F.O.S	.9
H Left	262 kN/m	H Right	253 kN/m
V Left	253 kN/m	V Right	359 kN/m
Comp. zone at hinge 2	97 mm	Factor on pass. press.	.1

Hinges

1 AT 1	2 AT 6	3 AT 13	4 AT 17
--------	--------	---------	---------

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-8.1	-14.9	0	0	0	0
2	-8	-13.3	8.2	0	0	0
3	-7.9	-12.3	6.9	0	0	0
4	-8.1	-11.8	5.4	0	0	0
5	-8.1	-10.8	3.3	0	0	0
6	-7.8	-8.5	1.6	0	0	0
7	-7.4	-6.4	.8	0	0	0
8	-7.2	-5	.3	0	0	0
9	-7	-4.3	.1	0	0	0
10	-6.9	-3.9	0	0	0	0
11	-6.9	-3.9	0	-20.3	-.1	0
12	-7	-4.3	-.1	-136.5	-2.7	0
13	-7.2	-5	-.3	-113.2	-4.9	0
14	-7.4	-6.4	-.8	-6.7	-.5	0
15	-7.8	-8.5	-1.6	0	0	0
16	-8.1	-10.8	-3.3	0	0	0
17	-8.1	-11.8	-5.4	0	0	0
18	-7.9	-12.3	-6.9	0	0	0
19	-8	-13.3	-8.2	0	0	0
20	-8.1	-14.9	0	0	0	0

J.G. ATKINS, WELLBROOK COURT, GIRTON, CAMBS. CB2

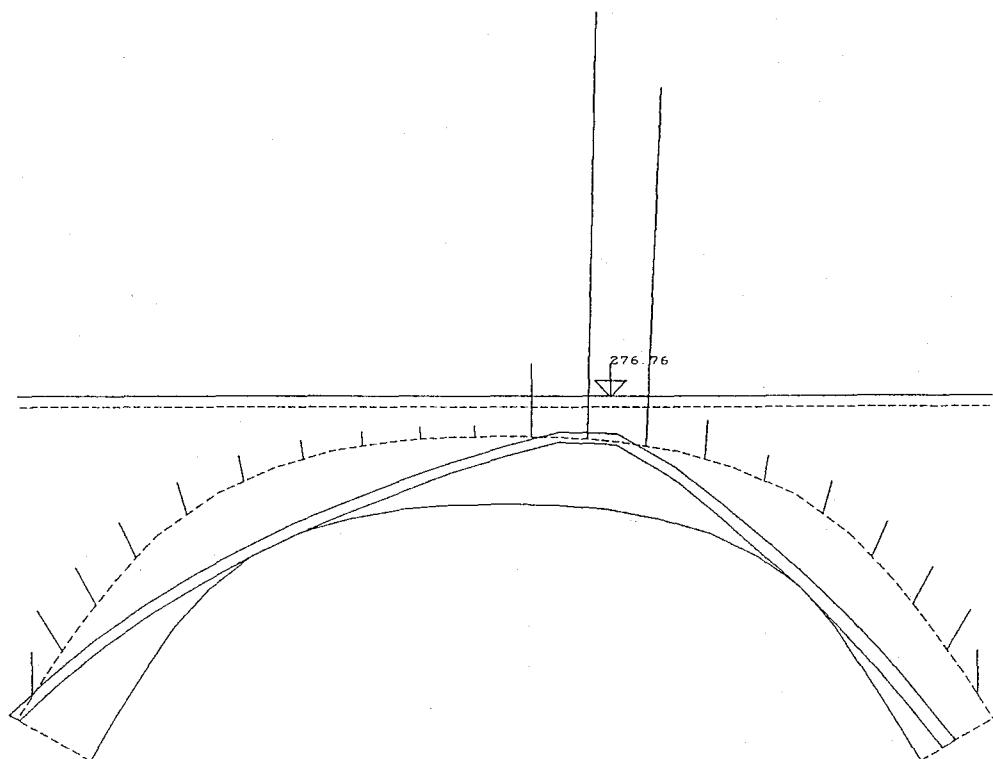
Assessment of Blunt Wall R6272

Structure

Blunt Wall Ref C 93

F.M. F.O.S = 0.9
to negotiate

Drawing ref	Calc'd by	Date	Sign
BL	RC	22.7.96 DB	He 96



H Left 261 kN Single Axle 10 St at 5000 H Right 253 kN
 V Left 253 kN V Right 358 kN

Actual ring depth 650 mm Required ring depth at crown 720 mm Geometric F.O.S 9
 Passive pressure factor soil 1
 Masonry 20.3 kN/m³ Fall 18 kN/m³ Surfacing 22 kN/m³
 PHI 35 deg Material strength 3 N/mm²
 C:\DOCUMENT\Blunt_A.10

O'Connor & Associates R6272

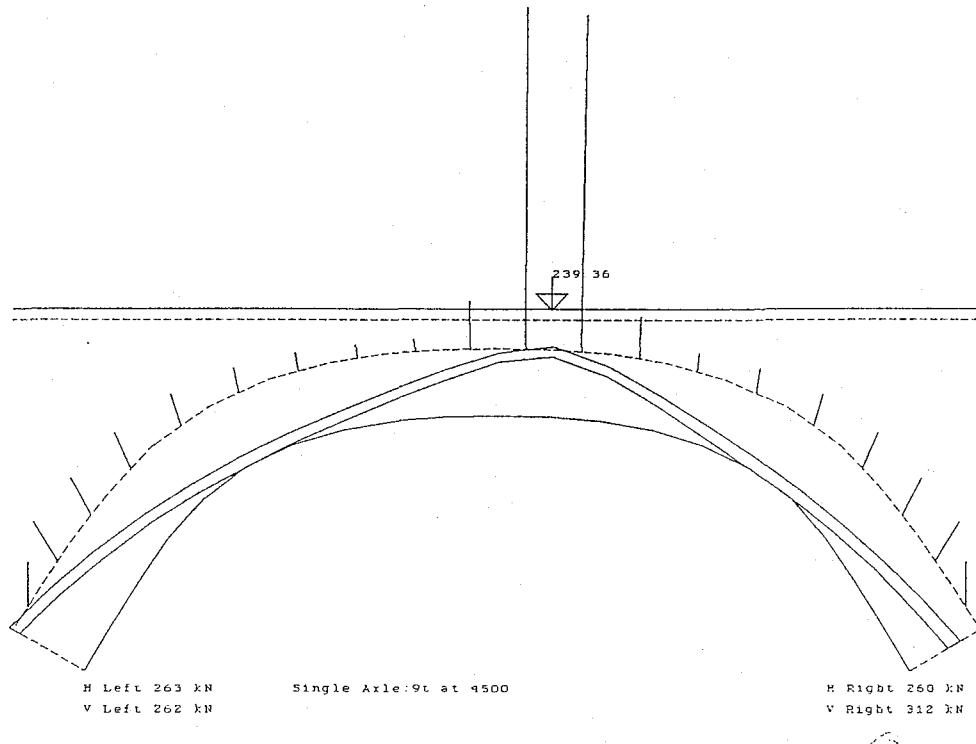
Blundstone Roadwork C 70

12-3-95 086 Mack

Blunt				
Span	7950 mm	Rise		2450 mm
Depth of fill	380 mm	Depth of surfacing		100 mm
Ring depth	650 mm	Ring depth factor		1.23
Position of backing	1	Depth of mortar loss		0 mm
Fill density	18 kN/m ³	Masonry density		20.3 kN/m
Surfacing density	22 kN/m ³			
Phi for fill	35 deg	Masonry strength		3 N/mm ³
Load	Single Axle: 9t at 4500			
Required ring depth	683 mm	Geometric F.O.S		.95
H Left	264 kN/m	H Right		261 kN/m
V Left	262 kN/m	V Right		312 kN/m
Comp. zone at hinge 2	97 mm	Factor on pass. press.		.1
Hinges				
1 AT 1	2 AT 6	3 AT 12	4 AT 16	

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-8.1	-14.9	0	0	0	0
2	-8	-13.3	8.2	0	0	0
3	-7.9	-12.3	6.9	0	0	0
4	-8.1	-11.8	5.4	0	0	0
5	-8.1	-10.8	3.3	0	0	0
6	-7.8	-8.5	1.6	0	0	0
7	-7.4	-6.4	.8	0	0	0
8	-7.2	-5	.3	0	0	0
9	-7	-4.3	.1	0	0	0
10	-6.9	-3.9	0	-12.4	.1	0
11	-6.9	-3.9	0	-110	-.4	0
12	-7	-4.3	-.1	-107.8	-2.1	0
13	-7.2	-5	-.3	-9.2	-.4	0
14	-7.4	-6.4	-.8	0	0	0
15	-7.8	-8.5	-1.6	0	0	0
16	-8.1	-10.8	-3.3	0	0	0
17	-8.1	-11.8	-5.4	0	0	0
18	-7.9	-12.3	-6.9	0	0	0
19	-8	-13.3	-8.2	0	0	0
20	-8.1	-14.9	0	0	0	0

Assessment of Way for R6292
 Blantyre Road c 75
 12.3.95 DBR Merv



Actual ring depth 650 mm Required ring depth at crown 682 mm Geometric F.O.S. 1.95

Passive pressure factor soil 1

Masonry 20.3 kN/m³

PHI 35 deg

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Fill 18 kN/m³

Material strength 3 N/mm²

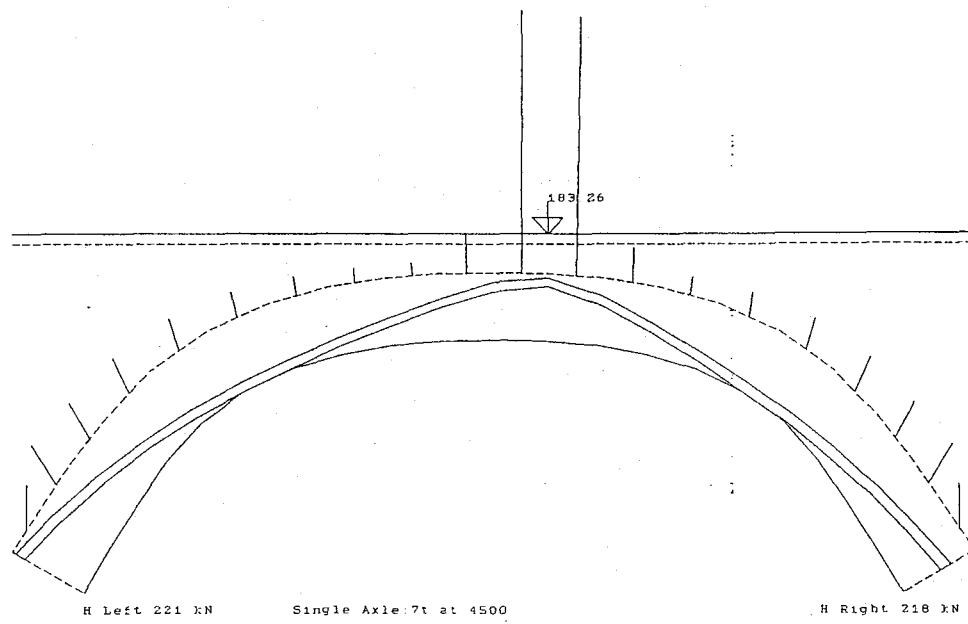
Surfacing 22 kN/m³

WATKINS, WELLBROOK POINT, GTR LONDON, ONTARIO			
Assignment # 126222			
Date Submitted: Blundell, Kenneth C. '96			
STUDYING FOR	WORKING FOR	TESTING FOR	MARKS
100%	100%	100%	100%
2.3.96 000			

Blunt			
Span	7950 mm	Rise	2450 mm
Depth of fill	380 mm	Depth of surfacing	100 mm
Ring depth	650 mm	Ring depth factor	1.23
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20.3 kN/m
Surfacing density	22 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 7t at 4500		
Required ring depth	618 mm	Geometric F.O.S	1.05
H Left	221 kN/m	H Right	219 kN/m
V Left	240 kN/m	V Right	278 kN/m
Comp. zone at hinge 2	83 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 6	3 AT 12	4 AT 16

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-8.1	-14.9	0	0	0	0
2	-8	-13.3	8.2	0	0	0
3	-7.9	-12.3	6.9	0	0	0
4	-8.1	-11.8	5.4	0	0	0
5	-8.1	-10.8	3.3	0	0	0
6	-7.8	-8.5	1.6	0	0	0
7	-7.4	-6.4	.8	0	0	0
8	-7.2	-5	.3	0	0	0
9	-7	-4.3	.1	0	0	0
10	-6.9	-3.9	0	-9.5	0	0
11	-6.9	-3.9	0	-84.2	-.3	0
12	-7	-4.3	-.1	-82.5	-1.6	0
13	-7.2	-5	-.3	-.7	-.3	0
14	-7.4	-6.4	-.8	0	0	0
15	-7.8	-8.5	-1.6	0	0	0
16	-8.1	-10.8	-3.3	0	0	0
17	-8.1	-11.8	-5.4	0	0	0
18	-7.9	-12.3	-6.9	0	0	0
19	-8	-13.3	-8.2	0	0	0
20	-8.1	-14.9	0	0	0	0

Architectural Drawing No. 86232
 Blunt Arch Bridge C-77
 Date 12-3-96 D.R. M.A. 96



H Left 221 kN Single Axle: 7t at 4500

V Left 240 kN

H Right 218 kN

V Right 270 kN

Actual ring depth 650 mm Required ring depth at crown 618 mm Geometric F 0.5 I.05
Passive pressure factor soil .1

Masonry 20.3 kN/m³

Fill 18 kN/m³

Surfacing 22 kN/m³

PHI 35 deg

Material strength 3 N/mm²

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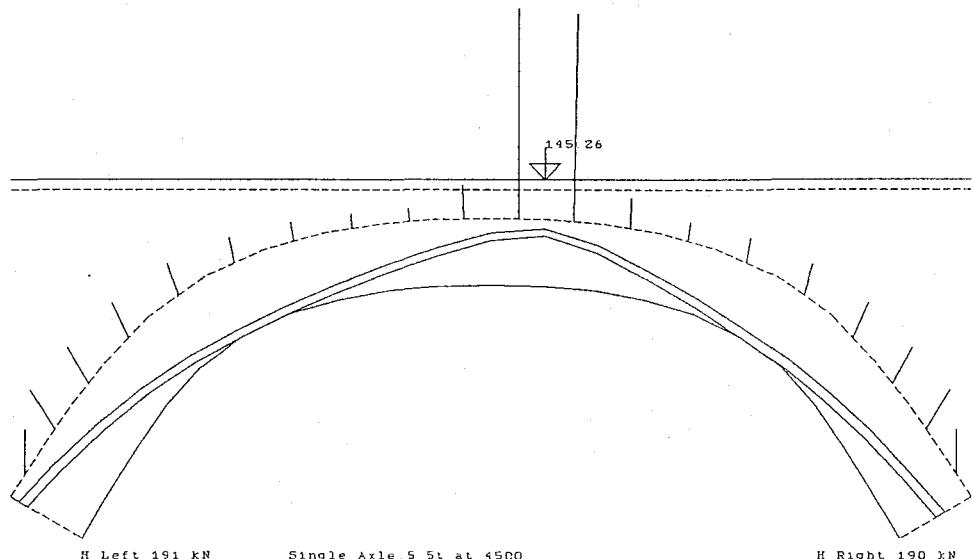
Assessment by day for R6272
Blaauwkrans Mainway C78
SL 12.3.96 WSR HJS

Blunt			
Span	7950 mm	Rise	2450 mm
Depth of fill	380 mm	Depth of surfacing	100 mm
Ring depth	650 mm	Ring depth factor	1.23
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20.3 kN/m
Surfacing density	22 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 5.5t at 4500		
Required ring depth	565 mm	Geometric F.O.S	1.15
H Left	192 kN/m	H Right	190 kN/m
V Left	225 kN/m	V Right	256 kN/m
Comp. zone at hinge 2	73 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 6	3 AT 12	4 AT 16

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-8.1	-14.9	0	0	0	0
2	-8	-13.3	8.2	0	0	0
3	-7.9	-12.3	6.9	0	0	0
4	-8.1	-11.8	5.4	0	0	0
5	-8.1	-10.8	3.3	0	0	0
6	-7.8	-8.5	1.6	0	0	0
7	-7.4	-6.4	.8	0	0	0
8	-7.2	-5	.3	0	0	0
9	-7	-4.3	.1	0	0	0
10	-6.9	-3.9	0	-7.5	0	0
11	-6.9	-3.9	0	-66.7	-.3	0
12	-7	-4.3	-.1	-65.4	-1.3	0
13	-7.2	-5	-.3	-5.6	-.2	0
14	-7.4	-6.4	-.8	0	0	0
15	-7.8	-8.5	-1.6	0	0	0
16	-8.1	-10.8	-3.3	0	0	0
17	-8.1	-11.8	-5.4	0	0	0
18	-7.9	-12.3	-6.9	0	0	0
19	-8	-13.3	-8.2	0	0	0
20	-8.1	-14.9	0	0	0	0

WS ATKINS, WELLBROOK CO. LTD. CIVIL ENGINEERS AND SURVEYORS

Estimated Weight 10272
Design Structure
Brickwork for say C 79
Quantity ref
Date 12.3.96 DSO MRE



H Left 191 kN
V Left 225 kN

Single Axle 5.5t at 4500

H Right 190 kN
V Right 255 kN

Actual ring depth 650 mm Required ring depth at crown 564 mm Geometric F.O.S 1.15
 Passive pressure factor soil 1
 Masonry 20.3 kN/m³
 PHI 35 deg
 C:\DOCUMENT\Blunt_D.9

Fill 18 kN/m³

Material strength 3 N/mm²

Surfacing 22 kN/m³

Oisemore Millway R0272
 Belvoir Country C 80
 12.3.95 DBM

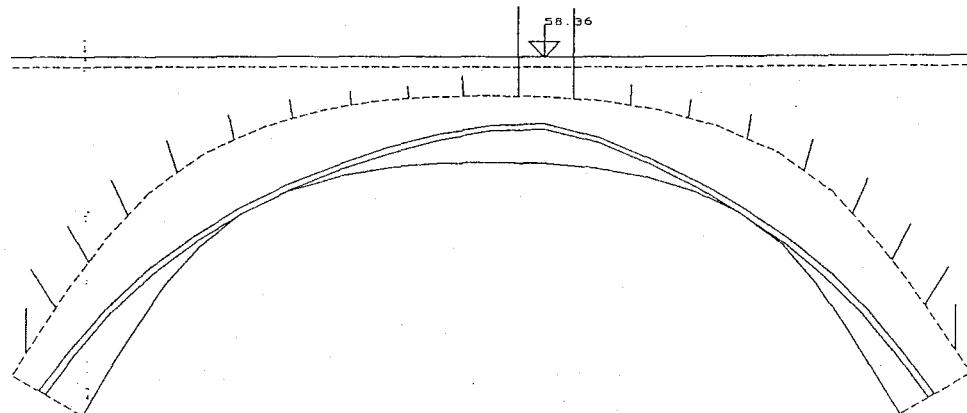
Blunt			
Span	7950 mm	Rise	2450 mm
Depth of fill	380 mm	Depth of surfacing	100 mm
Ring depth	650 mm	Ring depth factor	1.23
Position of backing	1	Depth of mortar loss	0 mm
Fill density	18 kN/m ³	Masonry density	20.3 kN/m
Surfacing density	22 kN/m ³		
Phi for fill	35 deg	Masonry strength	3 N/mm ³
Load	Single Axle: 2t at 4500		
Required ring depth	389 mm	Geometric F.O.S	1.67
H Left	123 kN/m	H Right	122 kN/m
V Left	191 kN/m	V Right	203 kN/m
Comp. zone at hinge 2	50 mm	Factor on pass. press.	.1
Hinges			
1 AT 1	2 AT 6	3 AT 12	4 AT 16

Segment	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-8.1	-14.9	0	0	0	0
2	-8	-13.3	8.2	0	0	0
3	-7.9	-12.3	6.9	0	0	0
4	-8.1	-11.8	5.4	0	0	0
5	-8.1	-10.8	3.3	0	0	0
6	-7.8	-8.5	1.6	0	0	0
7	-7.4	-6.4	.8	0	0	0
8	-7.2	-5	.3	0	0	0
9	-7	-4.3	.1	0	0	0
10	-6.9	-3.9	0	-3	0	0
11	-6.9	-3.9	0	-26.8	-.1	0
12	-7	-4.3	-.1	-26.3	-.5	0
13	-7.2	-5	-.3	-2.2	-.1	0
14	-7.4	-6.4	-.8	0	0	0
15	-7.8	-8.5	-1.6	0	0	0
16	-8.1	-10.8	-3.3	0	0	0
17	-8.1	-11.8	-5.4	0	0	0
18	-7.9	-12.3	-6.9	0	0	0
19	-8	-13.3	-8.2	0	0	0
20	-8.1	-14.9	0	0	0	0

Autumnal Bluff Rd 32

Bluffton Bluff C 81

SC RD 32 085 HALE



H Left 123 kN

Single Axle 2t at 4500

V Left 190 kN

H Right 122 kN

V Right 202 kN

Actual ring depth 650 mm Required ring depth at crown 368 mm Geometric F.O.S 1.67
Passive pressure factor soil 1

Masonry 20.3 kN/m³

Fill 18 kN/m³

Surfacing 22 kN/m³

PHI 35 deg

Material strength 3 N/mm²

C:\DOCUMENT\Blunt_E_9

Assessment of Railway 86272
Guangzhou Railway C82
SL 12-3-96 USE MM 2

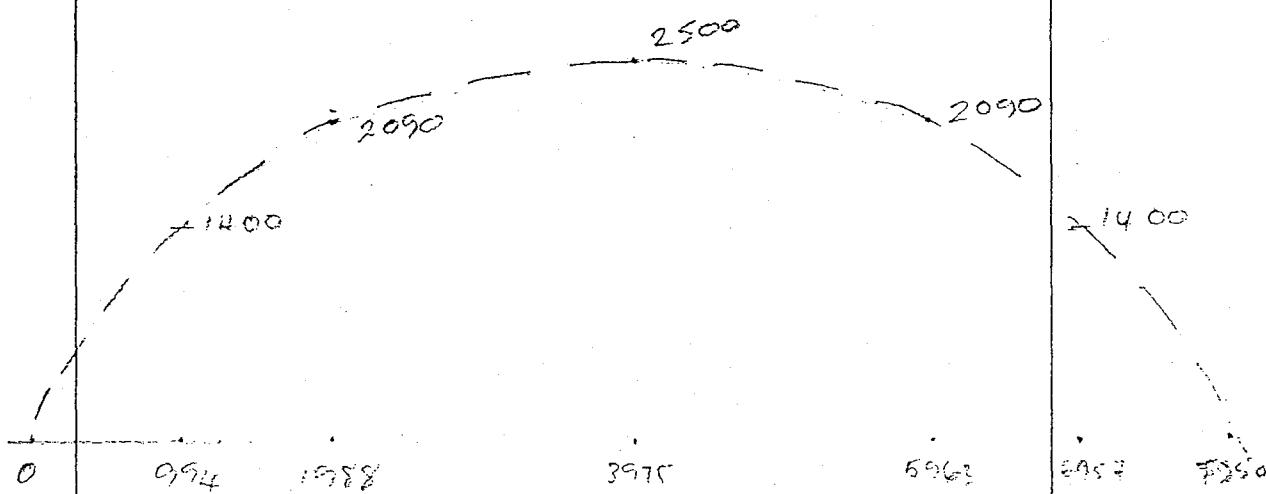
WS/Atkins

(- info to user)
(- alt. methods)

Project ASSESSMENT OF H/WAY STR.	Job ref BC 6272 / 804
Part of structure BLUNTISHAM RAILWAY	Calc sheet no rev C 581
Drawing ref	Calc by Date SL 28-2-96
	Check by Date OBB 89 MAR 96

Ref	Calculations	Output
		7-3-96

ARCHIE ASSESSMENT (West - Right).



To Scale 1:50

filename : BLINT5

Segments 20
No. Survey pts 7
d 500 650 } — train Structure /
L 490 380 } Report
Sector 1.23
Ea 20.6
Cf 18
m 30
material str 3
rest of bid 1
depth of surf 100
Pd 22.5

WS/Atkins

Project

ASSESSMENT OF HIGHWAY SUR

Job ref

BC6272/80

Part of structure

BLUNTISHAM RAILWAY

Calc sheet no rev

C 1841

Drawing ref

Calc by

Date

R

28-2-86

Check by

MSB

Date 11.6.86

Ref	Calculations	Output
	<p>(0,0) 1000 (7950, 0)</p> <p>TO SCALE 1:50</p> <p>BLUNTISHAM RAILWAY</p> <p>BLUNT 2</p> <p>[East - Left]</p>	
	<p>estimated to further co-ordinates $\therefore (994, 1650)$ and $(6957, 1650)$</p> <p>BLUNT 2</p> <p>segments 20. no 6 length pt 7</p> <p>$d = 540 = 650 \}$ - From Structural $n = 490 = 380 \}$ - Repeat $f = X = 1.23$</p> <p>From masonry of = 20 = 20.6</p> <p>All = 18</p> <p>= 35</p> <p>mat. st. = 3.</p> <p>post of 611 = 1.</p> <p>depth of foot = 100</p> <p>lev. f. = 20 = 22.5.</p>	

WS/Atkins

Project

ASSESSMENT OF H/WAY/ST.

Job ref

BC6272/804

Part of structure

BLUNTISHAM RAILWAY

Calc sheet no. rev

C 1051

Drawing ref

Calc by
LL

Date

28.2.96

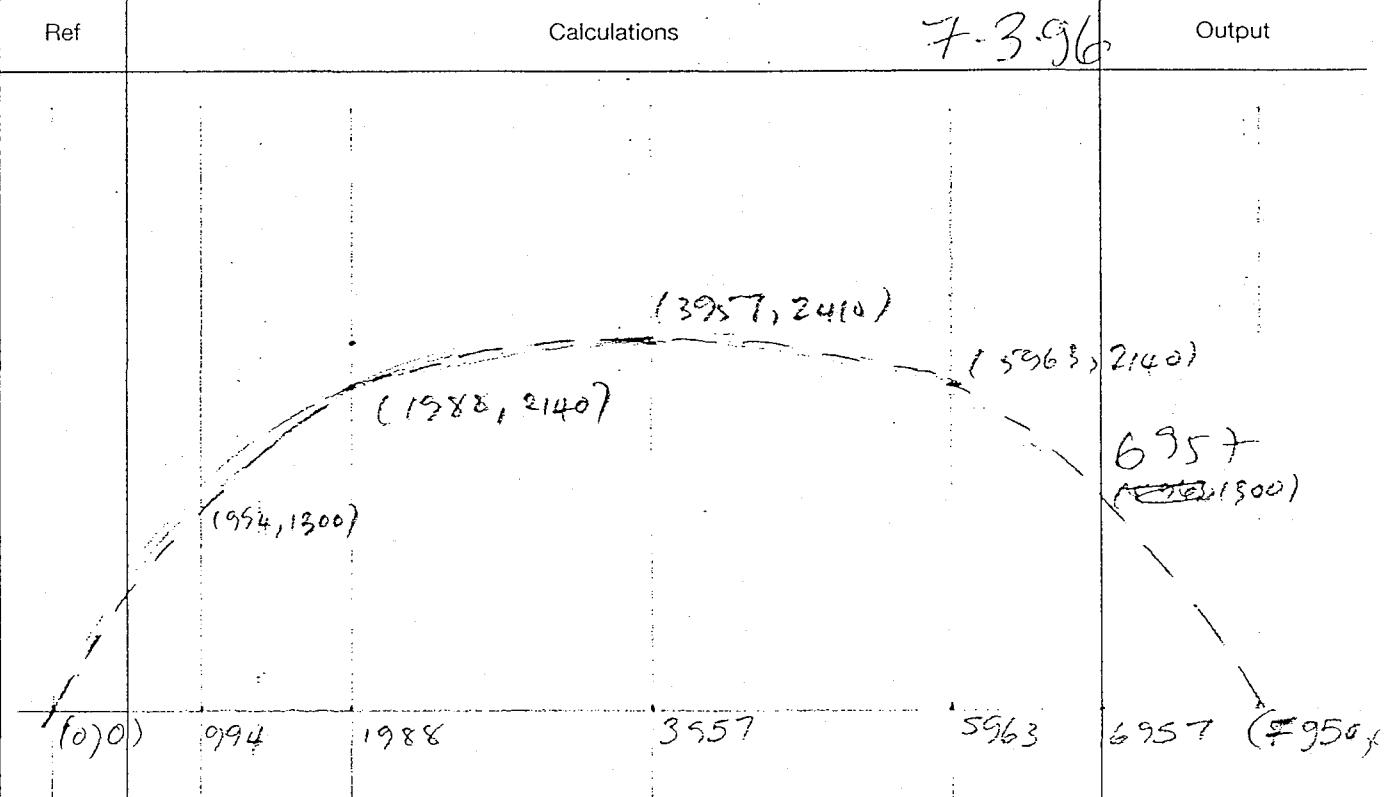
Check by

133

Date

Mar 96

Ref	Calculations	7.3.96	Output
-----	--------------	--------	--------



Scale 1:50

BLUNT 3"

[East - Right]

$$R_g = 2140$$

$$R_c = 2410$$

Segments = 20
 Survey pts = 7
 Id = 540 650
 h = 490 380
 f = 20 1.23
 fm = 18 20.6
 fpm = 35
 fpm = 3
 Maf st = 1
 set of hill = 1
 depth of surface = 100
 DS = 20 22.5

From Structural Report

WS/Atkins

Project

Job ref

ASSESSMENT OF BRIDGE STR

RC6272/804

Part of structure

Calc sheet no rev

BRUNTSFORD RAILWAY

C 1861

Drawing ref

Calc by

Date

sl

28.2.96

Check by

Date

Ref	Calculations	Output
	<p>(2420)</p> <p>(220)</p> <p>(1375)</p> <p>(220)</p> <p>16,00 994 1988 3725 5963 6957 2850</p> <p>Scale 1:50</p> <p>file name BRUNT 4 (West - Left)</p> <p>Segments New Sheet p4 20</p> <p>d 540 - 650) term structure!</p> <p>b 490 - 380) Repeat</p> <p>f 123 .</p> <p>m 26.6</p> <p>mat str 35</p> <p>posn hill 3</p> <p>objt al 100 - 150mm from D. Pointfield</p> <p>ss 20 - 22.5</p>	

British Railways Board
FORM 'AA' (BRIDGES)
Cambridgeshire County Council
Assessment of Highway Structures, Package 25 (County)
APPROVAL IN PRINCIPAL FOR ASSESSMENT

Group Standard
GC/TP0356

Date: February 1996

STRUCTURE/LINE NAME: BLUNTISHAM RAILWAY BRIDGE/DISUSED

ELR/STRUCTURE NO: CCC BRIDGE NO 365743

BRIEF DESCRIPTION OF EXISTING BRIDGE:

- (a) Span Arrangement: The bridge consists of a single span brick arch with a skew angle of 40°. Clear square span = 7.95m, width = 10.8m. Bridge carries A1123 road over a disused railway line (tracks removed).
- (b) Superstructure Type: Brick arch - crown 650mm thick.
- spring 830mm thick.
- (c) Substructure Type: Brick abutments (gravity) - 1600mm thick.
Foundations unknown.
- (d) Details of any Special Features: Brick parapets - 350mm thick.

ASSESSMENT CRITERIA

- (a) Loadings and Speed: HA to BD 21/93, HB to BD 37/88
Permitted traffic speed = 40 mph (64 kph)
- (b) Codes to be used: See attached Appendix A
- (c) Proposed Method of Structural Analysis: MEXE and ARCHIE analyses
- (d) Details of any Special Requirements: Parapets to be assessed in accordance with County Surveyors Society Guidance Note "Assessment and Design of Unreinforced Masonry Vehicle Parapets" 1995

STRUCTURAL ASSESSMENT ENGINEER'S COMMENTS

1. A Principal Inspection and testing works have been undertaken on this bridge to identify the condition factors and parameters required to assess the bridge in accordance with current assessment standards, refer: WS Atkins Principal Inspection Report dated February 1996.
2. A list of authorities consulted is included in Appendix B.
3. A location plan is attached for information.

British Railways Board
FORM 'AA' (BRIDGES)
Cambridgeshire County Council
Assessment of Highway Structures, Package 25 (County)
APPROVAL IN PRINCIPAL FOR ASSESSMENT

Group Standard
GC/TP0356

Date: February 1996

CIVIL ENGINEER'S COMMENTS

BRB WORKS GROUP COMMENTS - IF APPLICABLE

PROPOSED CATEGORY FOR INDEPENDENT CHECK:

SUPERSTRUCTURE Category II

SUBSTRUCTURE Category II

NAME OF CHECKER SUGGESTED IF CAT 2 OR 3 WS Atkins Consultants
The check will be undertaken by an independent group of engineers

CATEGORY 2

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

SIGNED

TITLE

DATE

SIGNED

TITLE

DATE

British Railways Board
FORM 'AA/1' (BRIDGES)
Cambridgeshire County Council
Assessment of Highway Structures, Package 25 (County)
APPROVAL IN PRINCIPLE FOR ASSESSMENT

Group Standard
GC/TP0356

Date: February 1996

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

STRUCTURE/LINE NAME: BLUNTISHAM RAILWAY BRIDGE/DISUSED

ELR/STRUCTURE NO: CCC BRIDGE NO 365743

SCOPE OF ASSESSMENT

The bridge is to be assessed in accordance with current assessment standards in order to ascertain its live load capacity.

ASSESSMENT CRITERIA

- a) Standards and Codes of Practice to be used in assessment: See attached Appendix A
- b) Proposed method of structural analysis: MEXE and ARCHIE analyses
- c) Planned Highway works/modifications at this site: None
- d) Road designation/class and whether classed as a heavy load route: A1123, Primary Road
Not a heavy load route
- e) Any other requirement: No

The above is submitted for acceptance.

Signed :
Title :

Date :

The above is agreed and accepted by the authority signatory shown below.

*Signed
Title :

DATE :

* A team leader or chief officer employed by an Agent Authority may sign "for and on behalf of Cambridgeshire County Council" where authorised to do so.

British Railways Board
FORM 'AA/1' (BRIDGES)
Cambridgeshire County Council
Assessment of Highway Structures, Package 25 (County)
APPROVAL IN PRINCIPLE FOR ASSESSMENT

Group Standard
GC/TP0356

Date: February 1996

APPENDIX A

British Railways Property Board "Approval In Principle and Checking Procedures For Bridges and Other Structures" GC/TP0356 February 1993

County Surveyors Society Guidance Note "Assessment and Design of Unreinforced Masonry Vehicle Parapets" 1995

Highways Agency Standards

BD 37/88 Loads for Highway Bridges

BD 34/90 Technical requirements for the assessment and strengthening programme for highway structures. Stage 1 - Older short span bridges and retaining structures

BD 21/93 The assessment of highway bridges and structures

BD 52/93 The design of highway bridge parapets

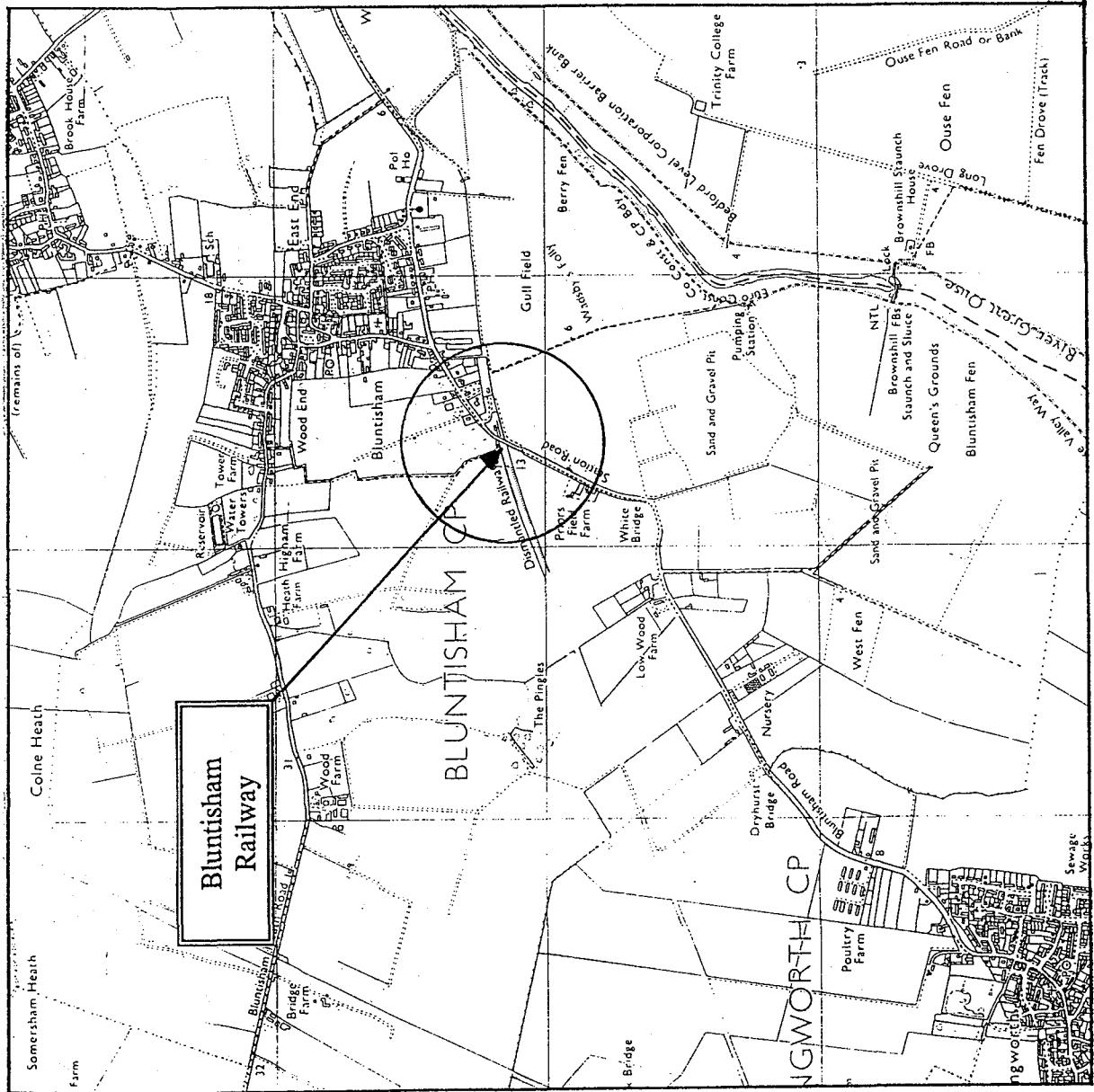
Date: February 1996

LIST OF STATUTORY AUTHORITIES CONSULTED

APPENDIX B

Authority Consulted	Interests/Apparatus Reported
Anglian Water	None reported
Cambridge Water Company	3" abandoned main along E side of bridge 4" PVC main on E side of bridge
Eastern Electricity	1 no. HV overhead line on W side
National Grid	None reported
British Gas	180mm main runs to S side
British Telecom	Buried cable running along bridge on west side
Mercury	None reported
Cambridge Cable	None reported
Bell Cablemedia	None reported
Energis	None reported
National Rivers Authority	None reported
Serco	None reported
Internal Drainage Boards	
Middle Level Commissioners	None reported
Welland and Deepings	None reported
Warboys, Somersham and Pidley	None reported
Nightlayers	None reported
Littleport and Downham	None reported
North Level	None reported
Connington and Holme	None reported
Alconbury and Ellington	None reported
Old West	None reported
Huntingdonshire District Council	None reported
East Cambridgeshire District Council	None reported
British Railways Property Board	TAA

DO NOT SCALE



WS Atkins - East Anglia

Telephone (01223) 275002
Fax (01223) 277524Walbrook Court
Girton Road
Cambridge
CB3 2NA

Client

CAMBRIDGESHIRE
COUNTY COUNCILProject BLUNTISHAM
RAILWAY

Title

LOCATION PLAN

Original Scale	Drawn By	Checked By	Authorised By
NTS	Date 1/95	Date 8/95	Date 8/95
Figure Number	26272/704/Fig 1	Rev. 1	Rev. 1
630-11947			

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British Railways Board

FORM 'BA' (BRIDGES)

Cambridgeshire County Council

Assessment of Highway Structures, Package 25 (County)

CERTIFICATION FOR ASSESSMENT CHECK

Group Standard

GC/TP0356

Revision 0

Date: April 1996

CATEGORY OF CHECK: II

STRUCTURE/LINE NAME: BLUNTISHAM RAILWAY BRIDGE/DISUSED

ELR/STRUCTURE NO: CCC BRIDGE NO: 365743
BRB REF: SIE/2289

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 15 February 1996.
- (2) It has been checked for compliance with the following principal British Standards, Codes of Practice, BR Technical notes and Assessment standards.

BD 37/88 Loads for highway bridges

BD 34/90 Technical requirements for the assessment and strengthening programme for highway structures. Stage 1 – Older short span bridges and retaining structures.

BD 21/93 The assessment of highway bridges and structures.

BD 52/93 The design of highway bridge parapets.

CATEGORY II AND III (NOTE: CATEGORY I CHECK MUST ALSO BE SIGNED)

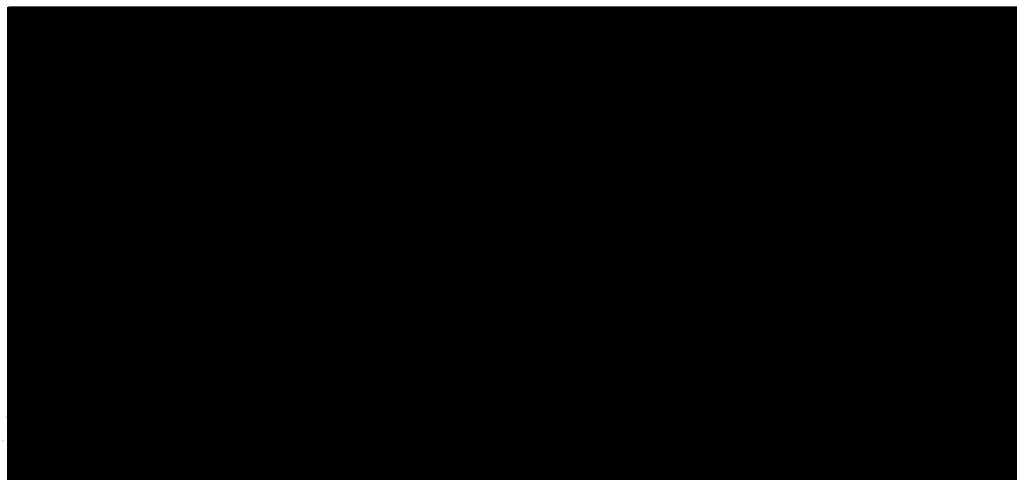
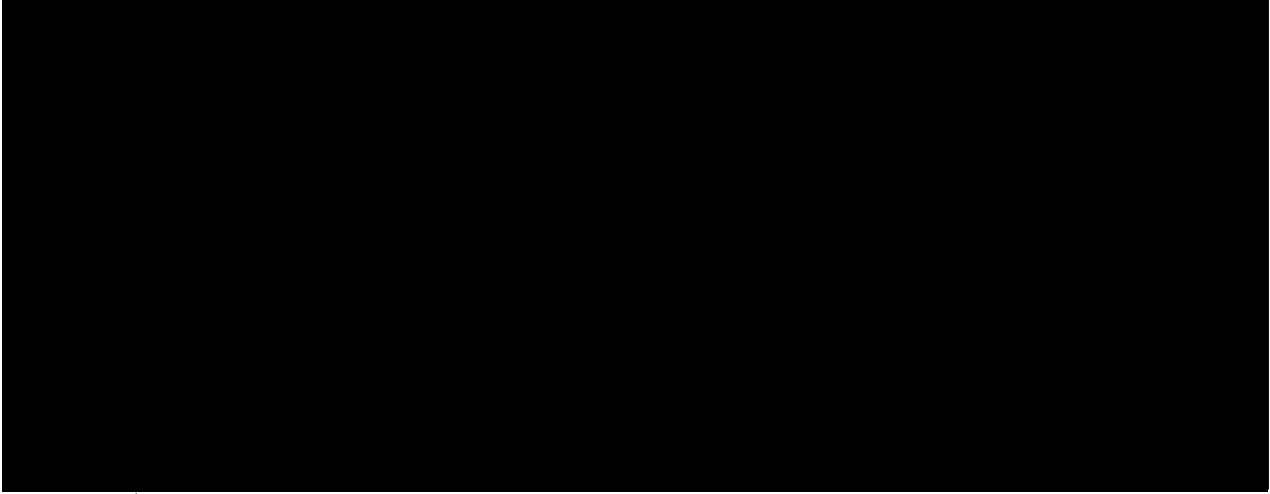
- (a) ASSESSMENT
- 

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British Railways Board
FORM 'BA' (BRIDGES)
Cambridgeshire County Council
Assessment of Highway Structures, Package 25 (County)
CERTIFICATION FOR ASSESSMENT CHECK

Group Standard
GC/TP0356
Revision 0
Date: April 1996

(b) CHECK



NOTIFICATION OF ASSESSMENT CHECK

STRUCTURE NAME / ROAD NO: BLUNTISHAM RAILWAY BRIDGE / A1123

LINE NAME: DISUSED RAILWAY

ELR CODE / STRUCTURE NO: CCC BRIDGE NO: 365743
BRB REF: SIE/2289

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 restriction is as follows:

STATEMENT OF CAPACITY

40 tonnes

Critical member/s: None

RECOMMENDED LOADING RESTRICTIONS

DESCRIPTION OF STRUCTURAL DEFICIENCIES AND RECOMMENDED STRENGTHENING

North-west wingwall fails qualitative assessment. Strengthening/repair options should be investigated.

