ESSEX COUNTY COUNCIL
ASSESSMENT CONTRACT 3

APPROVAL IN PRINCIPLE FOR THE ASSESSMENT OF WELLINDITCH BRIDGE

ECC BRIDGE NO. 1662
RAIL PROPERTY Ltd BRIDGE NO. WFM/833

TOPSTOPS

Essex County Council
Transportation &
Operational Services

APPROVAL IN PRINCIPLE FOR THE ASSESSMENT OF WELLINDITCH BRIDGE

ECC Bridge Number 1662

Rail Property Number WFM/833

APPROVAL IN PRINCIPLE CONTENTS

- British Railways Board FORM 'AA' (BRIDGES)
- British Railways Board FORM 'AA/1' (BRIDGES)
- Location Plan
- General Arrangement, Cross Section and Idealisation Drawings
- Technical Approval Schedule "TAS" (June 1989)
- Appendix to TAS Schedule dated (June 1989) WS Atkins amended March 1999
- Appendix: Inspection for Assessment

FORM 'AA' (BRIDGES)

APPROVAL IN PRINCIPLE FOR ASSESSMENT

STRUCTURE / LINE NAME WELLINDITCH BRIDGE

ELR / STRUCTURE NO. WFM/833

BRIEF DESCRIPTION OF EXISTING BRIDGE:

(a) Span Arrangement

The bridge has 3 no. clear skew spans of 8.70m, 8.65m and 8.70m. The angle of skew is 26°.

(b) Superstructure Type

Three span brick arch.

(c) Substructure Type

Brick abutments and piers.

(d) Details of any Special Features

None.

ASSESSMENT CRITERIA

(a) Loadings and Speed

Loadings to be in accordance with BD 21/97. The current permitted traffic speed across the structure is 60mph.

(b) Codes to be used

See attached TAS schedule and March 1999 addendum.

(c) Proposed Method of Structural Analysis

The structure will be analysed as a multi span arch using the MULTI mechanism method computer program. The individual arches will be analysed using the modified MEXE method, detailed in BD 21/97 and BA 16/97, and the ARCHIE computer program. As the fill depth over the arch is less than the arch barrel thickness for all 3 no. spans, the higher capacity of the ARCHIE and MEXE results will be adopted for the individual arches. For the overall capacity of the bridge the results of the MULTI mechanism will be used. For the analysis the following parameters will be adopted:

ARCHIE/MULTI

Backing level (determined from record drawings)	1.4m above springing level
Masonry self weight	21kN/m^3
Fill self weight	19kN/m^3
Surfacing self weight	23kN/m^3
ϕ' for fill	30^o
ARCHIE passive pressure coefficient	0.3
Masonry strength	4.4 N/mm^2

Passive pressures generated behind the arch will be limited to 30% of the full passive pressures.

MEXE:

		North Arch	Centre Arch	South Arch
Condition Factor	F_{cM}	0.9	1.0	0.9
Barrel Factor	F_b	1.0	1.0	1.0
Fill Factor	F_f	0.7	0.7	0.7
Width Factor	F_w	0.9	0.9	0.9
Mortar Factor	F_{mo}	0.9	0.9	0.9
Depth Factor	F_d	0.8	0.8	0.8

Axle lift-off should be considered.

Section sizes and dimensions will be based on drawings AI1658/1/FIG 01, 02, 03, 07, 08 and 09.

(d) Details of any Special Requirements

None.

STRUCTURAL ASSESSMENT ENGINEER'S COMMENTS

CIVIL ENGINEER'S COMMENTS

FORM 'AA' (BRIDGES)

APPROVAL IN PRINCIPLE FOR ASSESSMENT

BRB WORKS GROUP COMMENTS - IF APPLICABLE

PROPOSED CATEGORY FOR INDEPENDENT CHECK

SUPERSTRUCTURE 2

SUBSTRUCTURE N/A

NAME OF CHECKER SUGGESTED IF CAT 2 OR 3 Different team within office

THE ABOVE IS SUBMITTED FOR APPROVAL IN PRINCIPLE

SIGNED [redacted]

TITLE

DATE

FOR AND ON BEHALF OF WS ATKINS CONSULTANTS LTD

FORM 'AA' (BRIDGES)

APPROVAL IN PRINCIPLE FOR ASSESSMENT

CATEGORY 1

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

SIGNED N/A

TITLE .....

DATE .....

CATEGORY 2 AND 3

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

SIGNED [redacted]

TITLE

DATE

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

STRUCTURE / LINE NAME WELLINDITCH BRIDGE

ELR / STRUCTURE NO. WFM/833

SCOPE OF ASSESSMENT

An inspection of the structure has been carried out prior to the assessment in order to confirm section sizes and overall dimensions as shown on the drawings. The substructure shows no signs of distress and is deemed satisfactory, therefore no analysis will be carried out.
The deck will be assessed to determine its load carrying capacity at ULS. HB loading and SLS checks are not applicable to arches. The parapets will not be assessed since they do not meet current standards.

ASSESSMENT CRITERIA

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

See attached TAS schedule and March 1999 addendum.

b) Proposed method of structural analysis

The structure will be analysed as a multi span arch using the MULTI mechanism method computer program. The individual arches will be analysed using the modified MEXE method, detailed in BD 21/97 and BA 16/97, and the ARCHIE computer program. As the fill depth over the arch is less than the arch barrel thickness for all 3 no. spans, the higher capacity of the ARCHIE and MEXE results will be adopted for the individual arches. For the overall capacity of the bridge the results of the MULTI mechanism will be used. For the analysis the following parameters will be adopted:

ARCHIE/MULTI

Backing level (determined from record drawings)	1.4m above springing level
Masonry self weight	$21kN/m^3$
Fill self weight	$19kN/m^3$
Surfacing self weight	$23kN/m^3$
ϕ' for fill	30^0
ARCHIE passive pressure coefficient	0.3
Masonry strength	$4.4\ N/mm^2$

Passive pressures generated behind the arch will be limited to 30% of the full passive pressures.

MEXE:

		North Arch	Centre Arch	South Arch
Condition Factor	F_{cM}	0.9	1.0	0.9
Barrel Factor	F_b	1.0	1.0	1.0
Fill Factor	F_f	0.7	0.7	0.7
Width Factor	F_w	0.9	0.9	0.9
Mortar Factor	F_{mo}	0.9	0.9	0.9
Depth Factor	F_d	0.8	0.8	0.8

Axle lift-off should be considered.

Section sizes and dimensions will be based on drawings AI1877/1375/FIG 01, 02, 03, 07, 08 and 09.

c) Planned Highway works / modifications at this site

None planned.

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

Unclassified. The road is not a heavy load route.

e) Any other requirement

None.

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

SIGNED [redacted]

TITLE

DATE

FOR AND ON BEHALF ESSEX COUNTY COUNCIL TRANSPORTATION AND OPERATIONAL SERVICES DIVISION.

LOCATION PLAN, DRAWINGS AND IDEALISATION DIAGRAMS

Essex County Council
Transportation &
Operational Services

[redacted]

Atkins

WELLINDITCH BRIDGE

Map Ref: TQ 582026 198688

A4	DRWG.NO. B1204/1662/LP001-
	CAD NO. WEL-LP01
	SCALES 1:5000
	DATE AUG 99 — DRAWN/TRACED [redacted]
	DATE AUG 99 — CHECKED [redacted]
	DATE — AUTHORISED

SCHEME TITLE

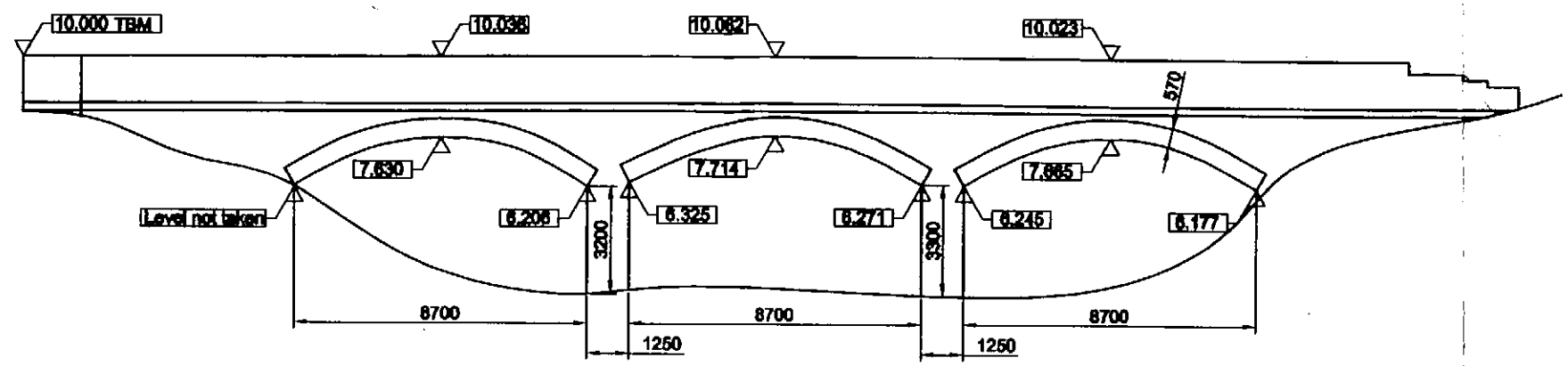
WELLINDITCH BRIDGE
STOW MARIES
LOCATION PLAN

DO NOT SCALE

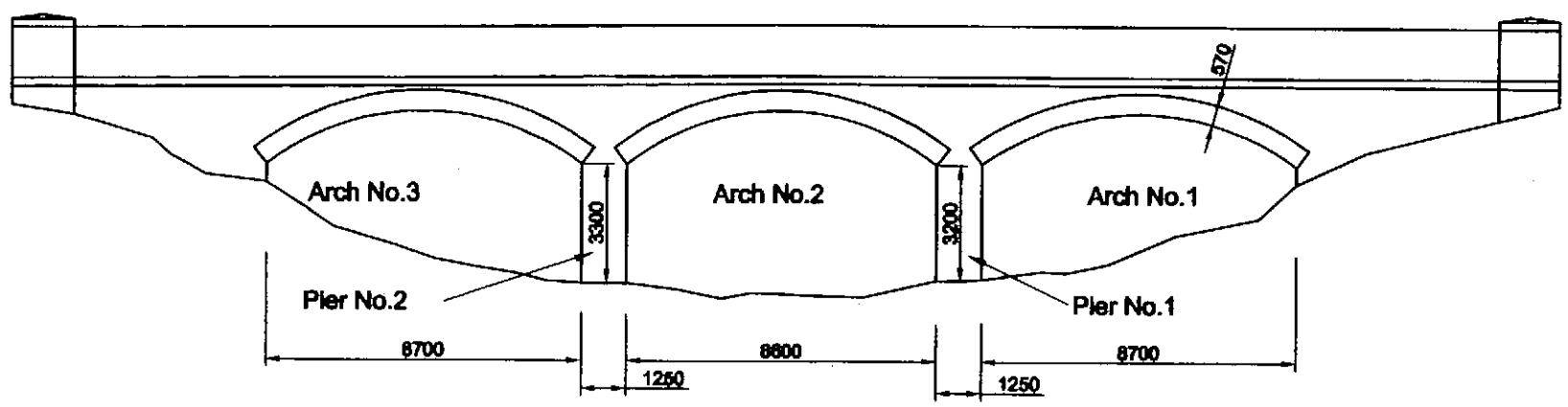
ECC Bridge No. 1662
Rail Property Board No. WFM/833

Notes:

All Dimensions in mm
All levels in metres above local datum



WEST ELEVATION



EAST ELEVATION

Essex County Council
Transportation & Operational Services

WS/Atkins

SCALES		SURVEYED	LEVELLED	DESIGNED	DRAWN/TRACED	CHECKED	AUTHORISED
NTS	INITIALS	DW	DW		MAD		
CAD FILE N:\A1877\1662\fig01	DATE	12/99	12/99		12/99		

REVISION NOTES	REVISION	CHECKED

DESCRIPTION OF DRAWING
WELLINDITCH BRIDGE, STOW MARIES
ELEVATIONS

Sheet 1 of 1

SCHEME TITLE
ECC ASSESSMENT CONTRACT 3
RAIL PROPERTY LTD BRIDGES

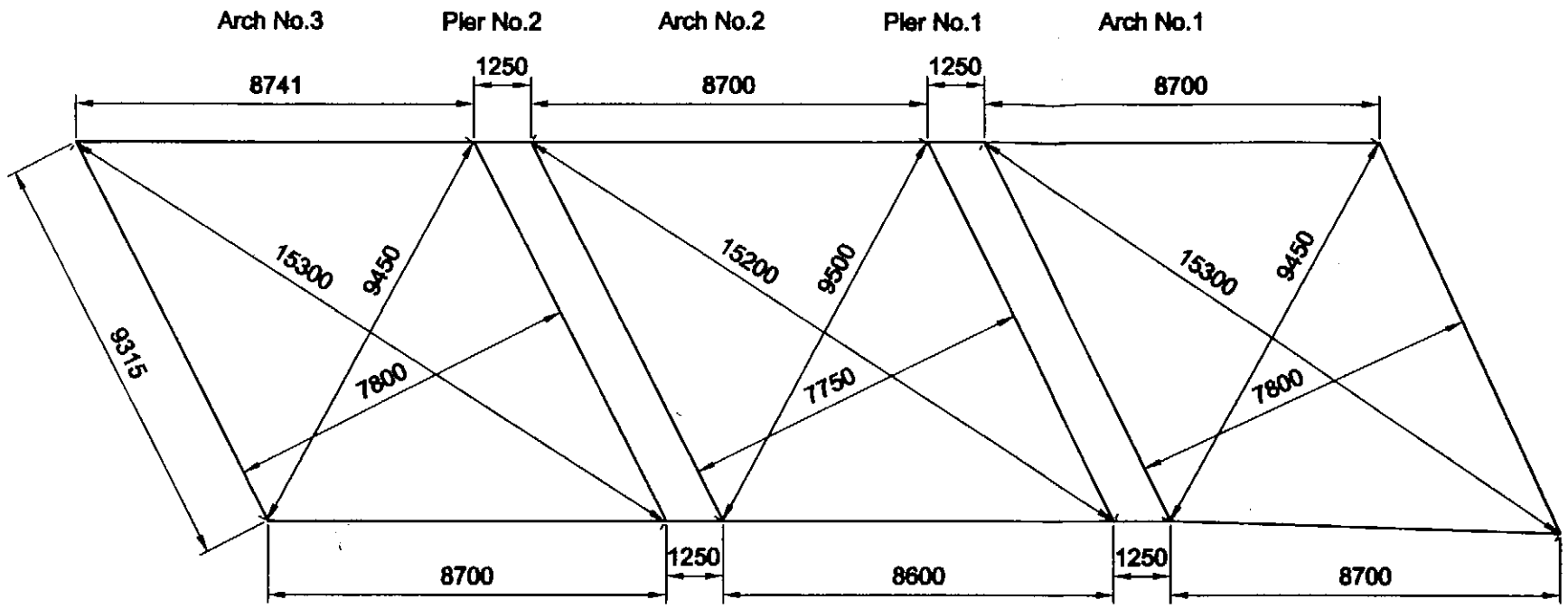
DRAWING NO. A1877/DWGS/1662/fig01

DO NOT SCALE

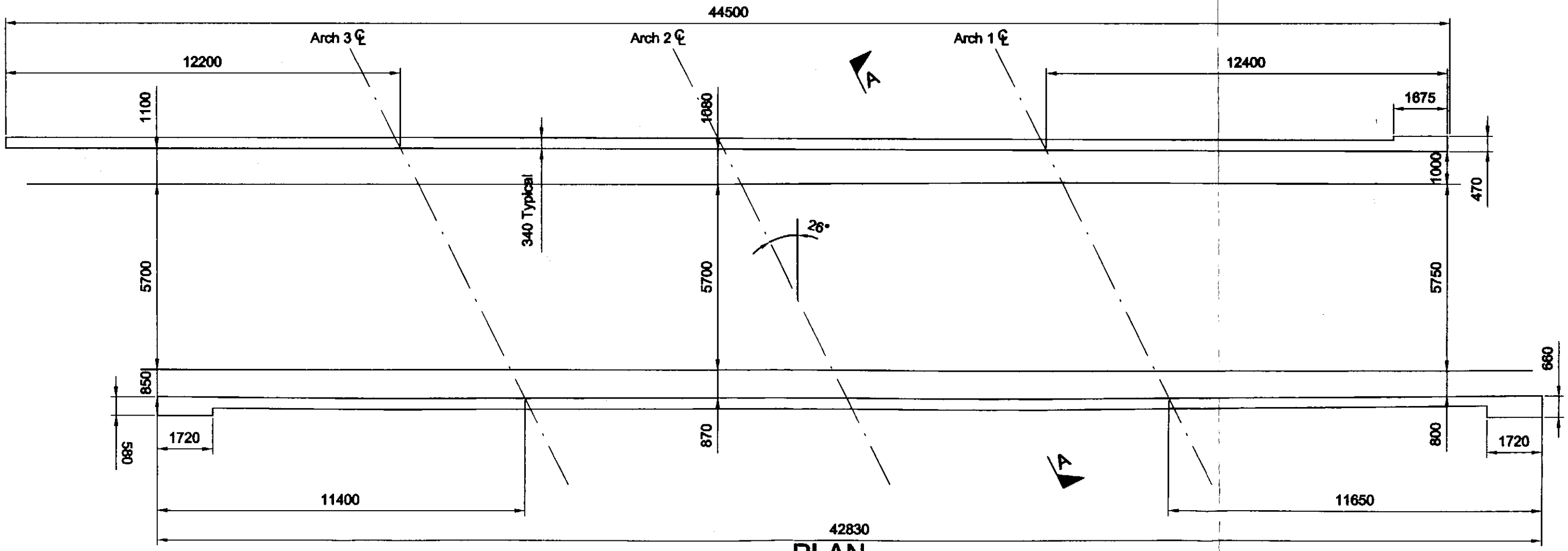
ECC Bridge No.	1662
Rail Property Board No.	WFM/833

Notes:

All Dimensions in mm



PLAN SHOWING BRIDGE DIMENSIONS



PLAN

Essex County Council
Transportation & Operational Services

WS/Atkins

SCALES		SURVEYED	LEVELLED	DESIGNED	DRAWN/TRACED	CHECKED	AUTHORISED
NTS	INITIALS	DW	SW		MAD		
CAD FILE h:\AI1877\1662\fig02	DATE	12/99	12/99		01/00		

REVISION NOTES	REVISION	CHECKED

DESCRIPTION OF DRAWING

WELLINDITCH BRIDGE, STOW MARIES
PLAN

Sheet 1 of 1

SCHEME TITLE

ECC ASSESSMENT CONTRACT 3
RAIL PROPERTY LTD BRIDGES

DRAWING NO. AI1877/DWGS/1662/fig02

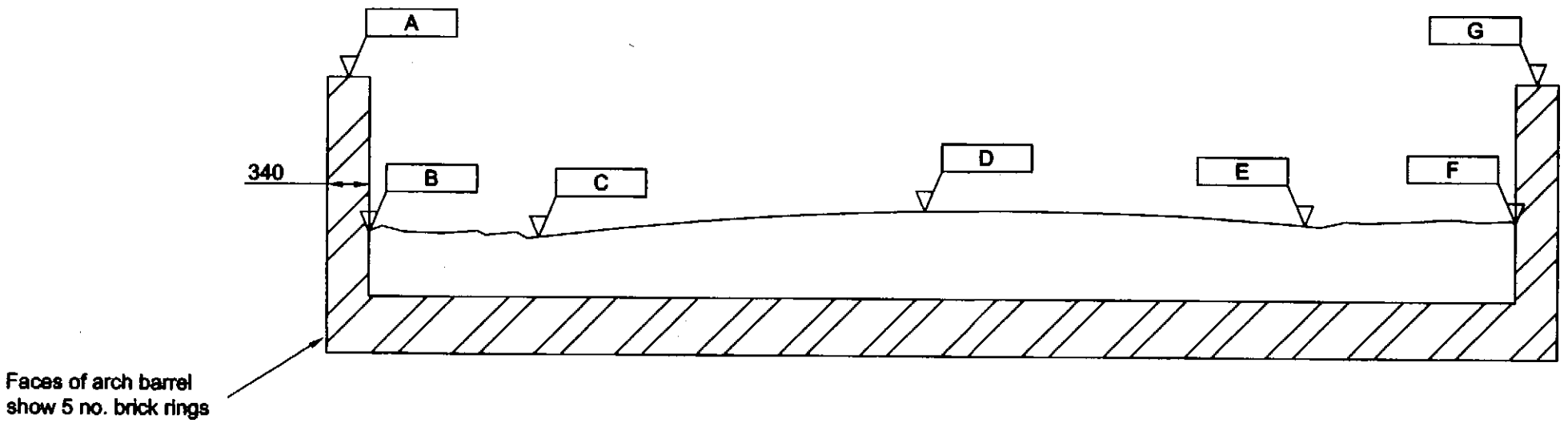
DO NOT SCALE

ECC Bridge No. 1662
Rail Property Board No. WFM/833

Notes:

All Dimensions in mm

All levels in m above local datum



REFER TO DWG 02 FOR LOCATION OF SECTION A-A

TYPICAL CROSS SECTION A-A

Not To Scale

Position	CL Arch 1 (North)	CL Arch 2 (Central)	CL Arch 3 (South)
A Top of West Parapet	10.036	10.082	10.023
B Bottom of West Parapet	8.688	8.754	8.659
C West Edge Carriageway	8.706	8.781	8.660
D CL Carriageway	8.793	8.823	8.688
E East Edge Carriageway	8.709	8.736	8.554
F Bottom of East Parapet	8.649	8.599	8.462
G Top of East Parapet	10.039	10.064	9.993

Essex County Council
Transportation & Operational Services

WS/Atkins

SCALES: NTS

CAD FILE: I:\A1677\1662\fig03

	SURVEYED	LEVELLED	DESIGNED	DRAWN/TRACED	CHECKED	AUTHORISED
INITIALS	DJW	DJW		SD		
DATE	12/99	12/99		1/00		

REVISION NOTES | REVISION | CHECKED

DESCRIPTION OF DRAWING: WELLINDITCH BRIDGE, STOW MARIES CROSS SECTION

Sheet 1 of 1

SCHEME TITLE: ECC ASSESSMENT CONTRACT 3 RAIL PROPERTY LTD BRIDGES

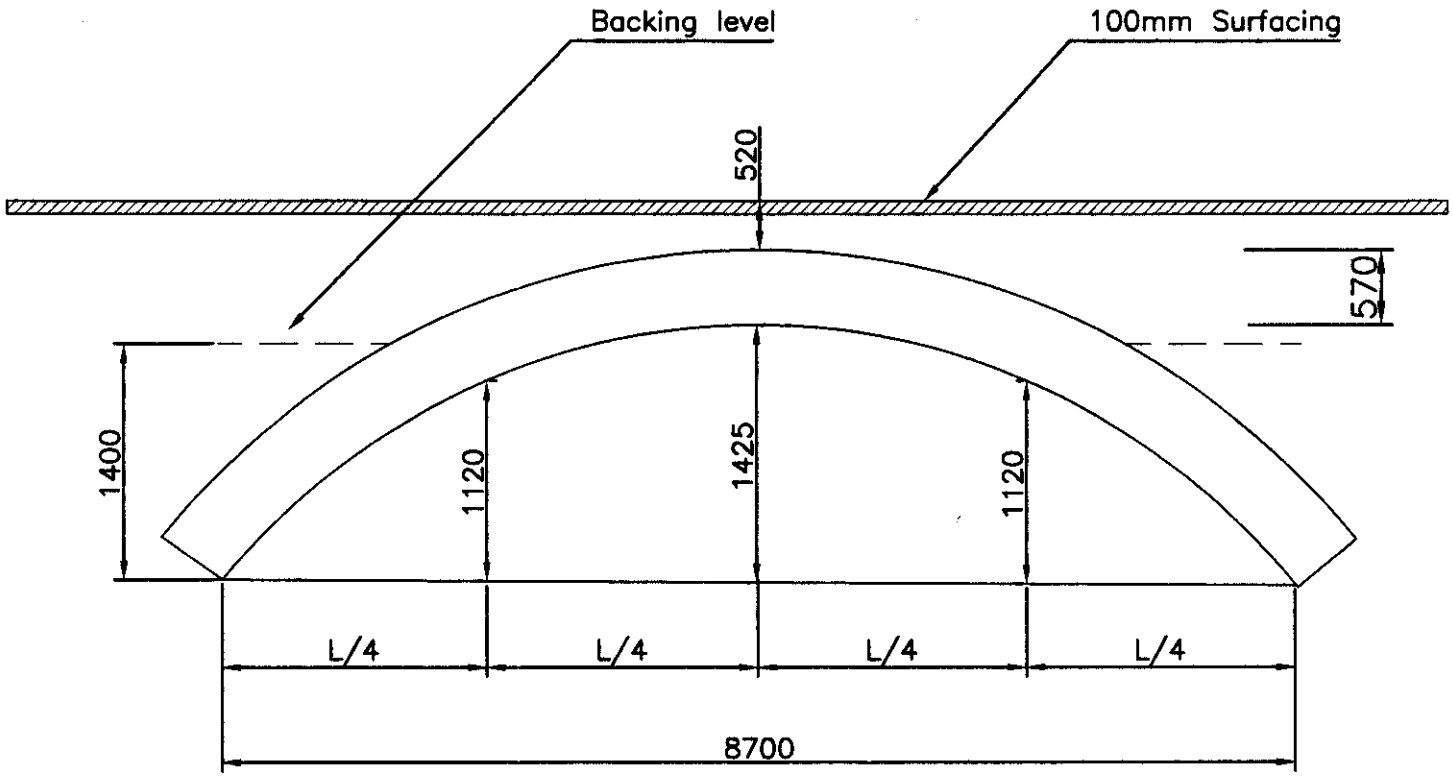
DRAWING NO. A1677/DWGS/1662/fig03

Essex County Council
Transportation &
Operational Services

[redacted]

WS Atkins

ECC Bridge No. 1662
Rail Property Board No. WFM/833



ARCH No.1(NORTH ARCH)
IDEALISATION DIAGRAM
NTS

DRWG.NO.	AI1877/1662/FIG07
CAD NO.	N:1877/1662/fig07
SCALES	NTS
DATE JAN 00	DRAWN/TRAC [redacted]
DATE JAN 00	CHECKED
DATE	AUTHORISED

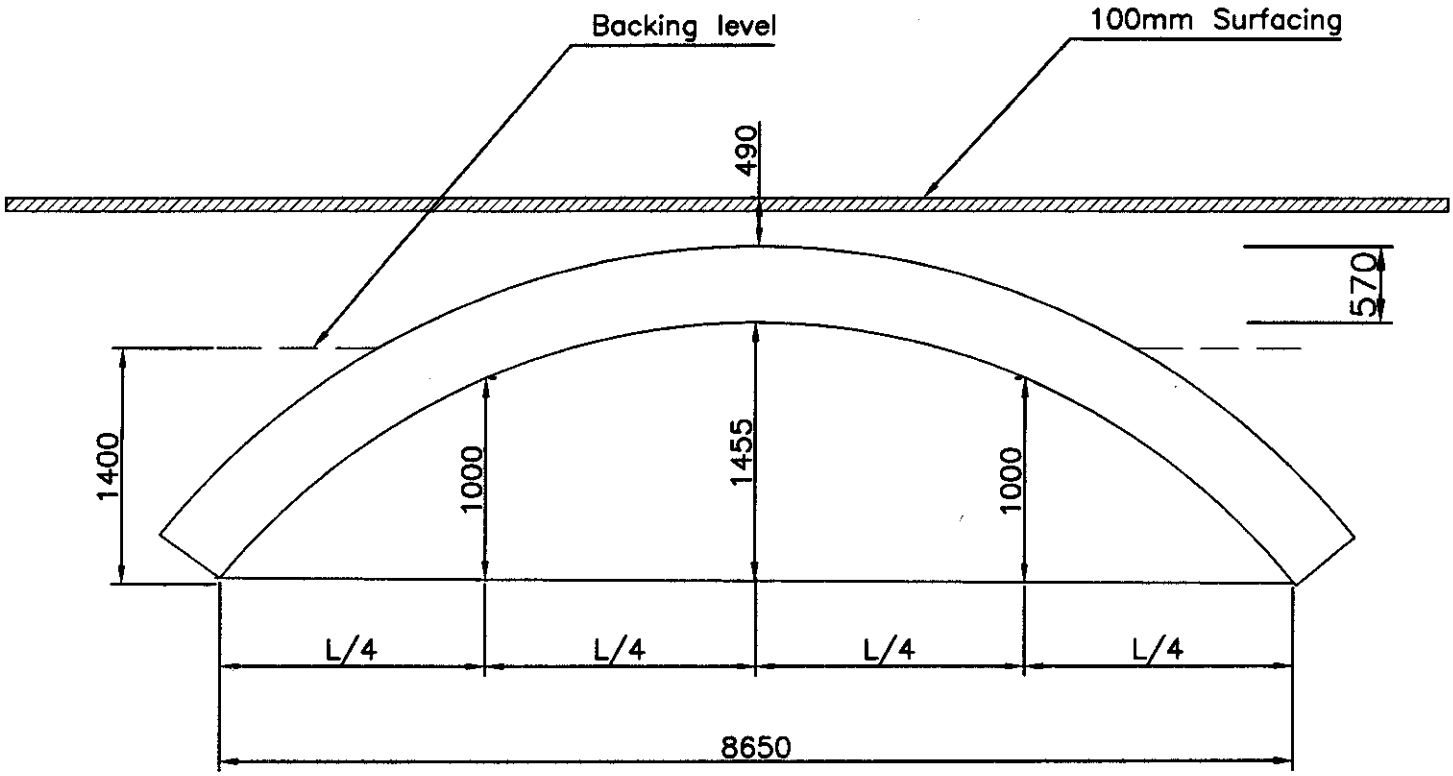
SCHEME TITLE ECC ASSESSMENT CONTRACT 3
WELLINDITCH BRIDGE, STOW MARIES
IDEALISATION DIAGRAM ARCH 1

Essex County Council
Transportation & Operational Services

[redacted]

W/S Atkins

ECC Bridge No. 1662
Rail Property Board No. WFM/833



ARCH No.2 (CENTRAL ARCH)
IDEALISATION DIAGRAM
NTS

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CAD NO.	N:1877/1662/fig08
SCALES	NTS
DATE JAN 00	DRAWN [redacted]
DATE JAN 00	CHECK
DATE	AUTHORISED

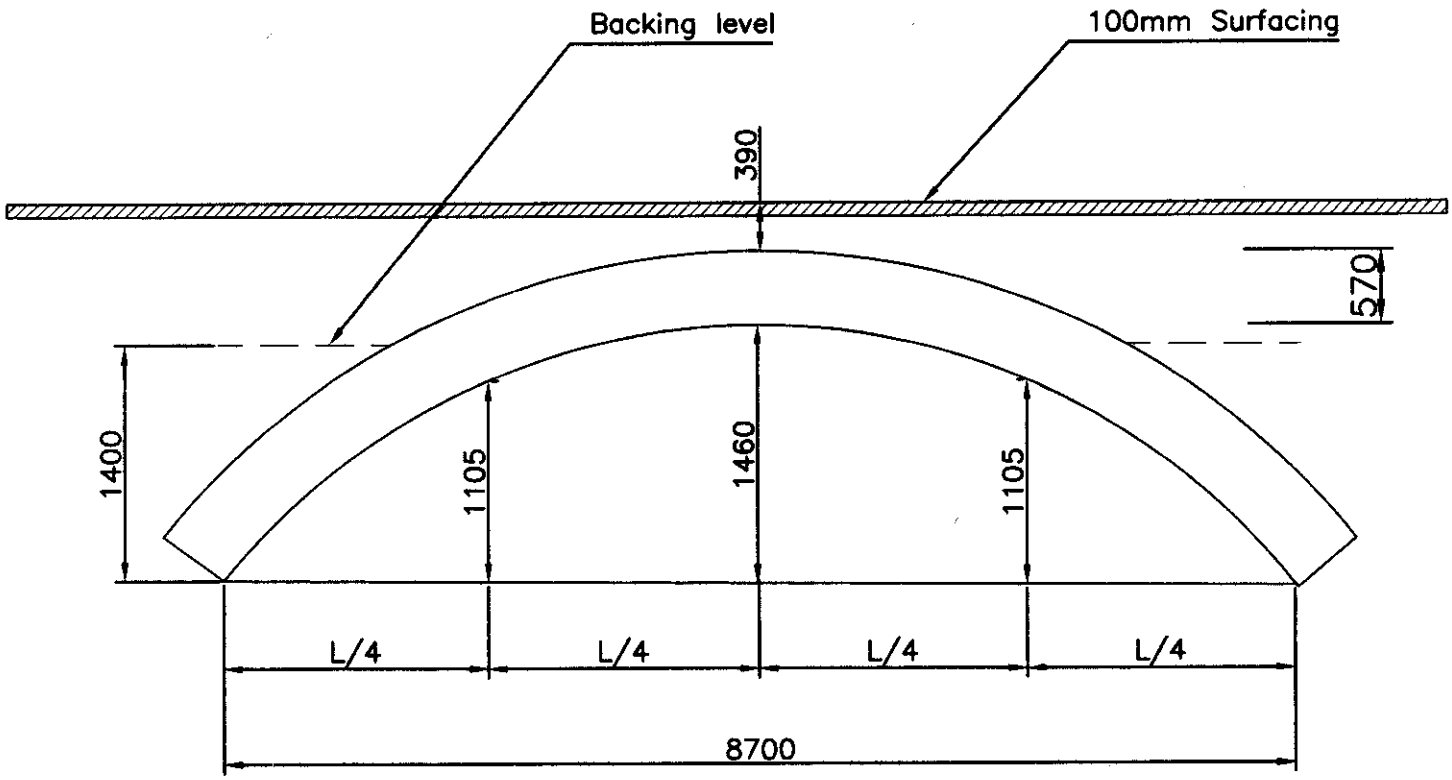
SCHEME TITLE ECC ASSESSMENT CONTRACT 3
WELLINDITCH BRIDGE, STOW MARIES
IDEALISATION DIAGRAM ARCH 2

Essex County Council
Transportation &
Operational Services

[redacted]

WS Atkins

ECC Bridge No. 1662
Rail Property Board No. WFM/833



ARCH No.3 (SOUTH ARCH)
IDEALISATION DIAGRAM
NTS

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CAD NO.	N:1877/1662/fig09
SCALES	NTS
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DATE JAN 00	CHECKED
DATE	AUTHORISED

SCHEME TITLE ECC ASSESSMENT CONTRACT 3
WELLINDITCH BRIDGE, STOW MARIES
IDEALISATION DIAGRAM ARCH 3

TECHNICAL APPROVAL SCHEDULE

TECHNICAL APPROVAL SCHEDULE "TAS" (JUNE 1989)

SCHEDULE OF DESIGN DOCUMENTS RELATING TO HIGHWAY BRIDGES & STRUCTURES (All documents are taken to include revisions current at date of this TAS).

1. BRITISH STANDARDS

~~BS 153 Part 3A, Specification for Steel Girder Bridges (see BE 1/77).~~

~~BS 5268 Part 2, Structural Use of Timber~~

~~BS 5400 - Steel concrete and composite bridges~~

~~Part 1: 1978 - General Statement (SEE BD 15/82)~~

~~Part 2: 1978 - Specification for loads (see BD 14/82)~~

~~Part 3: 1982 - CP for design of steel bridges (see BD 13/82)~~

~~Part 4: 1984 - CP for design of concrete bridges (see BD 24/84)~~

~~Part 5: 1979 - CP for design of composite bridges (see BD 16/82)~~

~~Part 9: 1983 - Bridge bearings (see BD 20/83)~~

~~Part 10: 1980 - CP for fatigue (see BD 9/81)~~

~~BS 5628: Part 1: 1978 - Unreinforced Masonry~~

~~BS 5930: 1981 - Site investigations~~

~~BS 6031: 1981 - Earthworks~~

2. BRITISH STANDARD CODES OF PRACTICE

~~CP 114: Part 2 Reinforced concrete in buildings (see Tech Memo BE 1/73)~~

~~CP 116 Part 2 The structural use of precast concrete (see Tech Memo BE 1/73)~~

~~CP 118 The structural use of aluminium~~

~~CP 2 Earth retaining structures~~

~~CP 2004 Foundations~~

3. PUBLICATIONS (HMSO)

~~Railway construction and Operation Requirements, Structural and Electrical clearances (1977).~~

~~Railway construction and operation. Requirements for passenger lines and recommendations for goods lines 1950 (reprinted 1970).~~

~~Roads in urban areas and Metric Supplement (as amended by TA 32/82)~~

~~Layout of roads in rural areas and Metric Supplement (as amended by TA 28/82).~~

~~Specification for Highway Works and Notes for Guidance (1986 Edition).~~

~~Highway Construction Details (1987 Edition).~~

~~Simplified Tables of External loads on Buried Pipelines (1970).~~

4. MISCELLANEOUS

~~Circular Roads No 61/72 - Routes for heavy and high abnormal loads.~~

5. TECHNICAL MEMORANDA (BRIDGES)

~~BE 5 The design of Highway bridge parapets (4th revision)~~

~~BE 27 Waterproofing and surfacing of bridge docks.~~

~~BE 3/72 Expansion joints for use La highway bridge docks.~~

~~BE 1/73 Reinforced concrete for highway structures (Relevant ports for the design of buried precast concrete pipes and sign/signal gantries only).~~

~~BE 1/74 The independent checking of erection proposals and temporary works details for major highway structure an trunk roads and motorways.~~

~~BE 8/75 Painting of concrete highway structures~~

~~BE1/77 Standard highway loadings (Relevant parts for the design of buried precast concrete pipes and sign/signal gantries only)~~

~~BE 7/77 Department standard (interim) motorway sign/signal gantries~~

~~BE 1/78 Design criteria for footbridges and sign/signal gantries (Relevant for the design of sign/signal gantries only)~~

~~BE 3/78 Reinforced earth, and anchored earth retaining walls and bridges abutments for embankments~~

6. HIGHWAYS TECHNICAL MEMORANDA

~~H 14/76 Noise barriers - Standard and Materials~~

7. MEMORANDA (BRIDGES)

~~IM 5 Formation of continuity joints in bridge decks~~

8 DEPARTMENTAL STANDARDS

8.1 TRAFFIC ENGINEERING AND CONTROL

~~TD 2/78 Pedestrian Subways - layout and dimensions~~

~~TD 3/79 Combined pedestrian and cycle subways - layout and dimensions~~

~~TD 9/81 Road layout and geometry. Highway link design~~

~~TD 19/83 Safety fences and barriers~~

~~TD) 27/86 Cross Sections and headroom~~

8.2 BRIDGES AND STRUCTURES

BD 2/89 Technical approval of DTp highway structures on motorways and other trunk roads

~~BD 6/81 Approval in principle and calibrating of computer programs for use in DTp highway structures on trunk roads and motorways~~

~~BD 7/81 Weathering steel for highway structures~~

~~BD 9/81 Implementation of BS 5400 Pt 10, CP for fatigue~~

~~BD 10/82 Design of highway structures in areas of mining subsidence~~

~~BD 12/82 Corrugated steel buried structures~~

~~BD 13/82 Design of steel bridges - 'Use of BS 5400 Pt 3: 1982~~

~~BD 14/82 Loads for highway bridges - Use of BS 5400 Pt 2: 1978~~

~~BD 15/82 General principles - Use of BS 5400 Pt 1 : 1978~~

~~BD 16/82 Design of composite bridges - 'Use of B3 5400 Pt 5 -. 1979~~

~~BD 19/83 Standard Bridges~~

~~BD 20/83 Bridge Bearings - 'Use of BS S400 Part 9: 1983~~

~~BD 21/84 The assessment of highway bridges and structures~~

~~BD 24/84 Design of concrete bridges - Use of BS 5400 Pt 4: 1984~~

~~BD 26/86 Design of lighting columns~~

~~BD 27/86 Materials for the repair of concrete highway structures~~

~~BD 28/87 Early thermal cracking of concrete~~

~~BD 29/87 Design criteria for footbridges~~

~~BD 30/87 Backfilled retaining walls and bridge abutments~~

~~BD 31/87 Buried concrete box type structures~~

~~BD 32/88 Piled foundations~~

~~BD 34/88 Assessment and Strengthening of Highway Structures on Motorways and other Trunk Roads~~

~~BD 35/88 Quality Assurance Scheme for paints and similar protective coatings~~

~~BD 36/88 The Evaluation of Maintenance Costs in Comparing Alternative Designs for Highway Structures~~

~~BD 37/88 Loads for Highway Bridges~~

APPENDIX TO TAS SCHEDULE DATED JUNE 1989
(WS Atkins amended March 1999, incorporating relevant technical standards published since June 1989)

1. BRITISH STANDARDS

BS 4360: 1990 – Specification for Weldable Structural Steel.

BS 4466: 1989 – Scheduling, Dimensioning, Bending and Cutting of Steel Reinforcement for Concrete

BS 5400 - Steel, Concrete and Composite Bridges.
- Part 1: 1988 – General Statement (see BD 15/92).
- Part 4: 1990 – CP for Design of Concrete Bridges (see BD 24/92).

BS 5628 - Use of Masonry.
- Part 1: 1992 – Unreinforced Masonry.
- Part 2: 1985 – Reinforced and Prestressed Masonry.

BS 5975: 1996 – CP for Falsework

BS 6651: 1992 – CP for Protection of Structures Against Lightning.

BS 6779 - Highway Parapets for Bridges and Other Structures
- Part 1: 1998 – Specification for Vehicle Containment Parapets of Metal Construction.
- Part 2: 1991 – Specification for Vehicle Containment Parapets of Concrete Construction.
- Part 3: 1994 – Specification for Vehicle Containment Parapets of Combined Metal and Concrete Construction.

BS 7295: 1990: Parts 1 & 2 – Fusion Bonded Epoxy Coated Carbon Steel Bars for the Reinforcement of Concrete

BS 7668: 1984 – Weldable Structural Steels. Hot Finished Structural Hollow Sections in Weather Resistant Steels

BS 8002: 1994 – CP for Earth Retaining Structures.

BS 8004: 1986 – CP for Foundations.

BS 8118 – Structural Use of Aluminium.

BS EN 10025: 1993 – Specification for Hot Rolled Products of Non-alloy Structural Steels - Technical Delivery Conditions.

BS EN 10113: Parts 1-3 – Hot Rolled Products in Weldable Fine Grain Structural Steel.

BS EN 10155: 1993 - Structural Steel with Improved Atmospheric Corrosion Resistance. Technical Delivery Conditions.

3. DoT PUBLICATIONS (HMSO)

Manual of Contract Documents for Highways Works:

Volume 1: Specification for Highway Works.

Volume 2: Notes for Guidance on the Specification for Highways Works.

Volume 3: Highway Construction Details.

Volume 4: Bills of Quantities for Highways Works.

8. DEPARTMENTAL STANDARDS

8.1 TRAFFIC ENGINEERING AND CONTROL

TD 9/93 - Road Layout and Geometry. Highway Link Design.

TD 27/96 - Road Geometry Links - Cross Sections and Headrooms.

TD 32/93 - Wire Rope Safety Fences.

TD 36/93 - Subways for Pedestrians and Pedal Cyclists - Layout and Dimensions.

8.2 BRIDGES AND STRUCTURES

BD 10/97 - Design of Highway Structures in Areas of Mining Subsidence.

BD 12/95 - Design of Corrugated Steel Buried Structures with Spans not Exceeding 8m, Including Circular Arches.

BD 13/90 - Design of Steel Bridges. Use of BS 5400 Pt 3: 1982.

BD 15/92 - General Principles for the Design and Construction of Bridges - Use of BS 5400 Pt 1: 1988.

BD 20/92 - Bridge Bearings. Use of BS 5400 Pt 9: 1983.

BD 21/97 - The Assessment of Highway Bridges and Structures.

BD 24/92 - Design of Concrete Bridges - Use of BS 5400 Pt 4: 1990.

BD 26/94 - Design of Lighting Columns.

BD 33/94 - Expansion Joints for Use in Highway Bridge Decks.

BD 34/90 - Technical Requirements for the Assessment and Strengthening Programme for Highway Structures on Motorways and Other Trunk Roads.
Stage 1 - Older Short Span Bridges and Retaining Structures.

~~BD 35/93 - Quality Assurance Schemes for Paints and Similar Protective Coatings.~~

~~BD 36/92 - Evaluation of Maintenance Costs in Comparing Alternative Designs for Highway Structures.~~

~~BD 41/97 - Reinforced Clay Brickwork Retaining Walls of Pocket Type and Grouted Cavity Type Construction.~~

~~BD 42/94 - Design of Embedded Retaining Walls and Bridge Abutments (Unpropped or Propped at the Top).~~

~~BD 43/90 - Criteria and Materials for the Impregnation of Concrete Structures.~~

~~BD 44/95 - The Assessment of Concrete Highway Bridges and Structures.~~

~~BD 45/93 - Identification Marking of Highway Structures.~~

~~BD 46/92 - Technical Requirements for the Assessment and Strengthening Programme for Highway Structures.~~
~~Stage 2 - Modern Short Span Bridges.~~

~~BD 47/94 - Waterproofing and Surfacing of Concrete Bridge Decks.~~

~~BD 48/93 - The Assessment and Strengthening of Highway Bridge Supports.~~

~~BD 49/93 - Design Rules for Aerodynamic Effects on Bridges.~~

~~BD 50/92 - Technical Requirements for the Assessment and Strengthening Programme for Highways Structures.~~
~~Stage 3 - Long Span Bridges.~~

~~BD 51/98 - Design Criteria for Portal and Cantilever Sign/Signal Gantries.~~

BD 52/93 - The Design of Highway Bridge Parapets.

~~BD 53/95 - Inspections and Records for Road Tunnels.~~

~~BD 54/93 - Post Tensioned Concrete Bridges. Prioritisation of Special Inspections.~~

~~BD 56/96 - The Assessment of Steel Highway Bridges and Structures.~~

~~BD 57/95 – Design for Durability.~~

~~BD 58/94 – The Design of Concrete Highway Bridges and Structures with External and Unbonded Prestressing.~~

~~BD 60/94 – The Design of Highway Bridges for Vehicle Collision Loads.~~

~~BD 61/96 – The Assessment of Composite Highway Bridges.~~

~~BD 62/94 – As Built, Operational and Maintenance Records for Highway Structures.~~

~~BD 63/94 – Inspection of Highway Structures.~~

~~BD 65/97 – Design Criteria for Collision Protector Beams.~~

~~BD 67/96 – Enclosures of Bridges.~~

~~BD 68/97 – Crib Retaining Walls.~~

~~BD 70/97 – Strengthened / Reinforced Soils and Other Fills for Retaining Walls and Bridge Abutments (Use of BS 8006: 1995).~~

~~SD 4/92 – Procedure for Adoption of Proprietary Manufactured Structures.~~

APPENDIX

INSPECTION FOR ASSESSMENT

BRIDGE INSPECTION DETAILS AND CONDITION RATING

ECC Bridge No.: 1662

Rail Property Ltd Bridge No.: WFM/833

Bridge Name: Wellinditch Bridge

Location: Stow Maries, Essex
Grid reference TQ 582026 198688

Date of Inspection: 02 December 1999

Weather: Dry, cold and windy

Description: Three span brick arch bridge with brickwork abutments, piers and parapets.

Inspection Method: Hands on

CONSULTING ENGINEERS CONDITION RATING		
	****	Satisfactory Condition
✓	***	Repairs Required
	**	Urgent Repairs Required
	*	Bridge In Dangerous Condition

To be filled in by Essex County Council

		Date
Inspected by	[redacted]	02 Dec 1999
Prepared by		Jan 2000
Checked by		Feb 2000

BRIDGE CLIENT		BRIDGE NO 1662	
File	Initial	Date	Suggested Condition Rating
Read by			
Read by			
Comments			

Index

1.0 INTRODUCTION

1.1 Essex County Council (ECC) entered into an agreement with Rail Property Ltd to assess Rail Property Ltd owned bridges carrying publicly maintainable highways. WS Atkins Consultants Ltd – Essex (WSAE) have been appointed by ECC to carry out the visual inspections and assessments of the bridges.

1.2 Wellinditch Bridge carries an unclassified road over a dismantled railway to the north of South Woodham Ferrers in Essex OS Ref. TQ 582026 198688.

1.4 An inspection of the structure was carried out on 02 December 1999. The inspection included a visual inspection and dimension survey to confirm structural details. The weather was dry, cold and windy during the inspection.

1.5 The results of the inspection are presented within the text of this report.

1.6 The structure consists of three skew span brick arches supported on brick abutments and piers. The arches each have clear skew spans of 8.70m, 8.65m and 8.70m with an angle of skew of 26°. The parapets are brick.

1.7 The carriageway is 5.7m wide with a 0.9m and 1.1m wide verge on the east and west side of carriageway respectively. The vertical alignment of the carriageway over the structure is a slight hog curve and the horizontal alignment is straight.

1.8 There is no weight restriction on the structure.

2.0 REFERENCE DRAWINGS

2.1 Rail Property Ltd provided drawings prior to the inspection. The references are:

5A/WFM/833/3	Location Plan
5A/13A/833/1	General Arrangement
5A/13A/833/2	General Arrangement

2.2 Following the inspection, survey drawings are produced as below and enclosed in the Approval in Principle for Assessment.

AI1877/DWGS/1662/FIG 01	Elevations
AI1877/DWGS/1662/FIG 02	Plan
AI1877/DWGS/1662/FIG 03	Cross section

2.3 Following the inspection, defect diagrams are produced as below and enclosed in appendix B.

AI1877/DWGS/1662/FIG 04	Elevation defects
AI1877/DWGS/1662/FIG 05	Arch soffit, pier and abutment face defects
AI1877/DWGS/1662/FIG 06	Parapet defects

3.0 INSPECTION PROCEDURE

3.1 The inspection was undertaken on 02 December 1999. Reference was made to the Bridge Inspection Guide (HMSO 1983) and the Department of Transport standard BD21/97 and advice note BA16/97.

3.2 The visual inspection of the structure was carried out to determine the condition of the bridge. The inspection was carried out within touching distance. Where required, access to the higher level elements of the structure was gained using a ladder.

3.3 A full level and dimensional survey was undertaken. Details of the levels and dimensions taken during the inspection are indicated on Drawings No. AI1877/DRGS/1662/FIG 01, FIG 02 and FIG 03 which are included in the Approval in Principle for Assessment.

3.4 The extent and severity of all defects were recorded. The photographs in Appendix A and the defect diagrams (Drawing No. AI1877/DRGS/1662/FIG 04, FIG 05 and FIG 06) in Appendix B illustrate the defects.

4.0 CONDITION REPORT

4.1 Foundations

The foundations were not accessible during the inspection. No evidence of any movement or distress was detected.

4.2 Abutments

4.2.1 The substructure of the bridge consists of brickwork abutments and piers.

4.2.2 The abutments are in fair condition with the following defects identified:

- A short 3mm wide crack in the north abutment face adjacent to ground level.
- Leaching to both abutments.
- 20mm to 30mm mortar loss to the south abutment.
- Staining to the south abutment.
- Vegetation growth on both abutments.
- Minor area of lichen growth on the south abutment.

4.3 Piers

4.3.1 The piers appear to be in fair condition with the following defects identified:

- Extensive mortar loss to both piers, average depth 5mm to 10mm.
- Missing bricks at the east end of pier no. 2 (south pier).
- Minor spalling at the east end of pier no. 1 (north pier).
- Leaching to both piers (photograph no. 3).
- Vegetation growth on pier no. 2.
- Graffiti on pier no. 2 (photograph no. 4).
- Minor area of lichen growth on both piers.

4.4 Arch barrels

4.4.1 The arch barrels are constructed from blue brick (Class 'B' engineering brick) with lime mortar. Five brick rings are visible in elevation.

4.4.2 Arch barrel no. 2 (central arch) is in good condition, whilst arch barrels no. 1 (north) and no. 3 (south) are in fair condition. The following defects have been identified:

Arch no. 1 (north arch)

- Extensive 5mm deep mortar loss.
- A 2mm wide crack in the mortar which zigzags across the barrel transversely.
- Brick loss and minor spalling.
- Minor leaching.
- General staining.

Arch no. 2 (central arch)

- Extensive mortar loss up to 10mm deep.
- Minor leaching.
- General staining.

Arch no. 3 (south arch)

- Extensive 5mm deep mortar loss.
- A 1mm wide crack in the mortar which zigzags across the barrel transversely.
- Minor spalling.
- Minor leaching.
- General staining.

4.5 Spandrels, Wing Walls and Arch Faces

4.5.1 The brickwork is in fair condition with the following defects identified:

- Both east and west elevations suffer from extensive mortar loss, average depth 20mm to 30mm.
- Missing brick over arch no. 1 (west face).
- Minor areas of leaching to arch faces and spandrels.
- A 2mm wide crack in the west spandrel above arch no. 3.
- Minor spalling to the face of arch no. 3.
- Lichen growth on all wing walls.
- Vegetation growth to both elevations.
- General staining of brickwork.

4.6 Embankments

4.6.1 The embankments adjacent to the bridge show no signs of any significant erosion or slippage. The ground has been largely infilled either side of the bridge (note high level of fill on photograph no. 1)

4.7 Parapets

4.7.1 The brick parapets comprise 340mm thick brickwork and capping stone units at the parapet ends (east parapet only). No vertical movement joints were found along the parapets.

4.7.2 The west parapet is in poor condition. A large section of the parapet at the south end has been lost (photograph no. 9) as have 4 no. coping bricks over arch no. 1 (photograph no. 8). In addition there is extensive mortar loss to the outer face and cracking (photograph no. 10), leaching and vegetation growth to both outer and traffic faces.

4.7.3 The east parapet is in fair condition. Both faces suffer from extensive mortar loss, vegetation growth and minor lichen growth.

4.8 Road Surface

4.8.1 The road surface over the bridge deck is in fair condition with rutting along the length of the bridge deck and minor cracking noted.

4.9 Waterproofing

4.9.1 It is not clear from the defects noted whether or not the bridge is waterproofed.

5.0 CONCLUSION

5.1 The structure is in fair condition overall. As well as element specific remedial work there are several areas of mortar loss through out the structure that require repair.

5.2 The abutments are in fair condition. Defects requiring repair are the cracking and the mortar loss.

5.3 The piers are in fair condition with the mortar loss and missing bricks requiring repair.

5.4 The arch barrels all require re-pointing. The brick loss to arch no. 1 should be replaced whilst the spalling to arch nos. 1 and 3 is not considered serious.

5.5 Extensive re-pointing is required to the spandrel walls and wing walls. The missing brick in the west spandrel should be replaced and the crack in the west spandrel repaired.

5.6 The west parapet is in poor condition and requires repairs at the south end and over arch no. 1. The east parapet is in fair condition. Both parapets require re-pointing.

5.7 The carriageway surfacing is in fair condition. The severity of the rutting should be monitored.

5.8 Based on the level and dimensional survey the structure has the following geometric features :-

	Arch no. 1 (North)	Arch no. 2 (Central)	Arch no. 3 (South)
Skew span (L)	8.70m	8.65m	8.70m
Skew angle (α)	26°	26°	26°
Rise of the arch barrel (r_c)	1.425m	1.455m	1.460m
Rise at quarter points (r_q)	1.120m	1.000m	1.105m

Dimensions were obtained from levels and site measurements. See Approval in Principle for Assessment for drawings showing dimensions.

5.9 Based on the inspection and record drawings each of the arch barrels has the following properties:

Barrel thickness = 570 mm
Masonry strength = 4.4 N/mm^2
(Based on BD 21/97 figure 4.2 assuming Class 'B' engineering bricks and lime mortar)
Backing material present up to a height of 1.4m above springing level.
No structurally significant longitudinal cracking or ring separation.

5.10 Based on the inspection and the recommendations of BA16/97 Annex D, it is suggested that the following factors are used for MEXE analysis: -

		Arch no. 1 (North)	Arch no. 2 (Central)	Arch no. 3 (South)
Condition Factor	F_{cM}	0.9	1.0	0.9
Barrel Factor	F_b	1.0	1.0	1.0
Fill Factor	F_f	0.7	0.7	0.7
Width Factor	F_w	0.9	0.9	0.9
Mortar Factor	F_{mo}	0.9	0.9	0.9
Depth Factor	F_d	0.8	0.8	0.8

For alternative analysis by the ARCHIE and MULTI computer programs, it is suggested that the overall condition factor F_c is based on the above factors and the recommendations of BD 21/97 6.21.

5.11 There is no Statutory Undertaker's plant present on the structure.

6.0 RECOMMENDATIONS FOR ASSESSMENT

6.1 The information collected from the site inspection, with respect to defects affecting the structural integrity of the bridge, should be incorporated into the Approval in Principle. Defects affecting the assessment are described in section 5.0. It is recommended that, for the Modified MEXE and ARCHIE analyses, the factors in section 5.10 should be adopted. No other allowance need be made for structural deterioration in the assessment calculations.

6.2 For the assessment, the geometrical properties and material strengths in section 5.8 and 5.9 should be adopted.

6.3 For the assessment, axle lift-off should be considered.

6.4 Abutments, piers, wing walls and foundations should be assessed qualitatively in accordance with BD 21/97 Chapter 8.

Note that the following are maintenance recommendations and will not affect the proposed assessment.

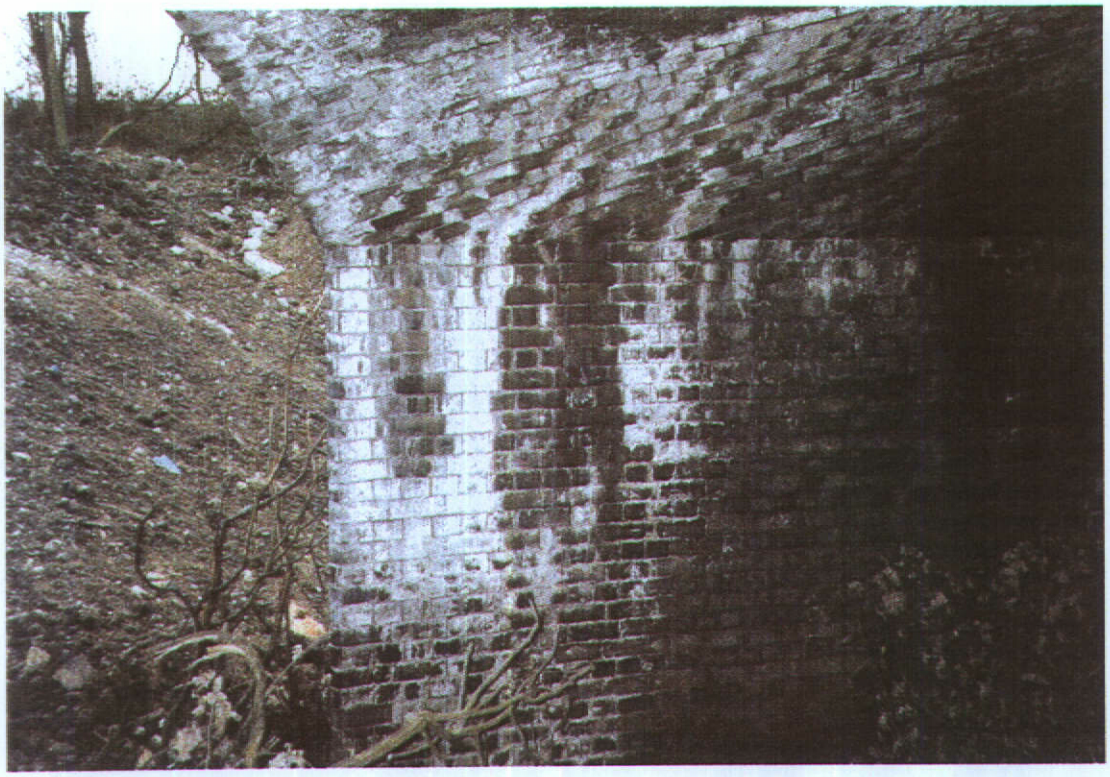
6.5 The weathered, eroded and missing areas of brickwork should be replaced or repaired, unless specified otherwise. The cracks in the structure should also be repaired. Priority should be given to the reconstruction of the west parapet.

APPENDIX A

Photographs

Photograph no. 1 – West elevation of Wellinditch Bridge

Photograph no. 2 – View over bridge looking north

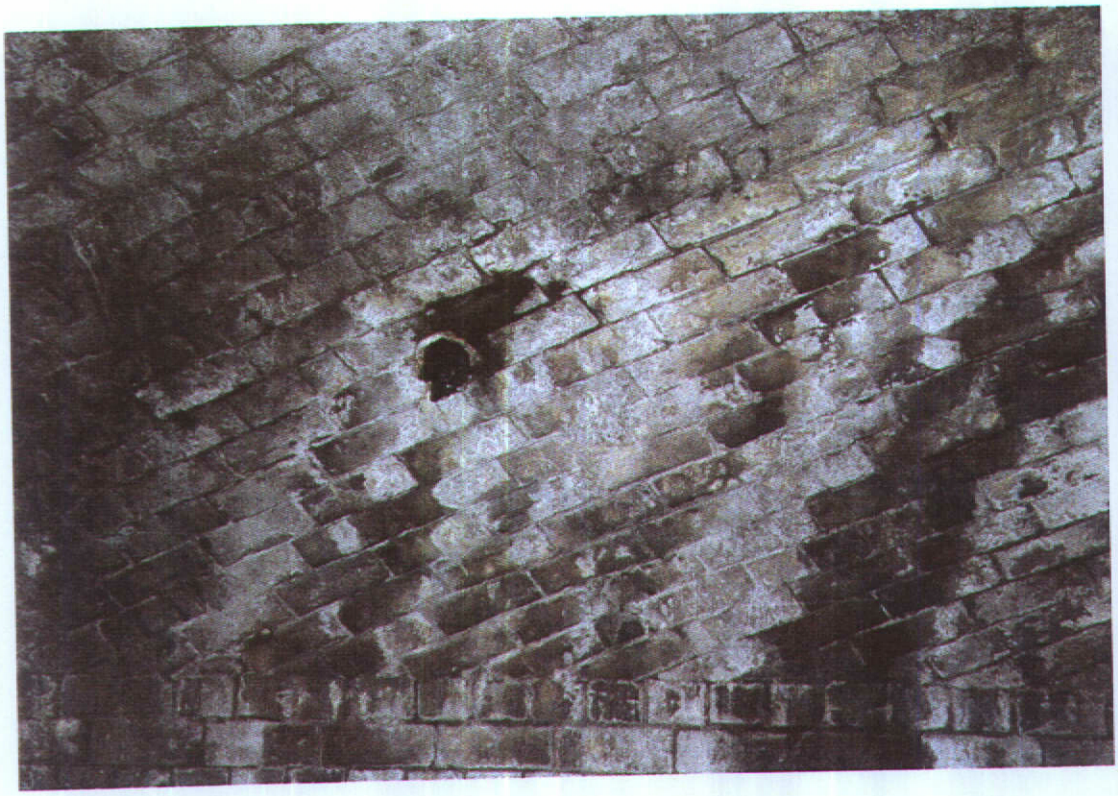


Photograph no. 3 – Leaching to pier no. 1 (north face)

Photograph no. 4 – Graffiti to pier no. 2 (north face)

Photograph no. 5 – Cracking and spalling to soffit of arch no. 1

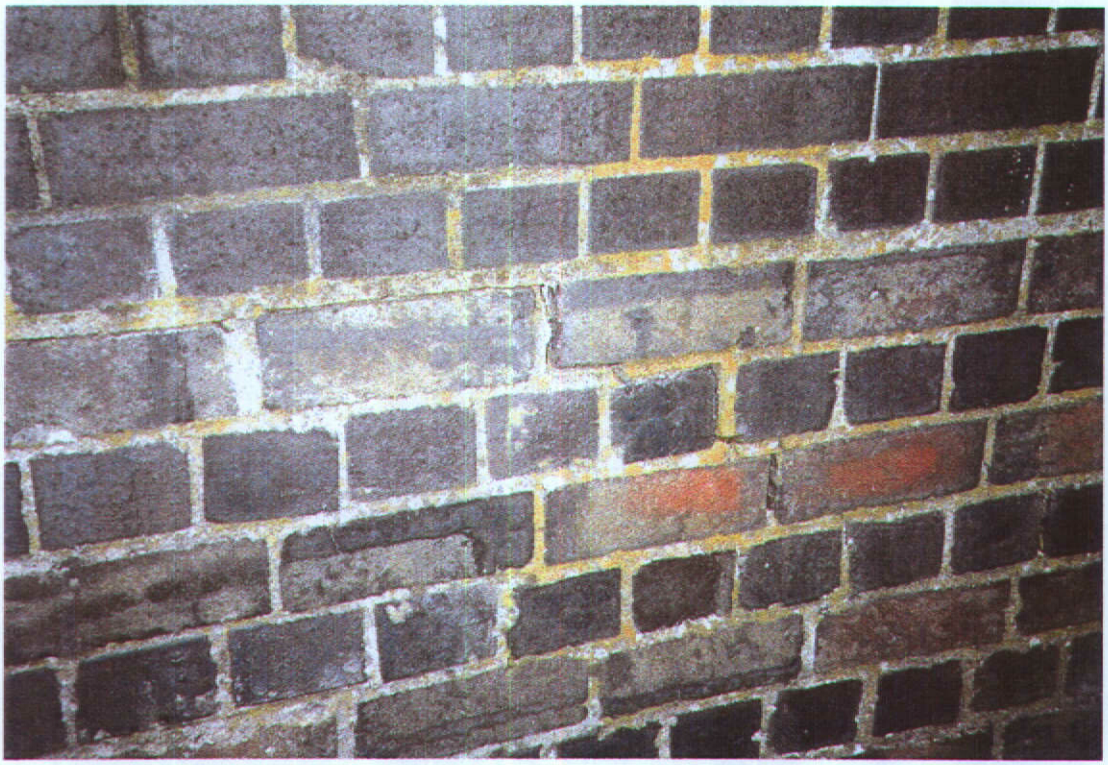
Photograph no. 6 – Cracking and leaching to soffit of arch no. 3



Photograph no. 7 – Leaching to soffit of arch no. 3

Photograph no. 8 – Missing bricks to west parapet over arch no. 1 (north arch)

Photograph no. 9 – West parapet (south end)



Photograph no. 10 – Cracking to traffic face of west parapet

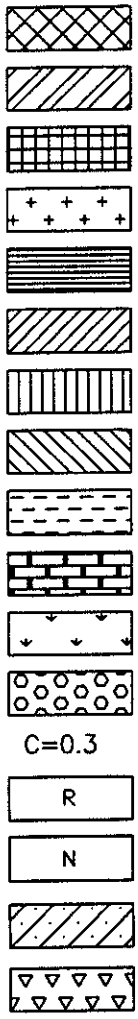
APPENDIX B

Defect Diagrams

ECC ASSESMENT CONTRACT 3 – RAIL PROPERTY Ltd BRIDGES

DETAIL OF STANDARD KEY

KEY

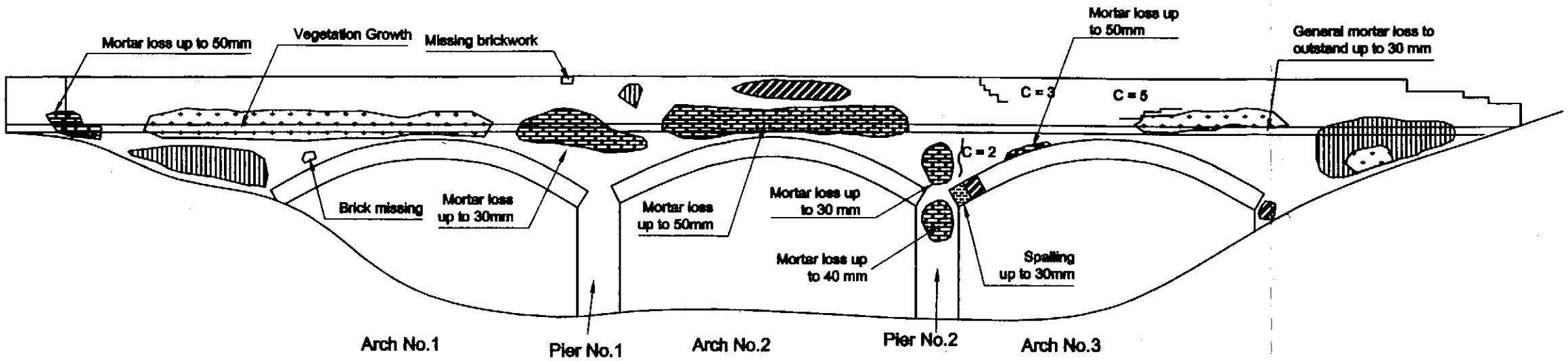


DO NOT SCALE

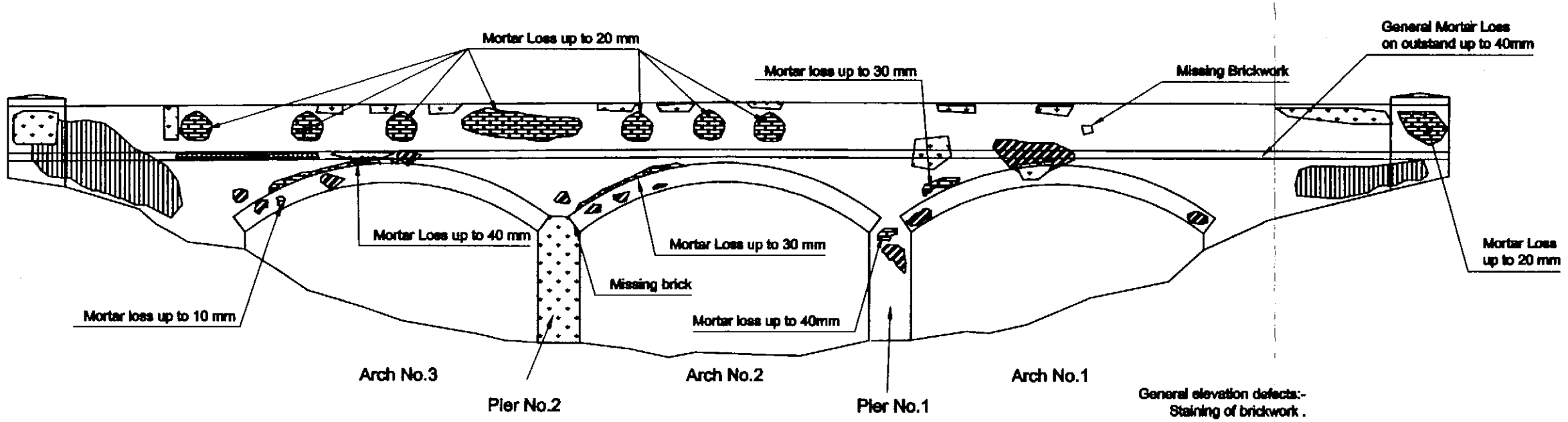
ECC Bridge No. 1662
Rail Property Board No. WFM/833

Notes:

All Dimensions in mm



WEST ELEVATION



EAST ELEVATION

Essex County Council
Transportation & Operational Services

WS/Atkins

SCALES	NTS						
		SURVEYED	LEVELLED	DESIGNED	DRAWN/TRACED	CHECKED	AUTHORISED
	INITIALS	DW	DW		SD		
CAD FILE N:\AI1877\1662\fig04	DATE	12/98	12/98		12/98		
	REVISION NOTES			REVISION		CHECKED	

DESCRIPTION OF DRAWING: WELLINDITCH BRIDGE, STOW MARIES ELEVATION DEFECTS

Sheet 1 of 1

SCHEME TITLE: ECC ASSESSMENT CONTRACT 3 RAIL PROPERTY LTD BRIDGES

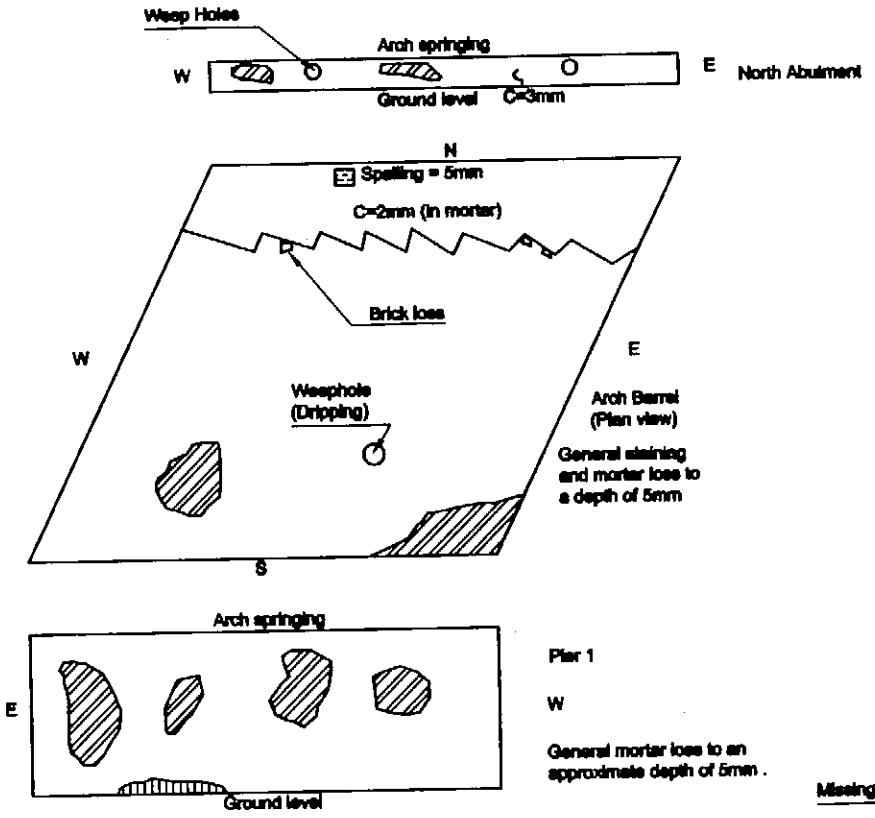
DRAWING NO. AI1877/DWGS/1662/fig 04

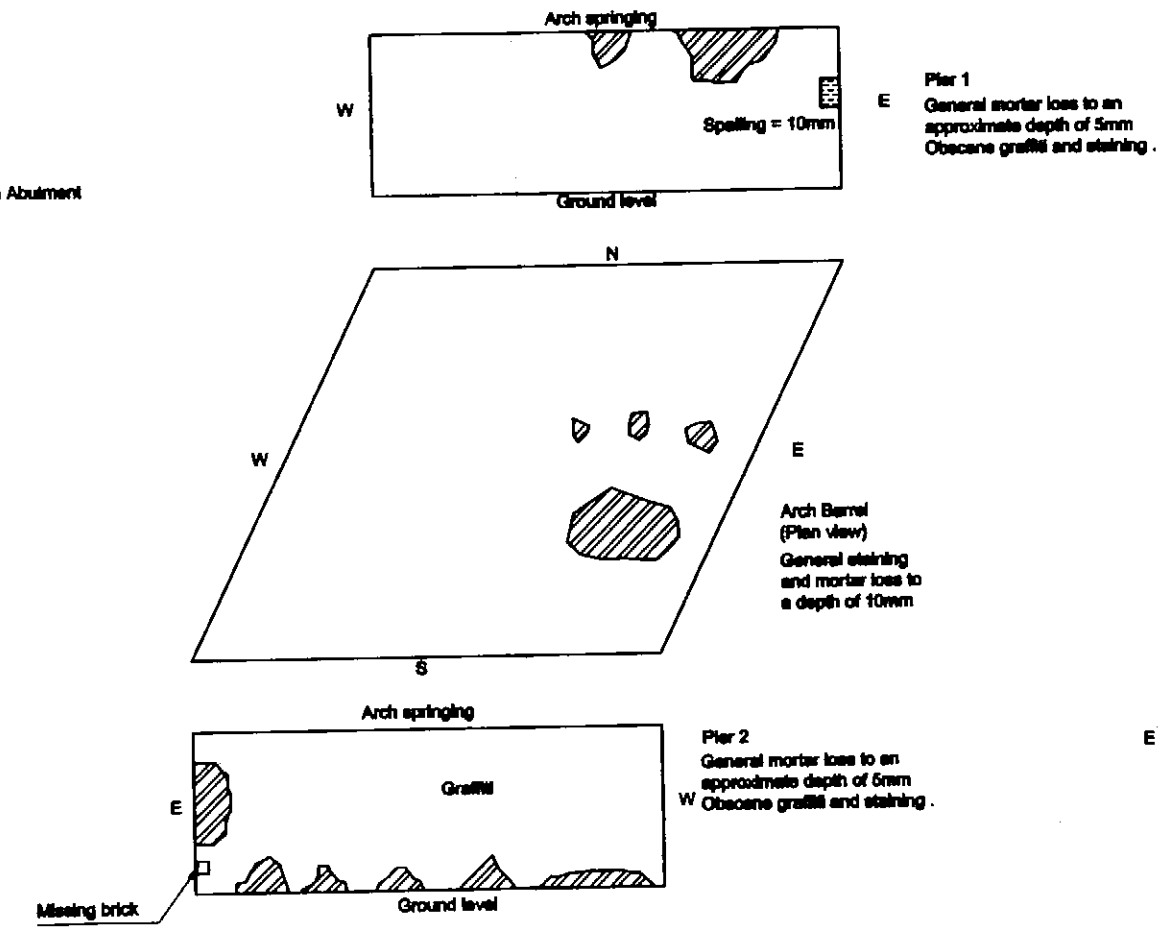
DO NOT SCALE

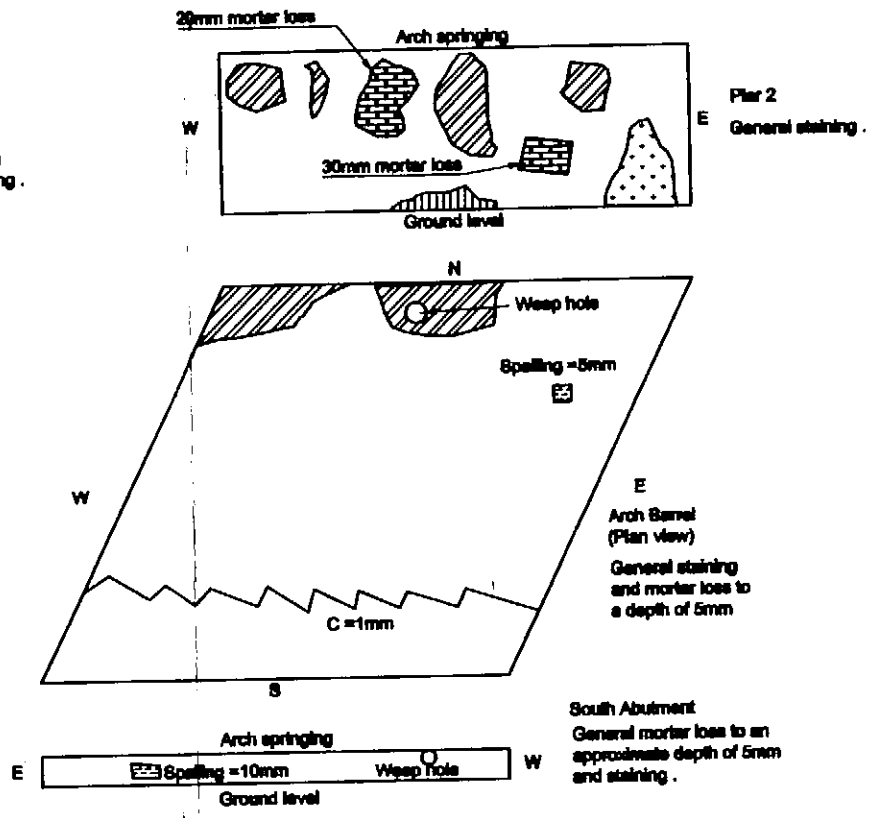
ECC Bridge No. 1662
Rail Property Board No. WFM/833

Notes:

All Dimensions in mm







ARCH 1
North Arch

ARCH 2
Central Arch

ARCH 3
South Arch

Essex County Council
Transportation & Operational Services

WS/Atkins

SCALES		SURVEYED	LEVELLED	DESIGNED	DRAWN/TRACED	CHECKED	AUTHORISED
NTS	INITIALS	DW	DW		SD		
	DATE	12/99	12/99		01/00		

CAD FILE N:\A1677\1662\fig05

REVISION NOTES	REVISION	CHECKED

DESCRIPTION OF DRAWING

WELLINDITCH BRIDGE, STOW MARIES
ARCH SOFFIT, PIER AND
ABUTMENT FACE DEFECTS

Sheet 1 of 1

SCHEME TITLE
ECC ASSESSMENT CONTRACT 3
RAIL PROPERTY LTD BRIDGES

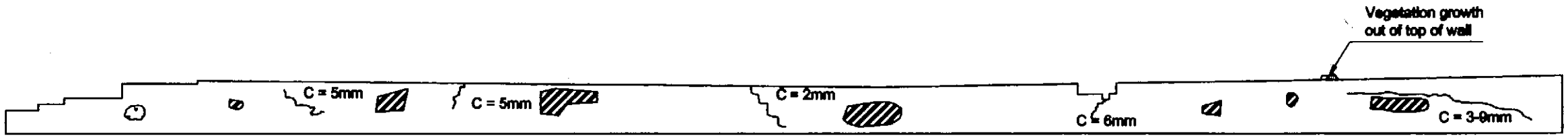
DRAWING NO. A1677/DWGS/1662/fig05

DO NOT SCALE

ECC Bridge No. 1662
Rail Property Board No. WFM/833

Notes:

All Dimensions in mm



WEST PARAPET INSIDE FACE

General Defect:-
Extensive mortar loss to
an average depth of 20mm

EAST PARAPET INSIDE FACE

Essex County Council
Transportation & Operational Services

WS/Atkins

SCALES		SURVEYED	LEVELLED	DESIGNED	DRAWN/TRACED	CHECKED	AUTHORISED
NTS	INITIALS	DW	DW		SD		
	DATE	12/99	12/99		12/99		
CAD FILE: h:\AI1577\1662\fig06	REVISION NOTES			REVISION		CHECKED	

DESCRIPTION OF DRAWING — Sheet 1 of 1

WELLINDITCH BRIDGE, STOW MARIES
PARAPET DEFECTS

SCHEME TITLE
ECC ASSESSMENT CONTRACT 3
RAIL PROPERTY LTD BRIDGES

DRAWING NO. AI1577/DWGS/1662/fig06

APPENDIX C

Statutory Undertakers

New Roads and Street Works Act (NRSWA) notices have been issued to the following companies. The responses are summarised below:

Company	Service
Street Lighting	No existing plant within the vicinity of the bridge.
British Telecom	No existing plant within the vicinity of the bridge.
Cable & Wireless	No existing plant within the vicinity of the bridge.
Energis	No existing plant within the vicinity of the bridge.
Transco	No existing plant within the vicinity of the bridge.
Eastern Electricity	No existing plant within the vicinity of the bridge.
National Grid	No existing plant within the vicinity of the bridge.
Essex and Suffolk Water	No existing plant within the vicinity of the bridge.
Anglian Water	No existing plant within the vicinity of the bridge.
Environment Agency	No comment.

ESSEX COUNTY COUNCIL
ASSESSMENT CONTRACT 3

ASSESSMENT REPORT FOR THE ASSESSMENT OF WELLINDITCH BRIDGE

ECC BRIDGE NO. 1662
RAIL PROPERTY Ltd BRIDGE NO. WFM/833

[redacted]

[redacted]

Essex County Council
Transportation and Operational Services Division
County Hall
Chelmsford
Essex
CM1 1QH

WS Atkins Consultants - Essex
Threadneedle House
9 - 10 Market Road
Chelmsford
Essex
CM1 1JQ

Rail Property Ltd
Room C5
Hudson House
York
YO1 6HP

Copy No. 1
Version No. 1.0

Assessment Report Index

EXECUTIVE SUMMARY

Wellinditch Bridge, to the north of South Woodham Ferrers, has been assessed in accordance with the Approval in Principle dated 27 March 2000. This is situated in appendix C of this report.

The structure consists of three skew span brick arches supported on brick abutments and piers. The arches each have clear skew spans of 8.70m, 8.65m and 8.70m with an angle of skew of 26°. The parapets are brick. There is no weight restriction on the structure.

Overall the structure is in fair condition.

The results for the whole structure are based on the MULTI mechanism method computer program. Results for the individual arches are based on the modified MEXE method, detailed in BD 21/97 and BA 16/97, and the ARCHIE computer program. As the fill depth over the arch is less than the arch barrel thickness for all 3 no. spans, the higher capacity of the ARCHIE and MEXE results will be adopted for the individual arches. The abutments, wing walls and foundations have been assessed qualitatively.

OVERALL STRUCTURAL CAPACITY	40 TONNES

The load carrying capacity of the main structural elements is listed below.

Spans 1 to 3

Arches:	40 Tonnes Assessment Live Loading
Piers:	40 Tonnes Assessment Live Loading

Sub-structures, foundations, wingwalls and spandrel walls:

A qualitative assessment of the abutments, foundations and wingwalls indicate that they are adequate to carry the present traffic loading. According to Clause 8.5 of BD21/97, they may be assumed to be adequate for 40 Tonne assessment loading without further assessment

Strengthening Measures

No strengthening measures are required.

FORM 'BA' (BRIDGES)

CERTIFICATION FOR ASSESSMENT CHECK

STRUCTURE / LINE NAME WELLINDITCH BRIDGE CATEGORY OF CHECK 2

ELR / STRUCTURE NO WFM/833

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 27 March 2000

(2) It has been checked for compliance with the following principle British Standards, Codes of Practice and Assessment standards. (SEE TAS SCHEDULE IN AIP)

List any departures from the above and additional methods or criteria adopted, with reference and justification for their acceptance (commenting on the results if appropriate).
NONE

CATEGORY 1

[redacted]

OR) 29 March 2000

MENT CHECKER) 29 March 2000

R OF THE FIRM OF CONSULTING
RS TO WHOM THE ASSESSOR /
R IS RESPONSIBLE

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

[redacted]

(ASSESSOR) 29 March 2000

DIRECTOR OF THE FIRM OF CONSULTING ENGINEERS TO WHOM THE ASSESSOR IS RESPONSIBLE

(b) CHECK

[redacted]

(ASSESSMENT CHECKER) 29 March 2000

DIRECTOR OF THE FIRM OF CONSULTING ENGINEERS TO WHOM CHECKER IS RESPONSIBLE

FORM 'BAA' (BRIDGES)

CERTIFICATION FOR ASSESSMENT CHECK

NOTIFICATION OF ASSESSMENT CHECK

STRUCTURE NAME / ROAD NO. WELLINDITCH BRIDGE

LINE NAME (DISUSED)

ELR CODE / STRUCTURE NO. WFM/833 ESSEX COUNTY COUNCIL No. 1662

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

STATEMENT OF CAPACITY

40 tonnes

Critical member/s: N/A

RECOMMENDED LOADING RESTRICTIONS

No weight restriction is required.

DESCRIPTION OF STRUCTURAL DEFICIENCIES AND RECOMMENDED STRENGTHENING

No strengthening measures required.

[redacted]

1.0 INTRODUCTION

1.1 Essex County Council (ECC) entered into an agreement with Rail Property Ltd to assess Rail Property Ltd owned bridges carrying publicly maintainable highways. WS Atkins Consultants Ltd – Essex (WSAE) have been appointed by ECC to carry out the visual inspections and assessments of the bridges.

1.2 An Approval in Principle document was submitted and approved on 27 March 2000. This includes a detailed inspection for assessment report. This assessment report should be read in conjunction with the Approval in Principle and Inspection for Assessment Report.

1.3 An inspection of the structure was carried out on 02 December 1999. The inspection included a visual inspection and dimension survey to confirm structural details. The weather was dry, cold and windy during the inspection. The results of the inspection are presented in the inspection for assessment report which forms part of the Approval in Principle dated 27 March 2000.

1.4 A summary of the inspection report findings are listed in section 2 of this assessment report. This includes details of the defects to the bridge which affect the load carrying assessment of the structure.

1.5 Wellinditch Bridge carries an unclassified road over a dismantled railway to the north of South Woodham Ferrers in Essex OS Ref. TQ 582026 198688.

1.6 The structure consists of three skew span brick arches supported on brick abutments and piers. The arches each have clear skew spans of 8.70m, 8.65m and 8.70m with an angle of skew of 26°. The parapets are brick.

1.7 The carriageway is 5.7m wide with a 0.9m and 1.1m wide verge on the east and west side of carriageway respectively. The vertical alignment of the carriageway over the structure is a slight hog curve and the horizontal alignment is straight.

1.8 There is no weight restriction on the structure.

2.0 CONCLUSIONS OF INSPECTION REPORT

Details of the key dimensions of the structure are shown on drawings AI1877/DWGS/1662/FIG 01, Fig 02 and FIG 03. These are included in the Approval in Principle document.

Details of the defects in the structure are shown on drawings AI1877/DWGS/1662/FIG 04 to FIG 06. These are situated in the inspection for assessment report which forms an appendix to the Approval in Principle.

The following is a summary of the defects listed in the inspection for assessment report.

2.1 Overall, the bridge is generally in fair condition.

2.2 Based on a visual inspection and the recommendations of BA 16/97 Annex D, the following factors for the Modified MEXE Method were adopted:

		Arch no. 1 (North)	Arch no. 2 (Central)	Arch no. 3 (South)
Condition Factor	F_{cM}	0.9	1.0	0.9
Barrel Factor	F_b	1.0	1.0	1.0
Fill Factor	F_f	0.7	0.7	0.7
Width Factor	F_w	0.9	0.9	0.9
Mortar Factor	F_{mo}	0.9	0.9	0.9
Depth Factor	F_d	0.8	0.8	0.8

For alternative analysis by the ARCHIE and MULTI computer programs, the overall condition factor F_c, based on the above factors and the recommendations of BD 21/97 6.21, has been adopted.

These factors were decided upon by the Engineer based on the inspection and the Standards listed in the Approval in Principle.

2.3 For the assessment axle lift-off should be considered.

2.4 Backing material has been assumed above the intermediate piers and abutments to levels indicated on Rail Property Ltd drawings 5A/13A/833/1 and 5A/13A/833/2, referenced in Section 2 of the Inspection for Assessment report.

2.5 The weathered, eroded and missing areas of brickwork should be replaced or repaired, unless specified otherwise. The cracks in the structure should also be repaired. Priority should be given to the reconstruction of the west parapet.

2.6 The abutments, wing walls and foundations showed little signs of distress and were assumed to be in sound condition.

3.0 ASSESSMENT METHODS AND FINDINGS

3.1 The assessment of Wellinditch Bridge, to the north of South Woodham Ferrers, has been carried out in accordance with the Approval in Principle dated 27 March 2000. The following drawings, included in the Approval in Principle document have been used.

AI1877/DWGS/1662/FIG 01	Elevations
AI1877/DWGS/1662/FIG 02	Plan
AI1877/DWGS/1662/FIG 03	Cross section

3.2 The following assumptions have been made regarding material strengths.

Masonry Strength	4.4 N/mm2

3.3 Detailed results tables are situated in appendix A of this assessment report. Copies of the assessment calculations are situated in appendix B.

ARCHES

3.4 The individual arches have been analysed using the modified MEXE method, detailed in BD 21/97 and BA 16/97, and the ARCHIE computer program. As the fill depth over the arch is less than the arch barrel thickness for all 3 no. spans, the higher capacity of the ARCHIE and MEXE results will be adopted for the individual arches.

3.5 For the assessment axle lift-off has been considered.

3.6 Backing has been assumed above the intermediate piers and abutments as discussed in Section 2 of this report.

3.7 The arches were assessed at **40 TONNES** Assessment Live Loading.

INTERMEDIATE PIERS

3.8 The whole structure was analysed as a multi span arch using the MULTI mechanism method computer program.

3.9 The piers were assessed at **40 TONNES** Assessment Live Loading.

ABUTMENTS, WING WALLS AND FOUNDATIONS

3.10 A qualitative assessment of the abutments, wing walls and foundations indicate that they are adequate to carry the present traffic loading. According to Clause 8.5 of BD21/97, they may be assumed to be adequate for 40 Tonne assessment loading without further assessment.

4.0 CONCLUSIONS

4.1 Wellinditch Bridge, to the north of South Woodham Ferrers, has been assessed in accordance with the Approval in Principle dated 27 March 2000.

4.2 The results for the whole structure are based on the MULTI mechanism method computer program. Results for the individual arches are based on the modified MEXE method, detailed in BD 21/97 and BA 16/97, and the ARCHIE computer program. As the fill depth over the arch is less than the arch barrel thickness for all 3 no. spans, the higher capacity of the ARCHIE and MEXE results will be adopted for the individual arches. A summary of the results is listed below.

4.3 Spans 1 to 3

Arches:	40 tonnes
Piers:	40 tonnes
Parapets:	The parapets do not conform to current standards and have not been assessed.

4.4 Abutments, wing walls and foundations

A qualitative assessment of the abutments, wing walls and foundations indicate that they are adequate to carry the present traffic loading. According to Clause 8.5 of BD21/97, they may be assumed to be adequate for 40 Tonne assessment loading without further assessment. Spandrel walls are assessed also at 40 Tonne.

4.5 The inspection for assessment showed that the structure requires minor maintenance. Details are included in section 6 of the inspection report.

4.6 Strengthening Requirements

No strengthening measures are required.

APPENDIX A

SUMMARY RESULTS TABLES

Analysis Results: Masonry Arch Analysis.

Span Reference		North Arch	North Arch	Central Arch	Central Arch
Method Used		MEXE	ARCHIE/ MULTI	MEXE	ARCHIE/ MULTI
Single Span Analysis – No Axle Lift Off					
Allowable Axle Loads	Single Axle Load	27.6t	>11.5t	32.5t	>11.5t
	Double Axle Load	17.9t	>10t	21.1t	>10t
	Triple Axle Load	15.9t	>8t	18.8t	>8t
Single Span Analysis – Axle Lift Off					
AAL	Double Axle Load	13.2t	>11.5t	15.6t	>11.5t
Multi Span Analysis (Assuming Slender Piers)					
Overall Global Capacity		N/A	40t	N/A	40t
Maximum Gross Vehicle Weight		40t	40t	40t	40t
Assessment Live Load Rating		40t	40t	40t	40t
HB Rating		N/A	N/A	N/A	N/A

Comments

- Axle lift off has been considered.
- Backing material has been assumed above the intermediate piers and abutments to levels indicated on Rail Property Ltd drawings 5A/13A/833/1 and 5A/13A/833/2, referenced in Section 2 of the Inspection for Assessment report

Rail Property Ltd
ECC Bridge Assessment Contract No. 3
Rail Property Bridge No. WFM/833 — Structure: Wellinditch Bridge
ECC Bridge No. 1662 — Date: May-2000

Analysis Results: Masonry Arch Analysis.

Span Reference	South Arch	South Arch		
Method Used	MEXE	ARCHIE/ MULTI		

Single Span Analysis – No Axle Lift Off

Allowable Axle Loads	Single Axle Load	21.4t	>11.5t		
	Double Axle Load	13.9t	>10t		
	Triple Axle Load	12.4t	>8t		

Single Span Analysis – Axle Lift Off

AAL	Double Axle Load	10.3t	>11.5t		

Multi Span Analysis (Assuming Slender Piers)

Overall Global Capacity	N/A	40t		

Maximum Gross Vehicle Weight	40t	40t		
Assessment Live Load Rating	40t	40t		
HB Rating	N/A	N/A		

Comments

- Axle lift off has been considered.
- Backing material has been assumed above the intermediate piers and abutments to levels indicated on Rail Property Ltd drawings 5A/13A/833/1 and 5A/13A/833/2, referenced in Section 2 of the Inspection for Assessment report

APPENDIX B

ASSESSMENT CALCULATIONS

WS/Atkins

CALCULATION INDEX

PROJECT: ECC ASSESSMENT CONTRACT 3

FILE NAME: WELLINGTON BRIDGE

FILE NO: A1 1 8 7 7 - 7 3 -

C = Calculation
S = Sketch
D = Data

Page

INDEX NO	CALCULATION/SKETCH/DATA	ORIGINATOR	DATE
1	Summary		2/00
2-5	ARCH ANALYSIS DATA		2/00
6	NORTH ARCH - MEXE		2/00
7	CENTRAL ARCH - MEXE		2/00
8	SOUTH ARCH - MEXE		2/00
9-10	MEXE Summary		2/00
11-13	ARCHIE ANALYSIS		2/00
14-26	ARCHIE OUTPUT DATA		2/00
27-42	MULTI ANALYSIS		2/00

Continued on Sheet

WS/Atkins	Project	Job ref
	ECL ASSESSMENT CONTRACT 3	AI 1877/23
	Part of structure: WELLINGTON	Calc sheet no / 2 / rev /
	Drawing ref	Calc by [redacted] Date 2/00
		Check by Date

Ref	Calculations	Output

ARCH ANALYSIS

The following information was taken from the AIP. The idealisation diagrams are included in the next few pages.

	Arch no. 1 (North)	Arch no. 2 (Central)	Arch no. 3 (South)
Skew span (L)	8.70m	8.65m	8.70m
Skew angle (α)	26°	26°	26°
Rise of the arch barrel (r_c)	1.425m	1.455m	1.460m
Rise at quarter points (r_q)	1.120m	1.000m	1.105m

		North Arch	Centre Arch	South Arch
Condition Factor	F_{cM}	0.9	1.0	0.9
Barrel Factor	F_b	1.0	1.0	1.0
Fill Factor	F_f	0.7	0.7	0.7
Width Factor	F_w	0.9	0.9	0.9
Mortar Factor	F_{mo}	0.9	0.9	0.9
Depth Factor	F_d	0.8	0.8	0.8

Axle lift-off should be considered.

Backing level (determined from record drawings)	1.4m above springing level
Masonry self weight	21kN/m^3
Fill self weight	19kN/m^3
Surfacing self weight	23kN/m^3
ϕ' for fill	30°
ARCHIE passive pressure coefficient	0.3
Masonry strength	4.4 N/mm^2

ARCHES SEMI-CIRCULAR IN SHAPE.

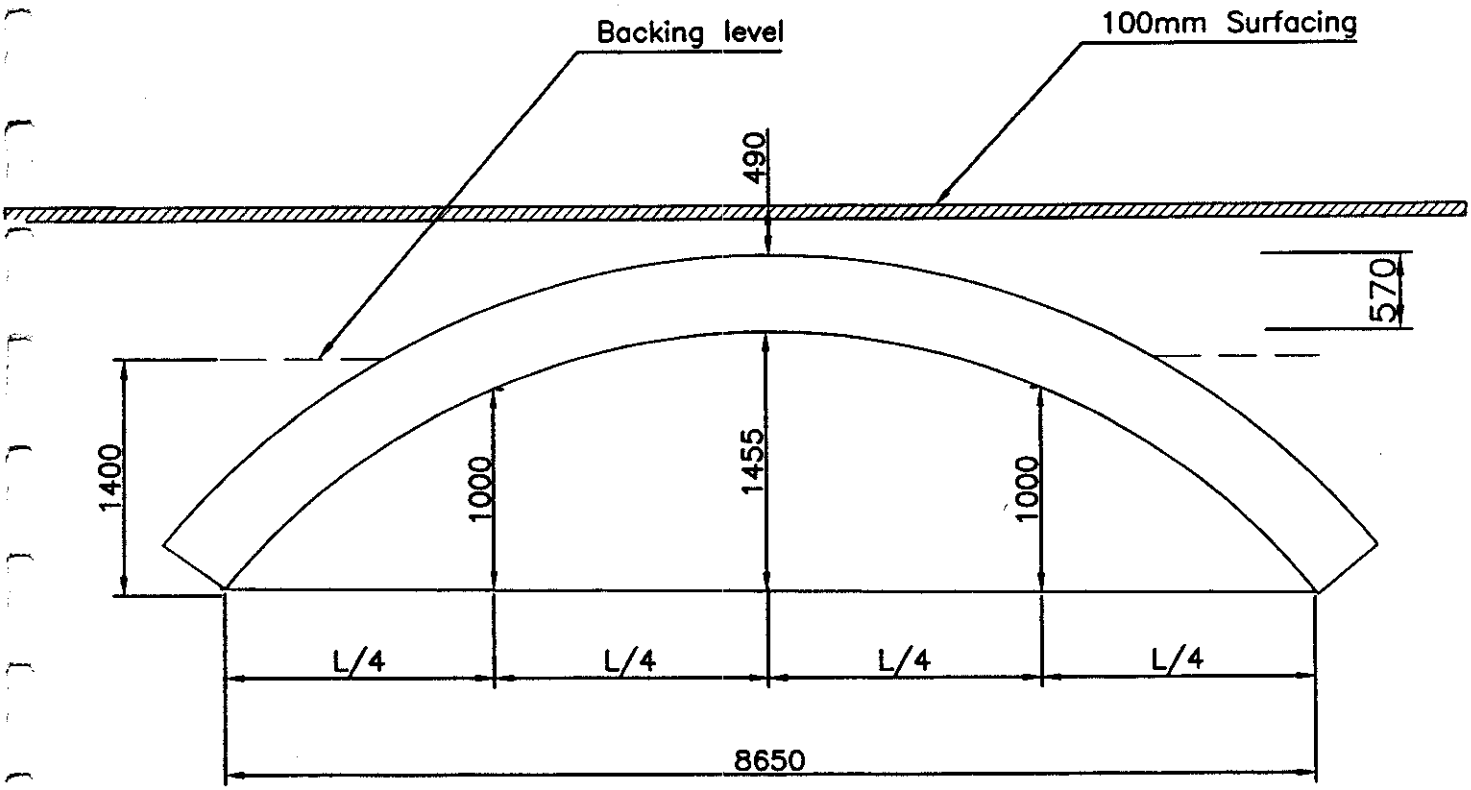
Essex County Council
Transportation & Operational Services

[redacted]

WS Atkins

(4)

ECC Bridge No. 1662
Rail Property Board No. WFM/833



ARCH No.2 (CENTRAL ARCH)
IDEALISATION DIAGRAM
NTS

DRWG.NO.	AI1877/1662/fig08
CAD NO.	N:1877/1662/fig08
SCALES	NTS
DATE JAN 00	DRAWN/TRACE [redacted]
DATE JAN 00	CHECKED
DATE	AUTHORISED

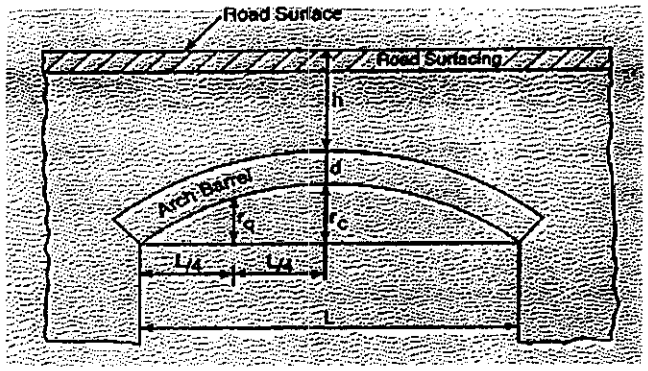
SCHEME TITLE ECC ASSESSMENT CONTRACT 3
WELLINDITCH BRIDGE, STOW MARIES
IDEALISATION DIAGRAM ARCH 2

WS/Atkins

ARCH ASSESSMENT TO MODIFIED MEXE (BA 16/97)

Structure Name: WELLINGTON - NORTH ARCH

1. DIMENSIONS



L = 8·700m
rc = 1·425m
rq = 1·120m
d = 0·570m
h = 0·520m
h + d = 1·090m

2. PROVISIONAL ASSESSMENT LOADING (Fig. 3/1)

PAL = 52·8 Tonne

3. SPAN / RISE FACTOR

$\frac{L}{rc} = \frac{8·700}{1·425} = 6·11$ (Fig. 3/3) Fsr = 0·74

4. PROFILE FACTOR

$\frac{rq}{rc} = \frac{1·120}{1·425} = 0·79$ (Fig. 3/4) Fp = 0·91

5. MATERIAL FACTOR

(Tables 3/1 & 3/2)

$Fm = \frac{(Fb.d) + Ff.h)}{d + h} = \frac{(1·0 \times 0·57) + (0·7 \times 0·52)}{0·570 + 0·520}$ Fm = 0·86

6. JOINT FACTOR

(Tables 3/3, 3/4 & 3/5)

Fj = Fw.Fd.Fmo = 0·9 x 0·8 x 0·9 Fj = 0·65

7. CONDITION FACTOR

(Para. 3.17 to 3.23) Fc = 0·90

8. MODIFIED AXLE LOAD

MAL = PAL x Fsr x Fp x Fm x Fj x Fc

MAL = 17·9 Tonne

9. AXLE LIFT-OFF FACTOR

(Fig. 3/5) SEE NEXT SHEETS. Af = VARIED

10. WEIGHT LIMIT ON ARCH (MAX GROSS VEHICLE WEIGHT)

(Table 3/6) 40 Tonne

11. CONCLUSIONS:

ACCEPTABLE CAPACITY FOR 40 TONNE VEHICLE

Assessed By: [redacted] Date: 11/2/00

Signed: [redacted]

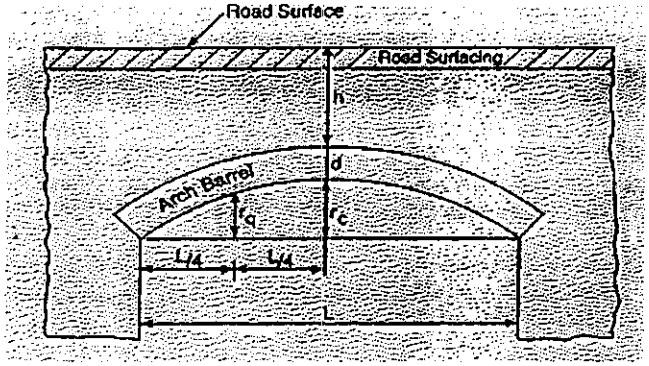
WS/Atkins

(8)

ARCH ASSESSMENT TO MODIFIED MEXE (BA 16/97)

Structure Name: WELLINGTON - SOUTH ARCH

1. DIMENSIONS



L = 8·700m
rc = 1·460m
rq = 1·105m
d = 0·570m
h = 0·390m
h + d = 0·960m

2. PROVISIONAL ASSESSMENT LOADING (Fig. 3/1)

PAL = 41·0 Tonne

3. SPAN / RISE FACTOR

$\frac{L}{rc} = \frac{8·700}{1·460} = 5·96$ (Fig. 3/3) Fsr = 0·75

4. PROFILE FACTOR

$\frac{rq}{rc} = \frac{1·105}{1·460} = 0·76$ (Fig. 3/4) Fp = 0·88

5. MATERIAL FACTOR

(Tables 3/1 & 3/2)

$Fm = \frac{(Fb.d) + Ff.h)}{d + h} = \frac{(1·0 \times 0·57) + (0·7 \times 0·39)}{0·57 + 0·39}$ Fm = 0·88

6. JOINT FACTOR

(Tables 3/3, 3/4 & 3/5)

Fj = Fw.Fd.Fmo = 0·9 x 0·8 x 0·9 Fj = 0·65

7. CONDITION FACTOR

(Para. 3.17 to 3.23) Fc = 0·90

8. MODIFIED AXLE LOAD

MAL = PAL x Fsr x Fp x Fm x Fj x Fc MAL = 13·9 Tonne

9. AXLE LIFT-OFF FACTOR

(Fig. 3/5) SEE NEXT SHEETS Af = VARIES

10. WEIGHT LIMIT ON ARCH (MAX GROSS VEHICLE WEIGHT)

(Table 3/6) 40 Tonne

11. CONCLUSIONS:

ADEQUATE CAPACITY FOR 40 TONNE VEHICLE

Assessed By: [redacted] Date: 11/2/00

Signed: [redacted]

WS/Atkins

Project	Job ref
ECC ASSESSMENT CONTRACT 3	AI 1877 /73
Part of structure: WELLINGTON	Calc sheet no / 10 / rev /
Drawing ref	Calc by [redacted] Date 2/00
	Check by Date

Ref	Calculations	Output

MEXE ANALYSIS

CENTRAL ARCH

	Loadcase	MAL	A_f	Allowable Axle Load
No. Axle Lift Off	Single Axle Load	21.1t	1.54	32.5t
	Double Axle	21.1t	1.00	21.1t
	Triple Axle	21.1t	0.89	18.8t
Lift Off	Double Axle	21.1t	0.74	15.6t

∴ Max gross vehicle weight = 40 tonnes.

SOUTH ARCH

	Loadcase	MAL	A_f	Allowable Axle Load
No Lift Off	Single Axle	13.9t	1.54	21.4t
	Double Axle	13.9t	1.00	13.9t
	Triple Axle	13.9t	0.89	12.4t
Lift Off	Double Axle	13.9t	0.74	10.3t

∴ Max gross vehicle weight = 40 tonnes.

WS/Atkins	Project: ECC ASSESSMENT CONTRACT 3	Job ref: A1 1877/73
	Part of structure: WELLINGTON	Calc sheet no: 1/12 rev: 1
	Drawing ref	Calc by: [redacted] Date: 2/00
		Check by	Date

Ref	Calculations	Output

ARCHIE ANALYSIS

CENTRAL ARCH

ARCHIE condition factor = 1.00 × 0.65 = 0.65

For 2 lanes, lane width = (1.8 + 1.8 + 0.7 + 1.5 + 0.49) × 0.65

= 4.089m

∴ Effective lane width applicable to archive loading = 4.089/2 = 2.044 m

Refer to axle load spreadsheet for loadings

SOUTH ARCH

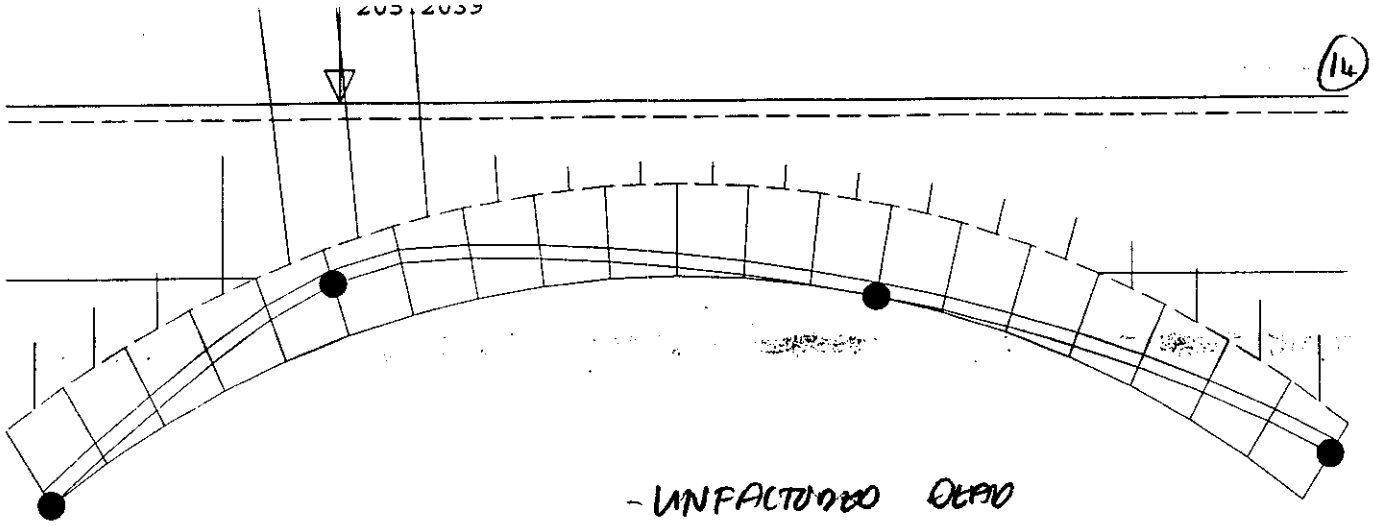
ARCHIE condition factor = 0.9 × 0.65 = 0.59

For 2 lanes, lane width = (1.8 + 1.8 + 0.7 + 1.5 + 0.39) × 0.59

= 3.652m

∴ Effective lane width applicable to single lane loading = 3.652/2 = 1.826m

Refer to axle load spreadsheet for loadings



Northarc

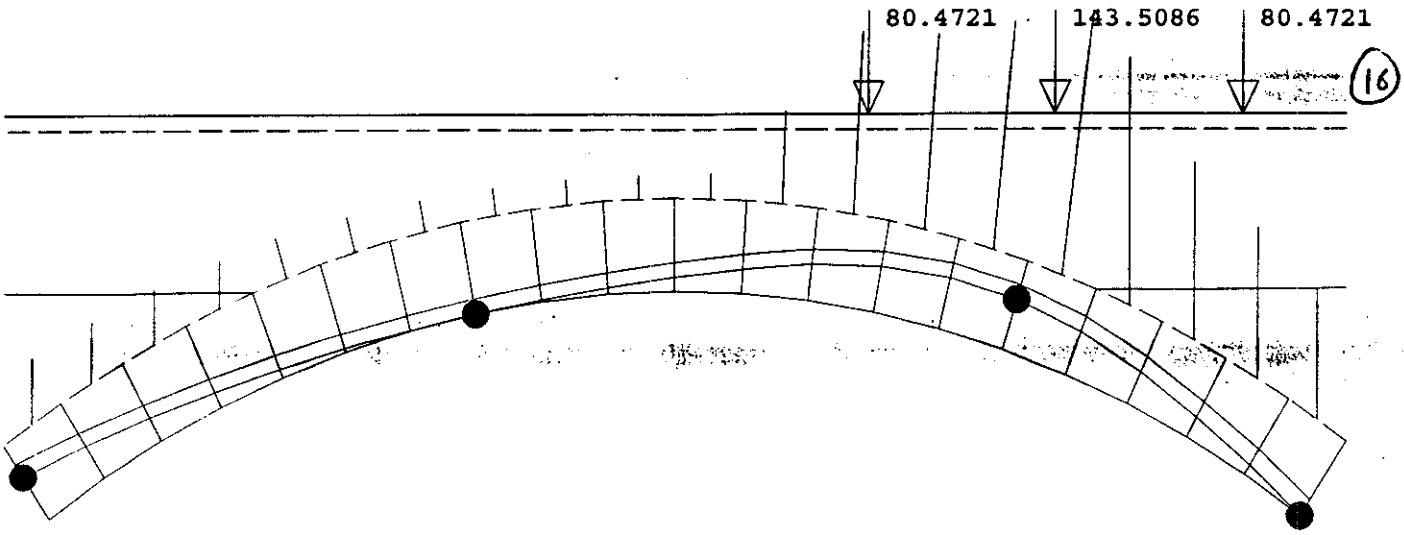
()			
Span	8700 mm	Rise	1425 mm
Depth of fill	520 mm	Depth of surfacing	100 mm
Ring depth	570 mm	Ring depth factor	1
Position of backing	4	Depth of mortar loss	0 mm
Fill density	19 kN/m^3	Masonry density	21 kN/m^3
Surfacing density	23 kN/m^3		
Phi for fill	30 deg	Masonry strength	4.4 N/mm^2
Load	Single Axle:11.5t at 2000		
Lane width	1864mm		
Required ring depth	436 mm	Geometric F.O.S	1.31
H Left	349 kN/m	H Right	365 kN/m
V Left	322 kN/m	V Right	185 kN/m
Comp. zone at hinge 2	88 mm	Factor on pass. press.	.3

Hinges

1 AT 1	2 AT 6	3 AT 14	4 AT 21

Param(mn).segment

	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.7	-15.2	0	0	0	0
2	-5.8	-14.1	0	0	0	0
3	-5.8	-12.4	0	-.5	0	0
4	-5.8	-10.6	0	-20.4	0	0
5	-5.8	-9.1	1.7	-62.4	7.6	0
6	-5.8	-7.9	1.1	-76	7.4	0
7	-5.8	-6.9	.8	-41.3	3.1	0
8	-5.8	-6.1	.5	-4.5	.2	0
9	-5.8	-5.5	.3	0	0	0
10	-5.8	-5.2	.1	0	0	0
11	-5.8	-5.2	-.1	0	0	0
12	-5.8	-5.5	-.3	0	0	-.1
13	-5.8	-6.1	-.5	0	0	-.3
14	-5.8	-6.9	-.8	0	0	-.6
15	-5.8	-7.9	-1.1	0	0	-.9
16	-5.8	-9.1	-1.7	0	0	-1.2
17	-5.8	-10.6	0	0	0	0
18	-5.8	-12.4	0	0	0	0
19	-5.8	-14.1	0	0	0	0
20	-5.7	-15.2	0	0	0	0



Northarc

()

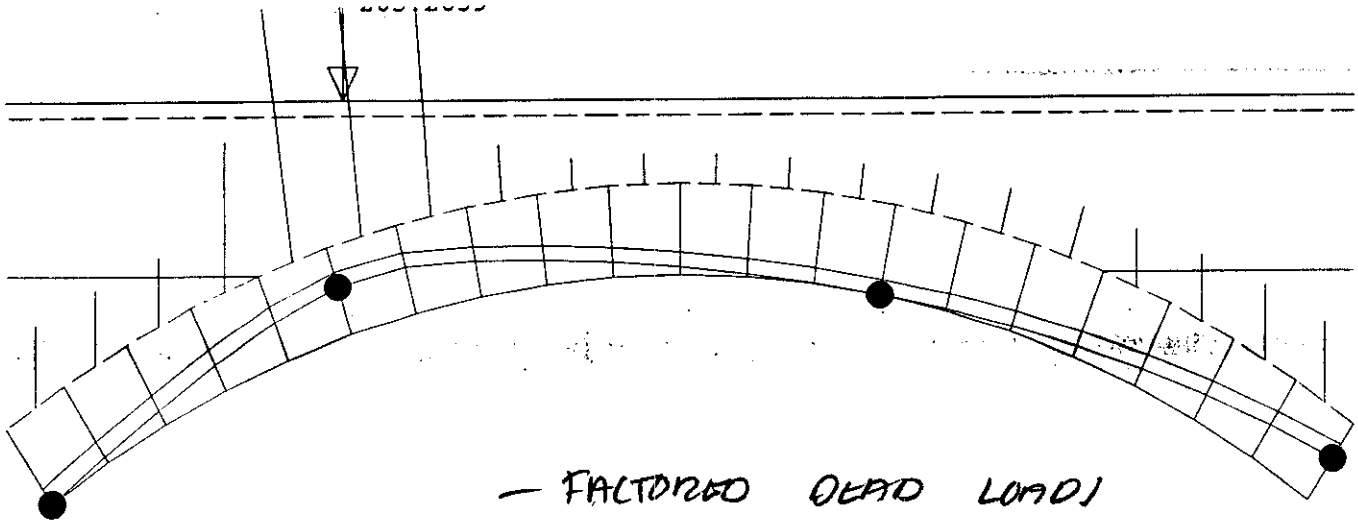
Span	8700 mm	Rise	1425 mm
Depth of fill	520 mm	Depth of surfacing	100 mm
Ring depth	570 mm	Ring depth factor	1
Position of backing	4	Depth of mortar loss	0 mm
Fill density	19 kN/m^3	Masonry density	21 kN/m^3
Surfacing density	23 kN/m^3		
Phi for fill	30 deg	Masonry strength	4.4 N/mm^2
Load	Triple Axle:24t:No Lift-off at 7000		
Lane width	1864mm		
Required ring depth	418 mm	Geometric F.O.S	1.36
H Left	394 kN/m	H Right	381 kN/m
V Left	197 kN/m	V Right	398 kN/m
Comp. zone at hinge 2	94 mm	Factor on pass. press.	.3

Hinges

1 AT 1	2 AT 8	3 AT 16	4 AT 21

Param(mn).segment

	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.7	-15.2	0	0	0	0
2	-5.8	-14.1	0	0	0	0
3	-5.8	-12.4	0	0	0	0
4	-5.8	-10.6	0	0	0	0
5	-5.8	-9.1	1.7	0	0	1.2
6	-5.8	-7.9	1.1	0	0	.9
7	-5.8	-6.9	.8	0	0	.6
8	-5.8	-6.1	.5	0	0	.3
9	-5.8	-5.5	.3	0	0	.1
10	-5.8	-5.2	.1	0	0	0
11	-5.8	-5.2	-.1	-.5	0	0
12	-5.8	-5.5	-.3	-15.4	-.5	0
13	-5.8	-6.1	-.5	-35.3	-1.9	0
14	-5.8	-6.9	-.8	-37.4	-2.8	0
15	-5.8	-7.9	-1.1	-43.7	-4.2	0
16	-5.8	-9.1	-1.7	-54.5	-6.6	0
17	-5.8	-10.6	0	-45.2	0	0
18	-5.8	-12.4	0	-27.1	0	0
19	-5.8	-14.1	0	-19.8	0	0
20	-5.7	-15.2	0	-14.6	0	0



— FACTORED DEAD LOADS

Northarc

()

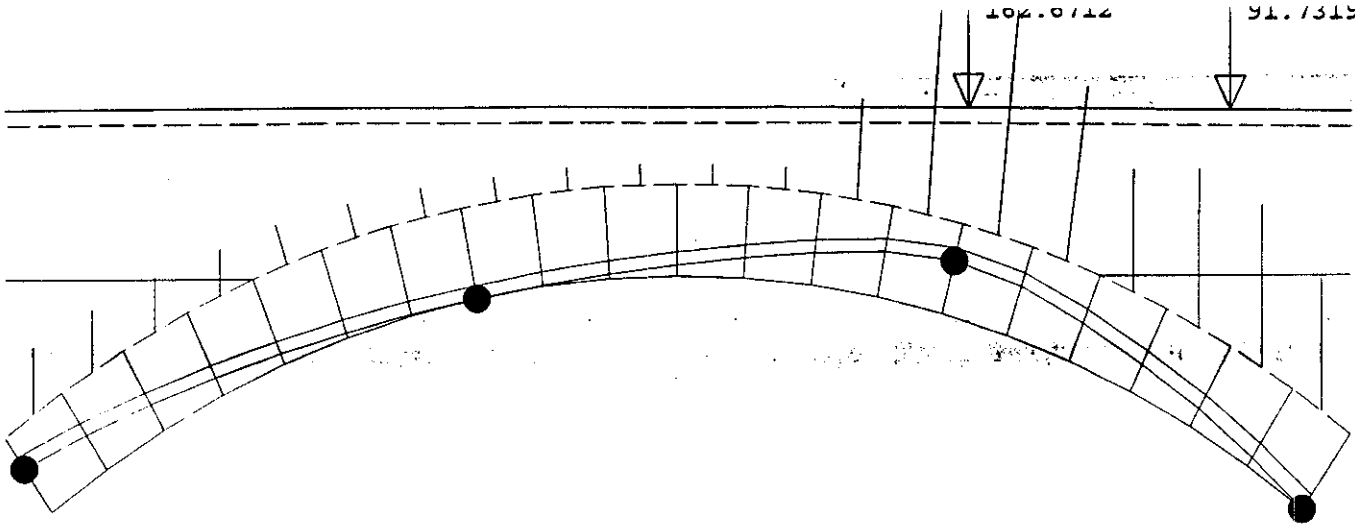
Span	8700 mm	Rise	1425 mm
Depth of fill	520 mm	Depth of surfacing	100 mm
Ring depth	570 mm	Ring depth factor	1
Position of backing	4	Depth of mortar loss	0 mm
Fill density	22.8 kN/m^3	Masonry density	24.2 kN/m^3
Surfacing density	40.3 kN/m^3		
Phi for fill	30 deg	Masonry strength	4.4 N/mm^2
Load	Single Axle:11.5t at 2000		
Lane width	1864mm		
Required ring depth	409 mm	Geometric F.O.S	1.39
H Left	391 kN/m	H Right	405 kN/m
V Left	355 kN/m	V Right	217 kN/m
Comp. zone at hinge 2	98 mm	Factor on pass. press.	.3

Hinges

1 AT 1 2 AT 6 3 AT 14 4 AT 21

Param(mn).segment

	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-6.5	-18.5	0	0	0	0
2	-6.7	-17.2	0	0	0	0
3	-6.7	-15.2	0	-.5	0	0
4	-6.7	-13.3	0	-20.4	0	0
5	-6.7	-11.6	2.1	-62.4	7.6	0
6	-6.7	-10.1	1.5	-76	7.4	0
7	-6.7	-8.9	1	-41.3	3.1	0
8	-6.7	-7.9	.6	-4.5	.2	0
9	-6.7	-7.2	.3	0	0	0
10	-6.7	-6.9	.1	0	0	0
11	-6.7	-6.9	-.1	0	0	0
12	-6.7	-7.2	-.3	0	0	-.1
13	-6.7	-7.9	-.6	0	0	-.4
14	-6.7	-8.9	-1	0	0	-.8
15	-6.7	-10.1	-1.5	0	0	-1.2
16	-6.7	-11.6	-2.1	0	0	-1.5
17	-6.7	-13.3	0	0	0	0
18	-6.7	-15.2	0	0	0	0
19	-6.7	-17.2	0	0	0	0
20	-6.5	-18.5	0	0	0	0



Centarch

()

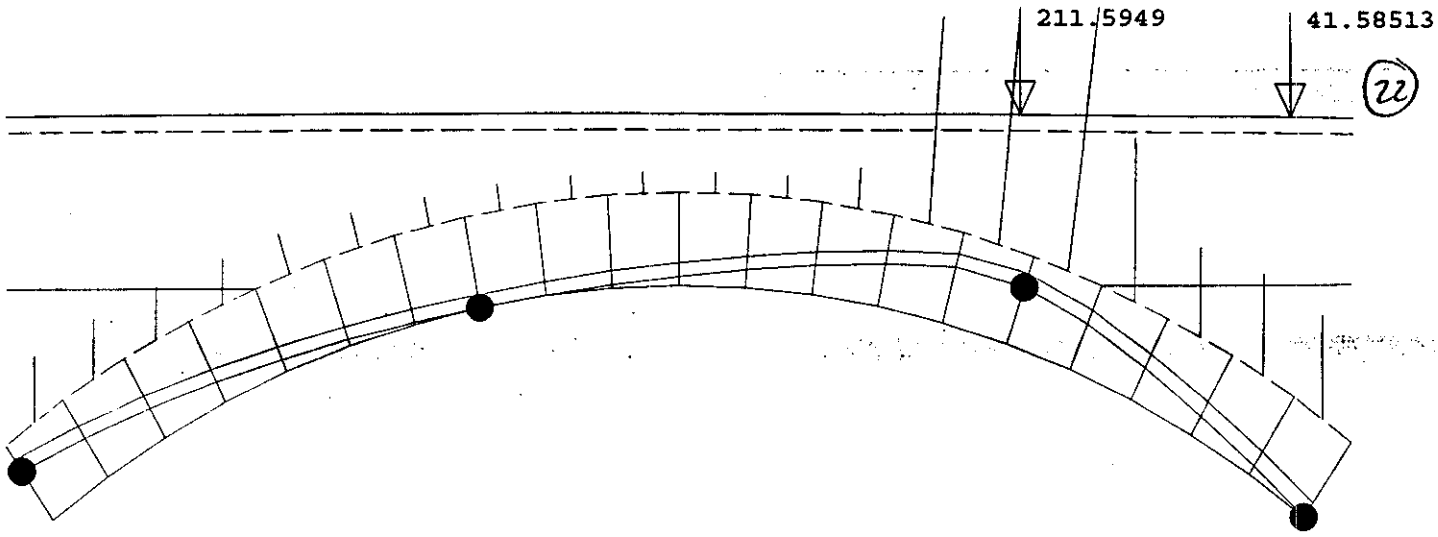
Span	8650 mm	Rise	1455 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	570 mm	Ring depth factor	1
Position of backing	4	Depth of mortar loss	0 mm
Fill density	19 kN/m^3	Masonry density	21 kN/m^3
Surfacing density	23 kN/m^3		
Phi for fill	30 deg	Masonry strength	4.4 N/mm^2
Load	Double Axle:20t:Left Heavy at 16950		
Lane width	2044mm		
Required ring depth	416 mm	Geometric F.O.S	1.37
H Left	349 kN/m	H Right	337 kN/m
V Left	185 kN/m	V Right	357 kN/m
Comp. zone at hinge 2	82 mm	Factor on pass. press.	.3

Hinges

1 AT 1	2 AT 8	3 AT 15	4 AT 21

Param(mm).segment

	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.7	-15.2	0	0	0	0
2	-5.8	-13.9	0	0	0	0
3	-5.8	-12.2	0	0	0	0
4	-5.8	-10.5	0	0	0	0
5	-5.8	-9	1.7	0	0	1.2
6	-5.8	-7.7	1.2	0	0	.9
7	-5.8	-6.7	.8	0	0	.6
8	-5.8	-5.8	.5	0	0	.3
9	-5.8	-5.3	.3	0	0	.1
10	-5.8	-5	.1	0	0	0
11	-5.8	-4.9	-.1	0	0	0
12	-5.8	-5.2	-.3	-.1	0	0
13	-5.8	-5.7	-.5	-17.4	-.9	0
14	-5.8	-6.5	-.8	-57.7	-4.4	0
15	-5.8	-7.5	-1.1	-62.1	-6.2	0
16	-5.8	-8.8	-1.6	-30.7	-3.8	0
17	-5.8	-10.2	0	-17.5	0	0
18	-5.8	-11.9	0	-23.5	0	0
19	-5.8	-13.6	0	-22.5	0	0
20	-5.7	-14.9	0	-14.9	0	0



Centarch

()

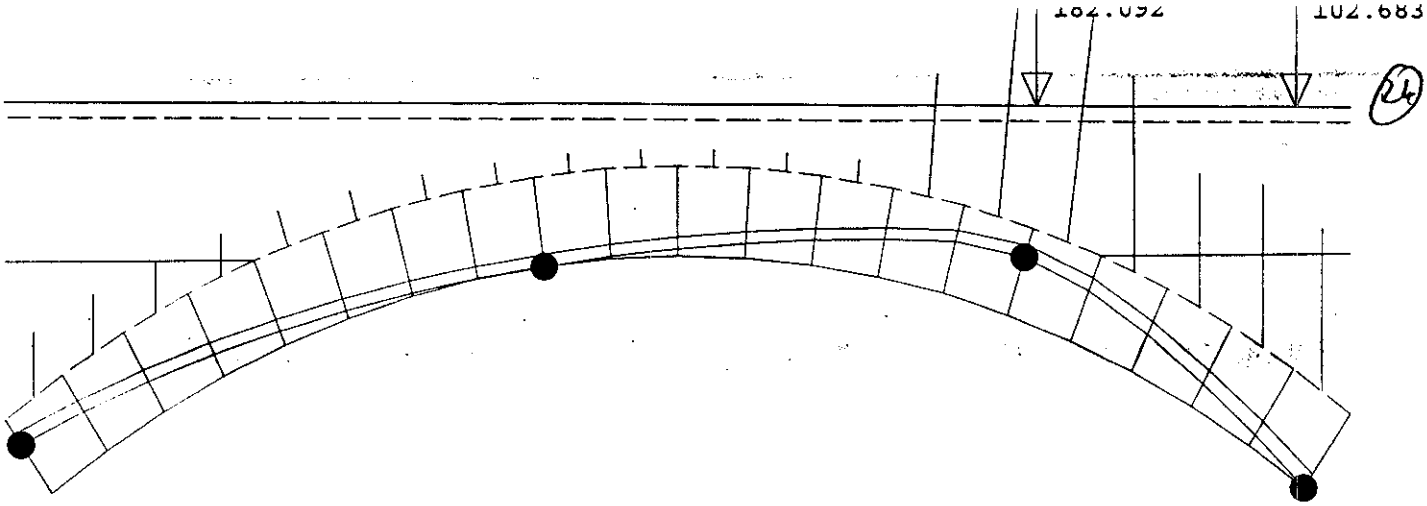
Span	8650 mm	Rise	1455 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	570 mm	Ring depth factor	1
Position of backing	4	Depth of mortar loss	0 mm
Fill density	19 kN/m^3	Masonry density	21 kN/m^3
Surfacing density	23 kN/m^3		
Phi for fill	30 deg	Masonry strength	4.4 N/mm^2
Load	Double Axle:20.3t:Right Lift-off at 16950		
Lane width	2044mm		
Required ring depth	460 mm	Geometric F.O.S	1.24
H Left	360 kN/m	H Right	344 kN/m
V Left	184 kN/m	V Right	354 kN/m
Comp. zone at hinge 2	87 mm	Factor on pass. press.	.3

Hinges

1 AT 1	2 AT 8	3 AT 16	4 AT 21

Param(mn).segment

	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.7	-15.2	0	0	0	0
2	-5.8	-13.9	0	0	0	0
3	-5.8	-12.2	0	0	0	0
4	-5.8	-10.5	0	0	0	0
5	-5.8	-9	1.7	0	0	1.2
6	-5.8	-7.7	1.2	0	0	.9
7	-5.8	-6.7	.8	0	0	.6
8	-5.8	-5.8	.5	0	0	.3
9	-5.8	-5.3	.3	0	0	.1
10	-5.8	-5	.1	0	0	0
11	-5.8	-4.9	-.1	0	0	0
12	-5.8	-5.2	-.3	0	0	0
13	-5.8	-5.7	-.5	-3.4	-.2	0
14	-5.8	-6.5	-.8	-39.8	-3.1	0
15	-5.8	-7.5	-1.1	-78.8	-7.9	0
16	-5.8	-8.8	-1.6	-67.4	-8.4	0
17	-5.8	-10.2	0	-26.1	0	0
18	-5.8	-11.9	0	-8.2	0	0
19	-5.8	-13.6	0	-9.5	0	0
20	-5.7	-14.9	0	-8.7	0	0



Southarc

()

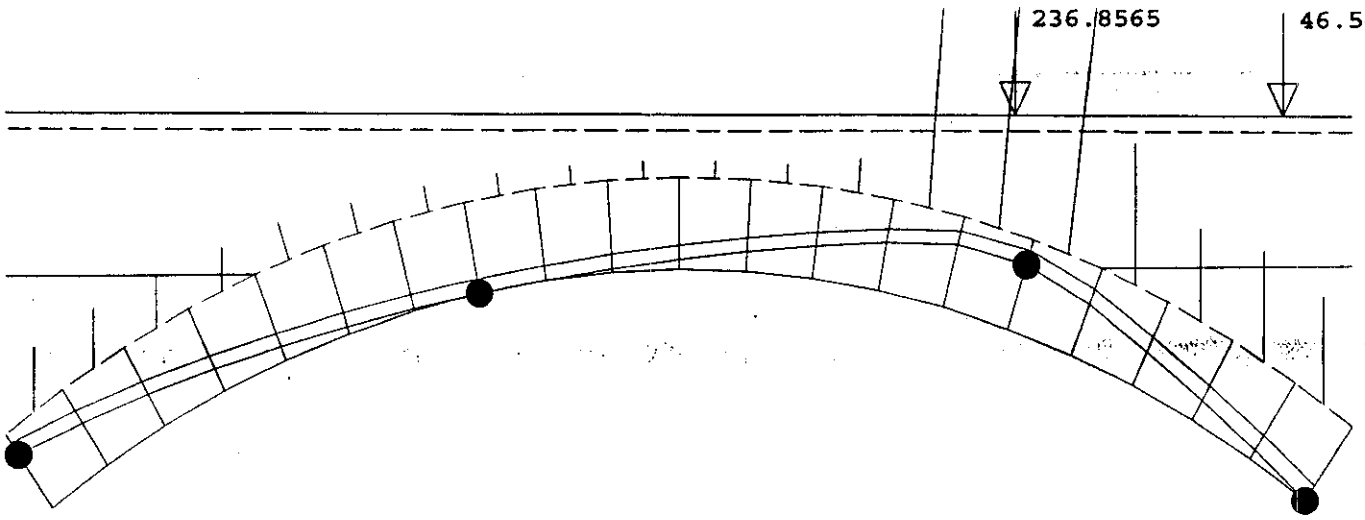
Span	8700 mm	Rise	1460 mm
Depth of fill	390 mm	Depth of surfacing	100 mm
Ring depth	570 mm	Ring depth factor	1
Position of backing	4	Depth of mortar loss	0 mm
Fill density	19 kN/m^3	Masonry density	21 kN/m^3
Surfacing density	23 kN/m^3		
Phi for fill	30 deg	Masonry strength	4.4 N/mm^2
Load	Double Axle:20t:Left Heavy at 27350		
Lane width	1826mm		
Required ring depth	455 mm	Geometric F.O.S	1.25
H Left	326 kN/m	H Right	312 kN/m
V Left	170 kN/m	V Right	366 kN/m
Comp. zone at hinge 2	78 mm	Factor on pass. press.	.3

Hinges

1 AT 1	2 AT 9	3 AT 16	4 AT 21

Param(mn).segment

	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.7	-14.8	0	0	0	0
2	-5.8	-13.5	0	0	0	0
3	-5.8	-11.7	0	0	0	0
4	-5.8	-9.9	0	0	0	0
5	-5.8	-8.3	1.5	0	0	1.1
6	-5.8	-7	1.1	0	0	.8
7	-5.8	-5.9	.7	0	0	.5
8	-5.8	-5	.4	0	0	.3
9	-5.8	-4.4	.2	0	0	.1
10	-5.8	-4	.1	0	0	0
11	-5.8	-4	-.1	0	0	0
12	-5.8	-4.2	-.2	0	0	0
13	-5.8	-4.8	-.4	-.4	0	0
14	-5.8	-5.6	-.6	-22.4	-1.7	0
15	-5.8	-6.6	-1	-64.2	-6.4	0
16	-5.8	-7.9	-1.5	-67.3	-8.3	0
17	-5.8	-9.4	0	-35.2	0	0
18	-5.8	-11.2	0	-19.2	0	0
19	-5.8	-12.9	0	-23.7	0	0
20	-5.7	-14.2	0	-22.3	0	0



Southarc

()

Span	8700 mm	Rise	1460 mm
Depth of fill	390 mm	Depth of surfacing	100 mm
Ring depth	570 mm	Ring depth factor	1
Position of backing	4	Depth of mortar loss	0 mm
Fill density	19 kN/m^3	Masonry density	21 kN/m^3
Surfacing density	23 kN/m^3		
Phi for fill	30 deg	Masonry strength	4.4 N/mm^2
Load	Double Axle:20.3t:Right Lift-off at 26850		
Lane width	1826mm		
Required ring depth	500 mm	Geometric F.O.S	1.14
H Left	377 kN/m	H Right	358 kN/m
V Left	182 kN/m	V Right	371 kN/m
Comp. zone at hinge 2	91 mm	Factor on pass. press.	.3

Hinges

1 AT 1 2 AT 8 3 AT 16 4 AT 21

Param(mn).segment

	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.7	-14.8	0	0	0	0
2	-5.8	-13.5	0	0	0	0
3	-5.8	-11.7	0	0	0	0
4	-5.8	-9.9	0	0	0	0
5	-5.8	-8.3	1.5	0	0	1.1
6	-5.8	-7	1.1	0	0	.8
7	-5.8	-5.9	.7	0	0	.5
8	-5.8	-5	.4	0	0	.3
9	-5.8	-4.4	.2	0	0	.1
10	-5.8	-4	.1	0	0	0
11	-5.8	-4	-.1	0	0	0
12	-5.8	-4.2	-.2	0	0	0
13	-5.8	-4.8	-.4	-3	-.2	0
14	-5.8	-5.6	-.6	-47	-3.6	0
15	-5.8	-6.6	-1	-95.2	-9.6	0
16	-5.8	-7.9	-1.5	-74.7	-9.2	0
17	-5.8	-9.4	0	-22.2	0	0
18	-5.8	-11.2	0	-9.1	0	0
19	-5.8	-12.9	0	-11.4	0	0
20	-5.7	-14.2	0	-9.9	0	0

(28)

arch width	8.330 m
Fill Depth	0.490 m
width2 (2 lanes loaded)	3.145 m
width1 (1 lane loaded)	3.790 m
gfl1 (BD 21/97, cl 6.20)	1.300
gfl2 (BD 21/97, cl 6.20)	1.900
Fcm	1.000
Fj	0.650
g	9.810

HB parameters
4.165 m
4.990 m
2.000

Lift-Off Factors (BD 21/97, Table 6.2)	
dlift1*	1.28
dlift2	0.50
tlifta1	1.50
tlifta2*	1.00
tlifta3	0.50
tliftb1*	1.28
tliftb2	1.00
tliftb3	0.50

HB units	Axle load (kN/m)	
	1 lane	2 lanes
15.00	92.49	110.81
20.00	123.32	147.75
25.00	154.15	184.69
30.00	184.99	221.63
35.00	215.82	258.56
40.00	246.65	295.50
45.00	277.48	332.44

AAL (t)		No-Lift Off		Lift-Off	
		Axle load (kN/m)		Axle load (kN/m)	
		1 lane	2 lanes	1 lane	2 lanes
11.50 SA		155.70	187.63	155.70	187.63
10.50 SA		142.16	171.32	142.16	171.32
9.00 SA		121.85	146.84	121.85	146.84
7.00 SA		94.77	114.21	94.77	114.21
5.50 SA		74.47	89.74	74.47	89.74
2.30 SA		27.08	32.63	27.08	32.63
10.00 DA	Heavy Axle*	135.39	163.16	173.30	208.84
	Light Axle	75.66	91.18	37.83	45.59
9.50 DA	Heavy Axle*	128.62	155.00	164.64	198.40
	Light Axle	71.88	86.62	35.94	43.31
9.00 DA	Heavy Axle*	121.85	146.84	155.97	187.96
	Light Axle	68.09	82.06	34.05	41.03
	Out Axle 1	60.53	72.94		
18.00 TA (a)	Mid Axle 2*	108.31	130.53		
1300	Out Axle 3	60.53	72.94		
	Out Axle 1	56.75	68.38	85.12	102.57
17.50 TA (a)	Mid Axle 2*	101.54	122.37	101.54	122.37
1350	Out Axle 3	56.75	68.38	28.37	34.19
	Out Axle 1	45.40	54.71	68.09	82.06
16.00 TA (a)	Mid Axle 2*	81.24	97.90	81.24	97.90
700	Out Axle 3	45.40	54.71	22.70	27.35
	Out Axle 1*	108.31	130.53		
18.00 TA (b)	Mid Axle 2	60.53	72.94		
1300	Out Axle 3	60.53	72.94		
	Out Axle 1*	101.54	122.37	129.98	156.63
17.50 TA (b)	Mid Axle 2	56.75	68.38	56.75	68.38
1350	Out Axle 3	56.75	68.38	28.37	34.19
	Out Axle 1*	81.24	97.90	103.98	125.31
16.00 TA (b)	Mid Axle 2	45.40	54.71	45.40	54.71
700	Out Axle 3	45.40	54.71	22.70	27.35

54.71
*
DA 19t (33t restrict)
155.00
1000
86.62
*
DA 19t (33t restrict)
155.00
1300
86.62
*
DA 19t (33t restrict)
155.00
1800
86.62
*
DA 18t (25t restrict)
146.84
1000
82.06
*
DA 18t (25t restrict)
146.84
1300
82.06
*
DA 18t (25t restrict)
146.84
1800
82.06
*
SA:10.5t (17t-33t restrict)
171.32
*
SA:9t (13t restrict)
146.84
*
SA:7t (10t restrict)
114.21
*
SA:5.5t (7.5t restrict)
89.74
*
SA:2t (3t restrict)
32.63
*□

2 OF 2

```
27.35
*
DA 19t (33t restrict)
198.40
1000
43.31
*
DA 19t (33t restrict)
198.40
1300
43.31
*
DA 19t (33t restrict)
198.40
1800
43.31
*
DA 18t (25t restrict)
187.96
1000
41.03
*
DA 18t (25t restrict)
187.96
1300
41.03
*
DA 18t (25t restrict)
187.96
1800
41.03
*
SA:10.5t (17t-33t restrict)
171.32
*
SA:9t (13t restrict)
146.84
*
SA:7t (10t restrict)
114.21
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SA:5.5t (7.5t restrict)
89.74
*
SA:2t (3t restrict)
32.63
*□
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Southarc
-3.7
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WELLINDITCH BRIDGE - MULTI RESULTS

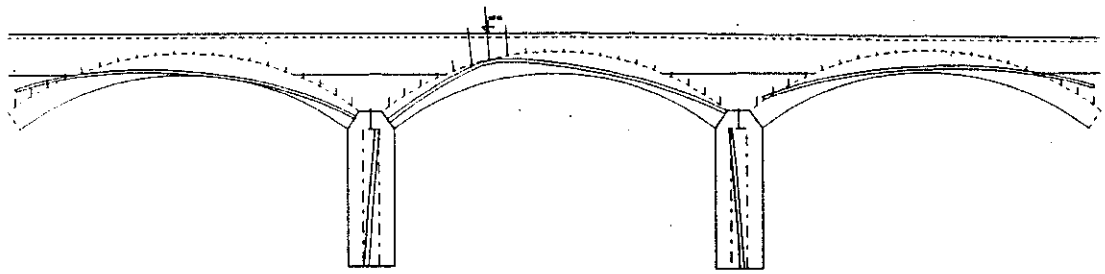
NO AXLE LIFT OFF

Hit enter to continue

Worst case load positions for all load cases

SA:11.5t (40/44t) @ 12500	DA 20t (38-40/44t) @ 12000
DA 20t (38-40/44t) @ 13000	DA 20t (38-40/44t) @ 12500
TA (a) 24t (38-40/44t) @ 13000	TA (a) 22.5t (38-40/44t) @ 13000
TA (a) 18t (38-40/44t) @ 12500	TA (b) 24t (38-40/44t) @ 13000
TA (b) 22.5t (38-40/44t) @ 13000	TA (b) 18t (38-40/44t) @ 12500
DA 19t (33t restrict) @ 12000	DA 19t (33t restrict) @ 13000
DA 19t (33t restrict) @ 12500	DA 18t (25t restrict) @ 13000
DA 18t (25t restrict) @ 13000	DA 18t (25t restrict) @ 12500
SA:10.5t (17t-33t restrict) @ 13000	SA:9t (13t restrict) @ 13000
SA:7t (10t restrict) @ 13000	SA:5.5t (7.5t restrict) @ 14000
SA:2t (3t restrict) @ 14000	

11.5 tonne single axle – PASSES



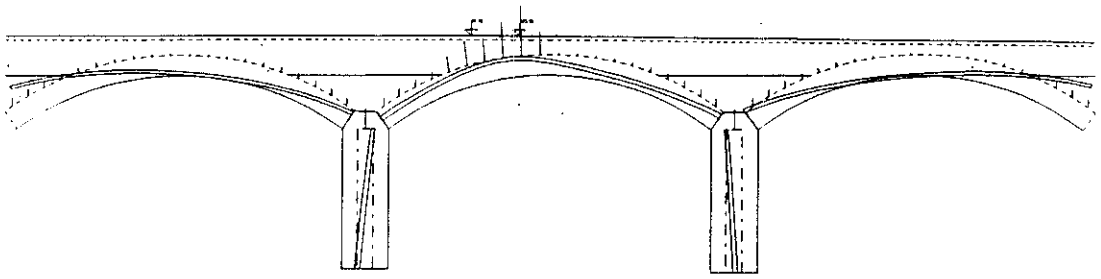
Left H kN	span V kN	Nr	Pier Force	Right H kN	span V kN	Offset from L	Load kN	σL kN/m^2	σR kN/m^2
389	178	1	0	451	315	440	625	944	55
465	235	2	0	434	172	670	539	339	524

Abutment reactions

Left H = 389 kN V = 123 kN at 1127 mm from springing.

Right H = 435 kN V = 109 kN at 620 mm from springing.

20t double axle; 1.3m spacing – PASSES



HIT ENTER TO CONTINUE

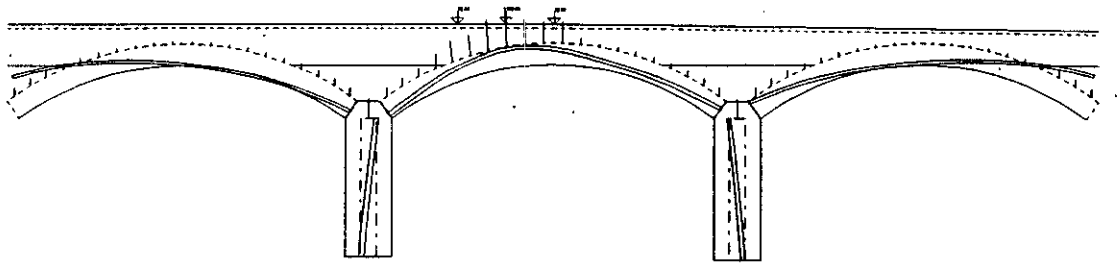
Left H kN	span V kN	Pier Nr	Force	Right H kN	span V kN	Offset from L	Load kN	σL kN/m^2	σR kN/m^2
334	186	1	0	398	335	447	652	967	76
411	237	2	0	362	170	795	539	79	783

Abutment reactions

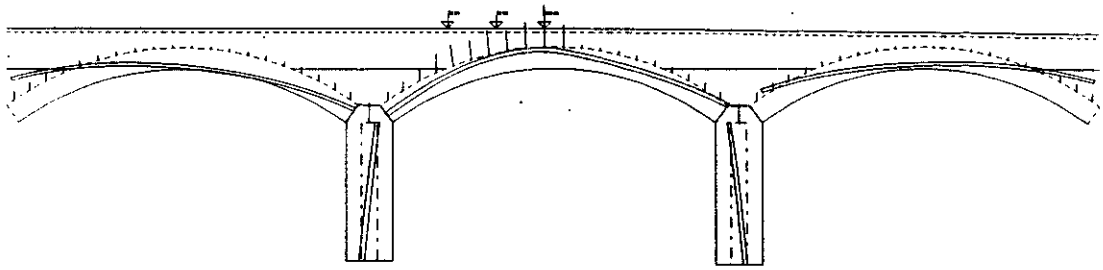
Left H = 334 kN V = 116 kN at 1131 mm from springing.

Right H = 362 kN V = 112 kN at 522 mm from springing.

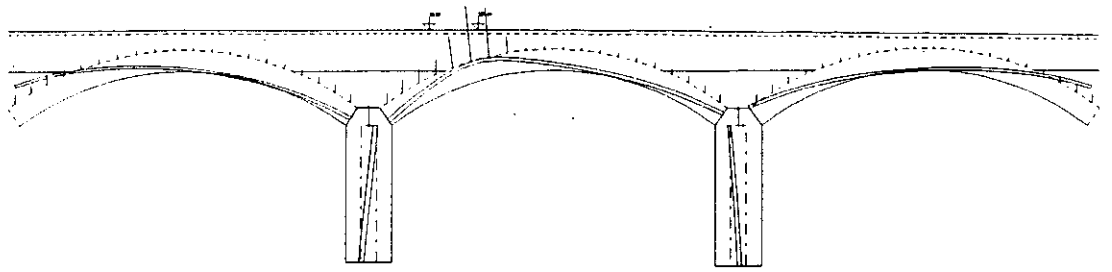
24t triple axle; arrangement 1 – PASSES



24t triple axle; arrangement 2 – PASSES



20t double axle; 1.3m spacing – PASSES



HIT ENTER TO CONTINUE

Left span H kN	V kN	Pier Nr	Force	Right span H kN	V kN	Offset from L	Load kN	σL kN/m^2	σR kN/m^2
308	180	1	0	371	349	440	660	998	59
392	201	2	0	362	159	666	493	317	472

Abutment reactions

Left H = 308 kN V = 121 kN at 1061 mm from springing.

Right H = 363 kN V = 122 kN at 597 mm from springing.

WS/Atkins

CALCULATION INDEX

C – Calculation
S – Sketch
D – Data

PROJECT: ECC ASSESSMENT CONTRACT 3 CHECK CALCS

FILE NAME: WELLINGBOROUGH BRIDGE

Page:

FILE NO: A118773-23

INDEX NO	CALCULATION/SKETCH/DATA	ORIGINATOR	DATE
1-6	ARCH ANALYSIS DATA	[redacted]	2/00
7	NORTH ARCH MEXE		2/00
8	CENTRAL ARCH MEXE		2/00
9	SOUTH ARCH MEXE		2/00
10-	ARCHIE LANE WIDTH		2/00
11-17	ARCHIE DATA CHECK		2/00
18-25	ARCHIE OUTPUT DATA		2/00
26-32	MULTI ANALYSIS		

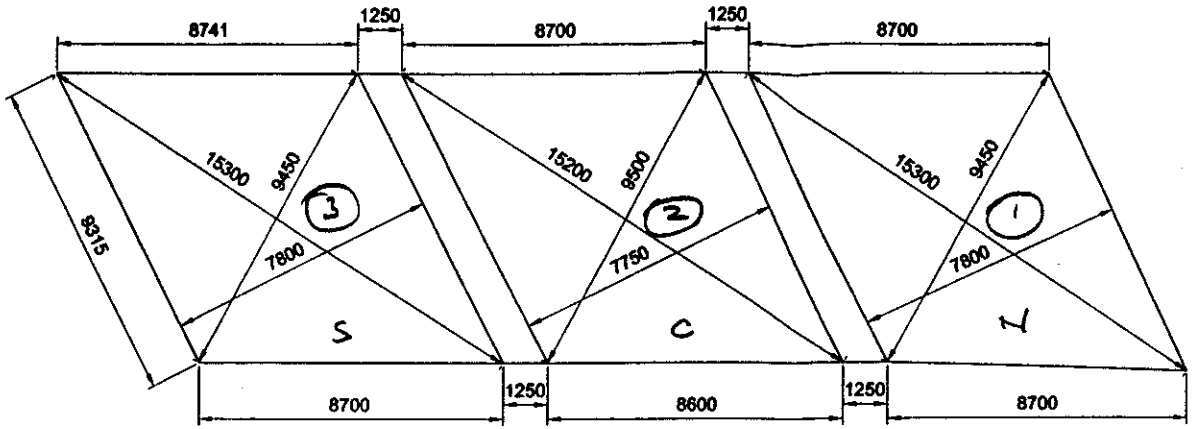
Continued on Sheet

DO NOT SCALE

ECC Bridge No. 1662
Rail Property Board No. WFM/833

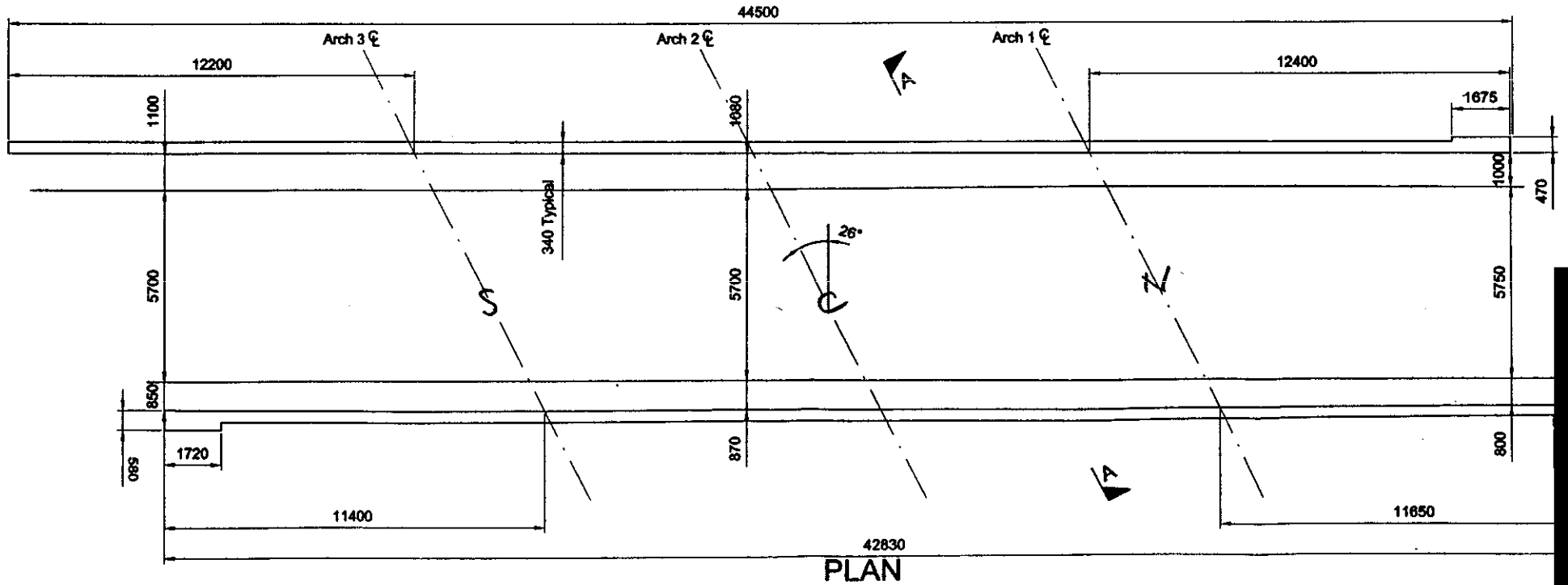
Notes:

All Dimensions in mm



60mph.

PLAN SHOWING BRIDGE DIMENSIONS



PLAN

[redacted]

Essex County Council
Transportation & Operational Services

WS/Atkins

SCALES	NTS
JOB FILE	M:\A1877\1662\fig02

	SURVEYED	LEVELLED	DESIGNED	DRAWN/TRACED	CHECKED	AUTHORISED
INITIALS	DW	DW		MAD		
DATE	12/98	12/98		01/00		

REVISION NOTES | REVISION | CHECKED

DESCRIPTION OF DRAWING: WELLINDITCH BRIDGE, STOW MARIES PLAN

Sheet 1 of 1

SCHEME TITLE: ECC ASSESSMENT CO RAIL PROPERTY LTD

DRAWING NO. A1877/DWGS/1662

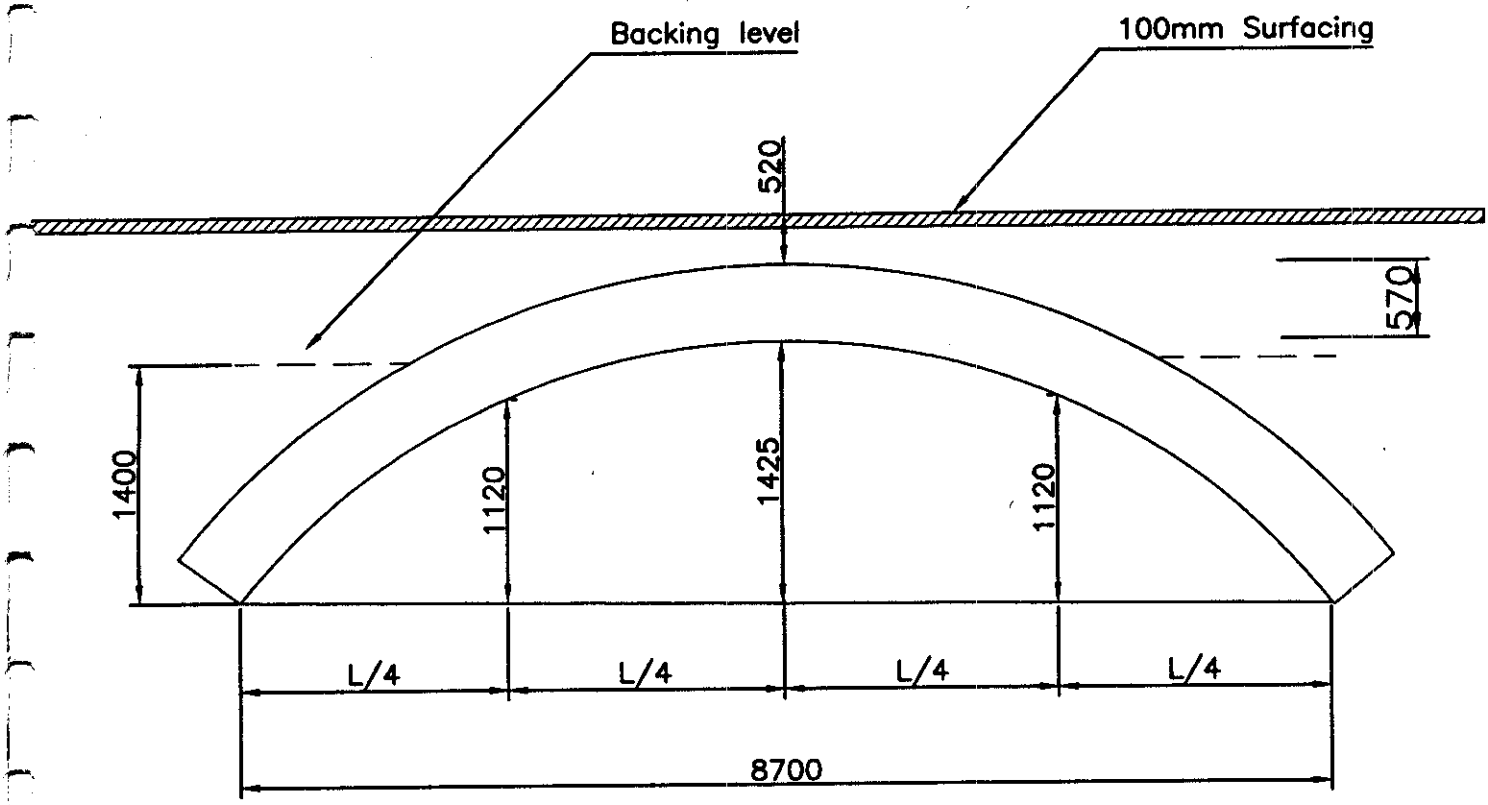
2

Essex County Council
Transportation & Operational Services

[redacted]

WS Atkins

ECC Bridge No. 1662
Rail Property Board No. WFM/833



ARCH No.1(NORTH ARCH)
IDEALISATION DIAGRAM
NTS

DRWG.NO.	AI1877/1662/FIG07
CAD NO.	N:1877/1662/fig07
SCALES	NTS
DATE JAN 00	DRAWN/T[redacted]
DATE JAN 00	CHECKE[redacted]
DATE	AUTHORIS[redacted]

SCHEME TITLE ECC ASSESSMENT CONTRACT 3
WELLINDITCH BRIDGE, STOW MARIES
IDEALISATION DIAGRAM ARCH 1

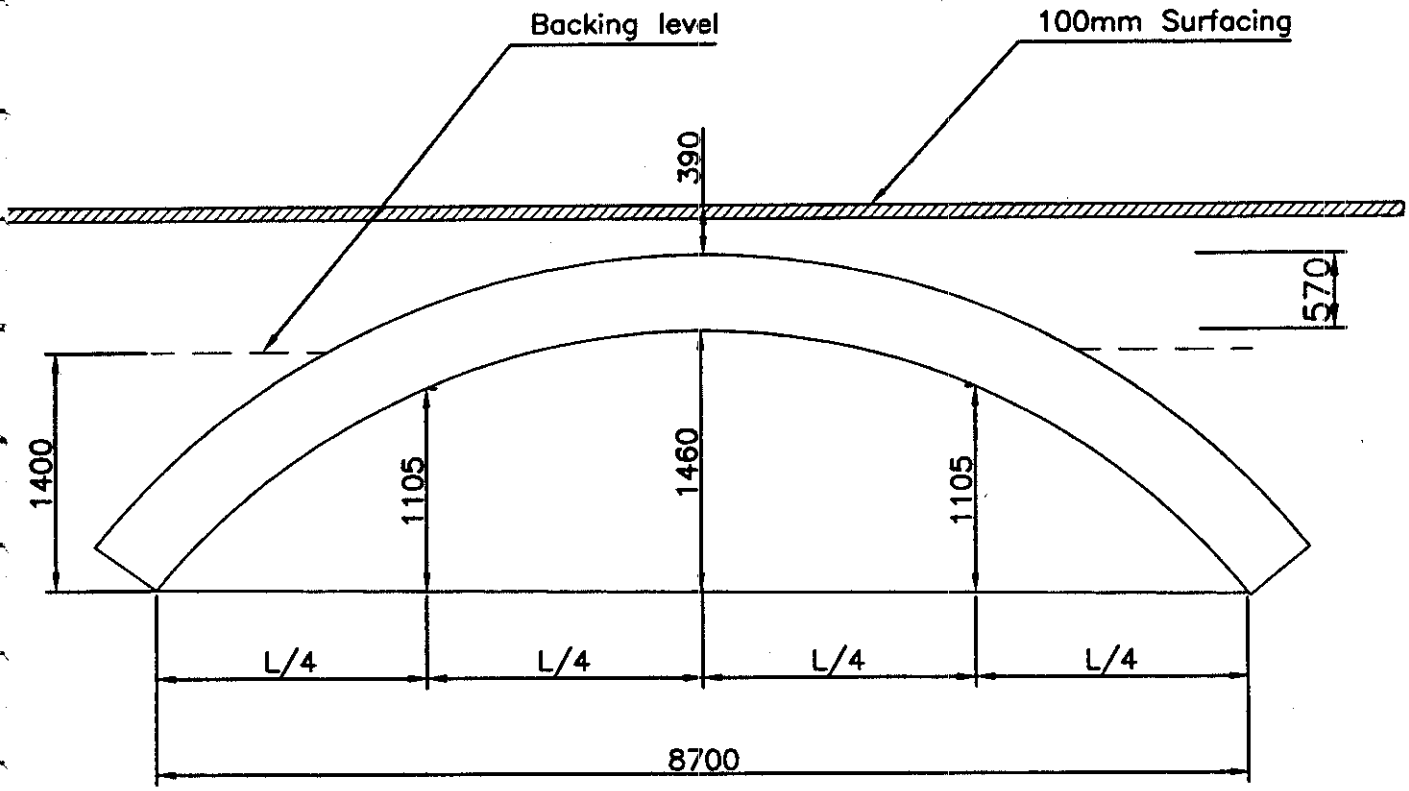
Essex County Council
Transportation & Operational Services

[redacted]

WS Atkins

ECC Bridge No. 1662
Rail Property Board No. WFM/833

A [redacted]



ARCH No.3 (SOUTH ARCH)
IDEALISATION DIAGRAM
NTS

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CAD NO.	N:1877/1662/fig09
SCALES	NTS
DATE JAN 00	DRAWN/TRACED [redacted]
DATE JAN 00	CHECKED
DATE	AUTHORISED

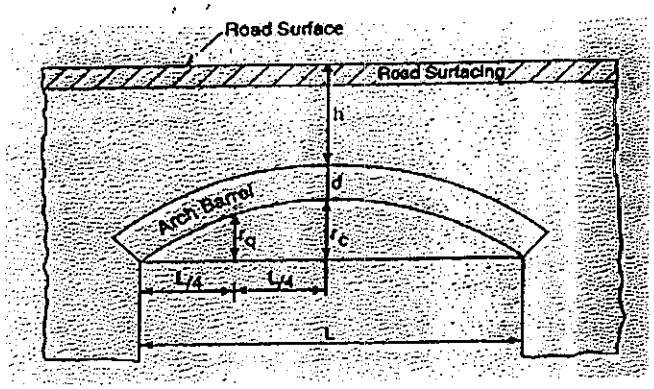
SCHEME TITLE ECC ASSESSMENT CONTRACT 3
WELLINDITCH BRIDGE, STOW MARIES
IDEALISATION DIAGRAM ARCH 3

WS/Atkins [redacted] (2)

ARCH ASSESSMENT TO MODIFIED MEXE (BA 16/97)

Structure Name: WELLINDITCH-CENTRAL ARCH NO2

1. DIMENSIONS



L = 8.7
rc = 1.455
rq = 1.00
d = .57
h = .49
h + d = 1.06

2. PROVISIONAL ASSESSMENT LOADING (Fig. 3/1)

PAL = 70 Tonne

3. SPAN / RISE FACTOR

$\frac{L}{rc} = \frac{8.7}{1.455} = 5.98$ (Fig. 3/3) Fsr = 0.74

4. PROFILE FACTOR

$\frac{rq}{rc} = \frac{1.00}{1.455} = 0.69$ (Fig. 3/4) Fp = 1.0

5. MATERIAL FACTOR

(Tables 3/1 & 3/2)

$Fm = \frac{(Fb.d) + Ff.h)}{d + h} = \frac{1 \times .57 + .7 \times .49}{.57 + .49}$ Fm = 0.86

6. JOINT FACTOR

(Tables 3/3, 3/4 & 3/5)

Fj = Fw.Fd.Fmo = .9 x .8 x .9 Fj = .648

7. CONDITION FACTOR

(Para. 3.17 to 3.23)

Fc = 1.0

8. MODIFIED AXLE LOAD

MAL = PAL x Fsr x Fp x Fm x Fj x Fc

MAL = 28.9 Tonne

9. AXLE LIFT-OFF FACTOR

(Fig. 3/5)

Af = 0.75

10. WEIGHT LIMIT ON ARCH (MAX GROSS VEHICLE WEIGHT)

(Table 3/6)

[redacted] Tonne

11. CONCLUSIONS:

Check Agrees.

CHECK ~~Assessed~~ By: [redacted] Date: 15/2/00

Signed: [redacted]

WS/Atkins

Project	Job ref
ECL ASSESSMENT CONTRACT NO3 WELLINDITCH	AI 1877/73
Part of structure: ARCHIE CHECK	Calc sheet no / 10 / rev /
Drawing ref / Calc by / Date	[redacted] / Date

Ref	Calculations	Output

NORTH SPAN.

Depth at ¼ span of fill: $h = 0.913$

For 2 lanes of loading spread: $= \frac{h+1.5}{2} + 1.8 + 0.7 + 1.8 + \frac{h+1.5}{2}$

$= 6.713$ m.

For 1 Vertical Spread $= 3.3565$ m.

For $f_{cw} = 0.9$
$f_J = 0.648$

Equivalent width $= 1.957$ m

CENTRAL SPAN.

Depth of fill at ¼ span: $h = 0.897$

For 1 Veh. spread $= 3.3485$ m.

For $f_{cw} = 0.7$
$f_J = 0.648$

Equivalent Spread $= 1.953$ m.

SOUTH SPAN

Depth of fill at ¼ span: $h = 0.817$ m.

For 1 Veh spread $= 3.3085$

For $F_{cw} = 0.9$
$F_J = 0.648$

Equivalent Load $= 1.929$

[redacted]

(12)

Northarc.dat

```
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 21
 19
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Centarch
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[redacted]

(14)

AT 1877/73

[redacted]

Southarc.dat

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 19
 30
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5281,1400,2411
5742,1324,2407
6197,1219,2402
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-3.8
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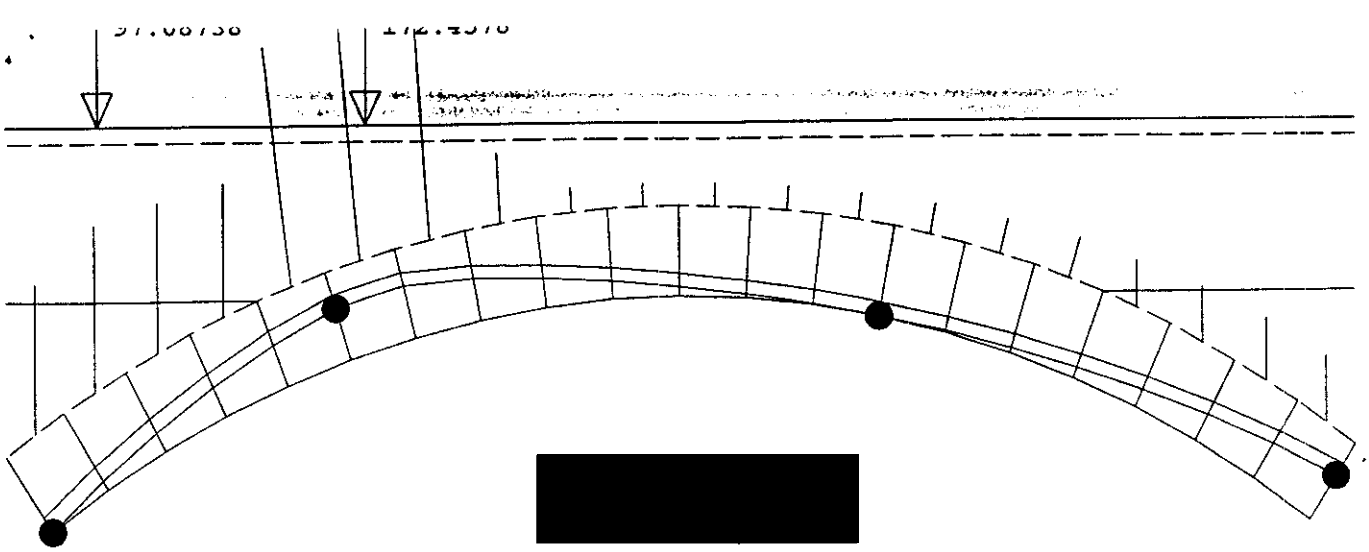
Accept

Accept

[redacted]



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Northarc

()

Span	8700 mm	Rise	1425 mm
Depth of fill	520 mm	Depth of surfacing	100 mm
Ring depth	570 mm	Ring depth factor	1
Position of backing	4	Depth of mortar loss	0 mm
Fill density	19 kN/m^3	Masonry density	21 kN/m^3
Surfacing density	23 kN/m^3		
Phi for fill	30 deg	Masonry strength	4.4 N/mm^2
Load	Double Axle:20.3t:Right Heavy at 1500		
Lane width	1957mm		
Required ring depth	419 mm	Geometric F.O.S	1.36
H Left	348 kN/m	H Right	361 kN/m
V Left	369 kN/m	V Right	186 kN/m
Comp. zone at hinge 2	87 mm	Factor on pass. press.	.3

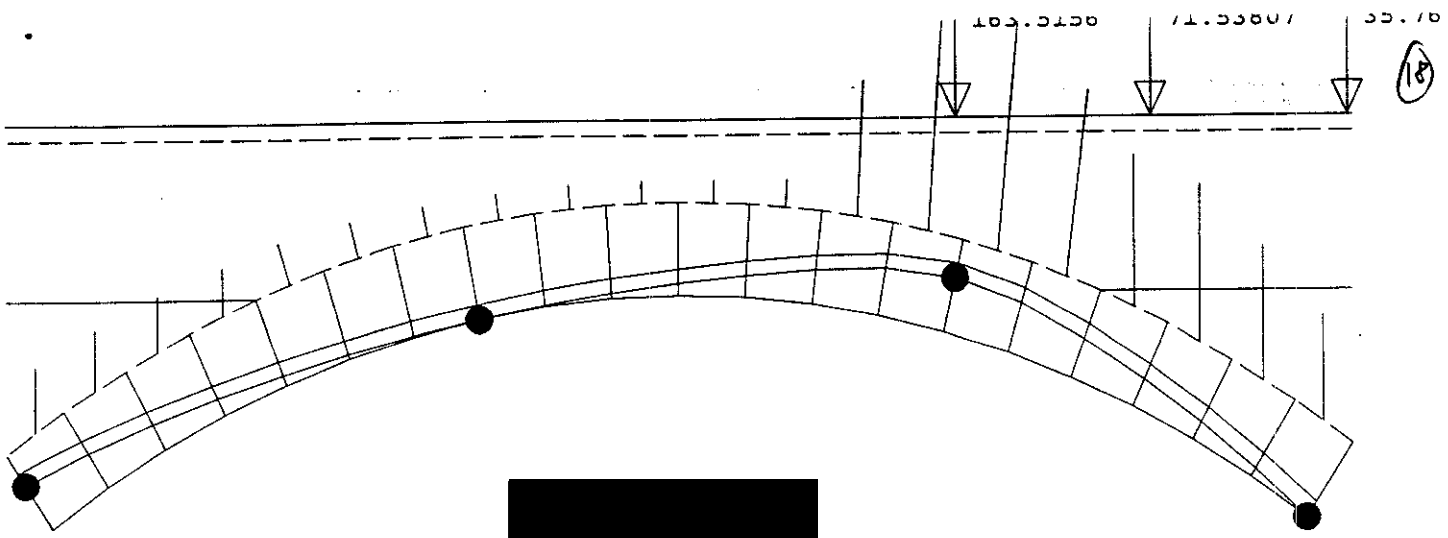
[redacted]

Hinges

1 AT 1	2 AT 6	3 AT 14	4 AT 21

Param(mn).segment

	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.7	-15.2	0	-18.7	0	0
2	-5.8	-14.1	0	-23.6	0	0
3	-5.8	-12.4	0	-21.4	0	0
4	-5.8	-10.6	0	-19.6	0	0
5	-5.8	-9.1	1.7	-44.3	5.4	0
6	-5.8	-7.9	1.1	-67.1	6.5	0
7	-5.8	-6.9	.8	-48.3	3.7	0
8	-5.8	-6.1	.5	-9.9	.5	0
9	-5.8	-5.5	.3	0	0	0
10	-5.8	-5.2	.1	0	0	0
11	-5.8	-5.2	-.1	0	0	0
12	-5.8	-5.5	-.3	0	0	-.1
13	-5.8	-6.1	-.5	0	0	-.3
14	-5.8	-6.9	-.8	0	0	-.6
15	-5.8	-7.9	-1.1	0	0	-.9
16	-5.8	-9.1	-1.7	0	0	-1.2
17	-5.8	-10.6	0	0	0	0
18	-5.8	-12.4	0	0	0	0
19	-5.8	-14.1	0	0	0	0
20	-5.7	-15.2	0	0	0	0



[redacted]

Northarc

()

Span	8700 mm	Rise	1425 mm
Depth of fill	520 mm	Depth of surfacing	100 mm
Ring depth	570 mm	Ring depth factor	1
Position of backing	4	Depth of mortar loss	0 mm
Fill density	19 kN/m^3	Masonry density	21 kN/m^3
Surfacing density	23 kN/m^3		
Phi for fill	30 deg	Masonry strength	4.4 N/mm^2
Load	Triple Axle:22.5t:Left Lift-off at 7000		
Lane width	1957mm		
Required ring depth	424 mm	Geometric F.O.S	1.34
H Left	382 kN/m	H Right	369 kN/m
V Left	192 kN/m	V Right	363 kN/m
Comp. zone at hinge 2	89 mm	Factor on pass. press.	.3

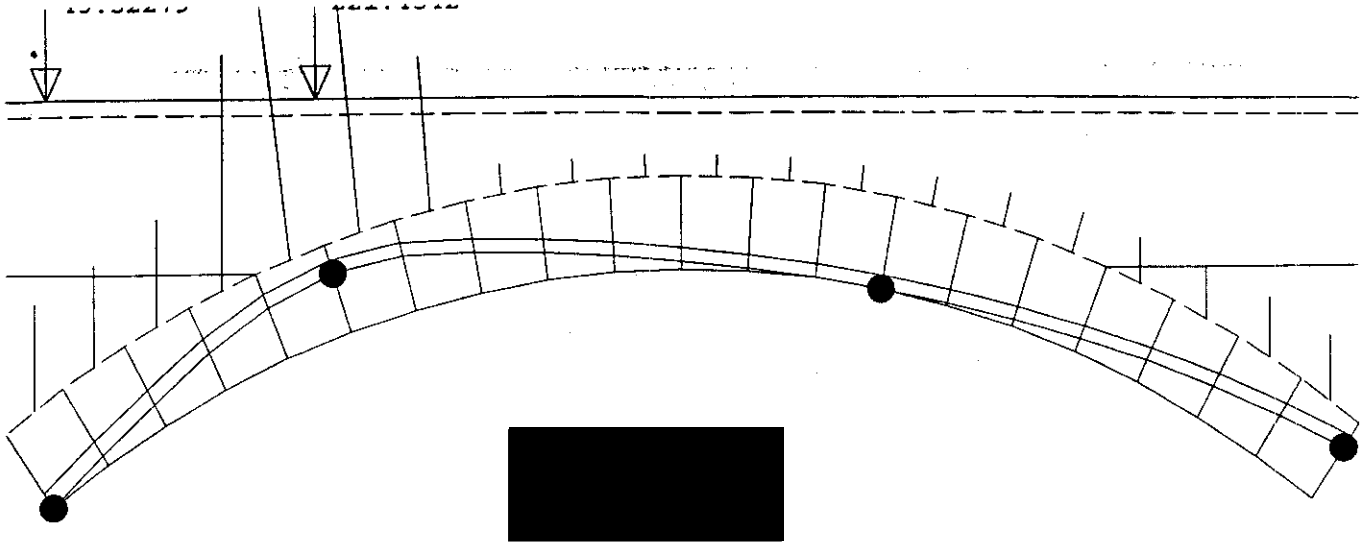
[redacted]

Hinges

1 AT 1	2 AT 8	3 AT 15	4 AT 21

Param(mn).segment

	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.7	-15.2	0	0	0	0
2	-5.8	-14.1	0	0	0	0
3	-5.8	-12.4	0	0	0	0
4	-5.8	-10.6	0	0	0	0
5	-5.8	-9.1	1.7	0	0	1.2
6	-5.8	-7.9	1.1	0	0	.9
7	-5.8	-6.9	.8	0	0	.6
8	-5.8	-6.1	.5	0	0	.3
9	-5.8	-5.5	.3	0	0	.1
10	-5.8	-5.2	.1	0	0	0
11	-5.8	-5.2	-.1	0	0	0
12	-5.8	-5.5	-.3	-.8	0	0
13	-5.8	-6.1	-.5	-25.2	-1.3	0
14	-5.8	-6.9	-.8	-62.7	-4.7	0
15	-5.8	-7.9	-1.1	-61.3	-5.9	0
16	-5.8	-9.1	-1.7	-32.9	-4	0
17	-5.8	-10.6	0	-23.3	0	0
18	-5.8	-12.4	0	-22.7	0	0
19	-5.8	-14.1	0	-15.8	0	0
20	-5.7	-15.2	0	-8.9	0	0



Centarch

()

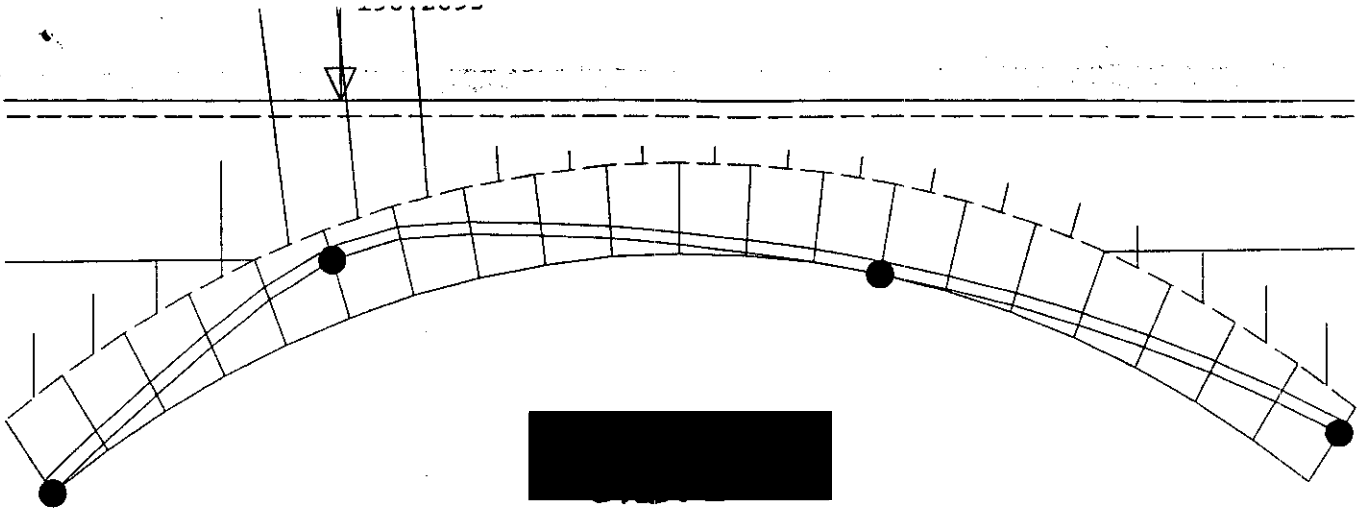
Span	8650 mm	Rise	1455 mm
Depth of fill	490 mm	Depth of surfacing	100 mm
Ring depth	570 mm	Ring depth factor	1
Position of backing	4	Depth of mortar loss	0 mm
Fill density	19 kN/m^3	Masonry density	21 kN/m^3
Surfacing density	23 kN/m^3		
Phi for fill	30 deg	Masonry strength	4.4 N/mm^2
Load	Double Axle:20.3t:Left Lift-off at 11450		
Lane width	1953mm		
Required ring depth	472 mm	Geometric F.O.S	1.21
H Left	341 kN/m	H Right	357 kN/m
V Left	366 kN/m	V Right	180 kN/m
Comp. zone at hinge 2	85 mm	Factor on pass. press.	.3

Hinges

1 AT 1	2 AT 6	3 AT 14	4 AT 21

Param(mn).segment

	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.7	-15.2	0	-8.9	0	0
2	-5.8	-13.9	0	-9	0	0
3	-5.8	-12.2	0	-11.7	0	0
4	-5.8	-10.5	0	-42	0	0
5	-5.8	-9	1.7	-77.3	9.7	0
6	-5.8	-7.7	1.2	-71.8	7.2	0
7	-5.8	-6.7	.8	-27.8	2.1	0
8	-5.8	-5.8	.5	-1.1	.1	0
9	-5.8	-5.3	.3	0	0	0
10	-5.8	-5	.1	0	0	0
11	-5.8	-4.9	-.1	0	0	0
12	-5.8	-5.2	-.3	0	0	-.1
13	-5.8	-5.7	-.5	0	0	-.3
14	-5.8	-6.5	-.8	0	0	-.6
15	-5.8	-7.5	-1.1	0	0	-.9
16	-5.8	-8.8	-1.6	0	0	-1.2
17	-5.8	-10.2	0	0	0	0
18	-5.8	-11.9	0	0	0	0
19	-5.8	-13.6	0	0	0	0
20	-5.7	-14.9	0	0	0	0



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Southarc

()

Span	8700 mm	Rise	1460 mm
Depth of fill	390 mm	Depth of surfacing	100 mm
Ring depth	570 mm	Ring depth factor	1
Position of backing	4	Depth of mortar loss	0 mm
Fill density	19 kN/m^3	Masonry density	21 kN/m^3
Surfacing density	23 kN/m^3		
Phi for fill	30 deg	Masonry strength	4.4 N/mm^2
Load	Single Axle:11.5t at 21850		
Lane width	1929mm		
Required ring depth	455 mm	Geometric F.O.S	1.25
H Left	320 kN/m	H Right	336 kN/m
V Left	308 kN/m	V Right	172 kN/m
Comp. zone at hinge 2	81 mm	Factor on pass. press.	.3

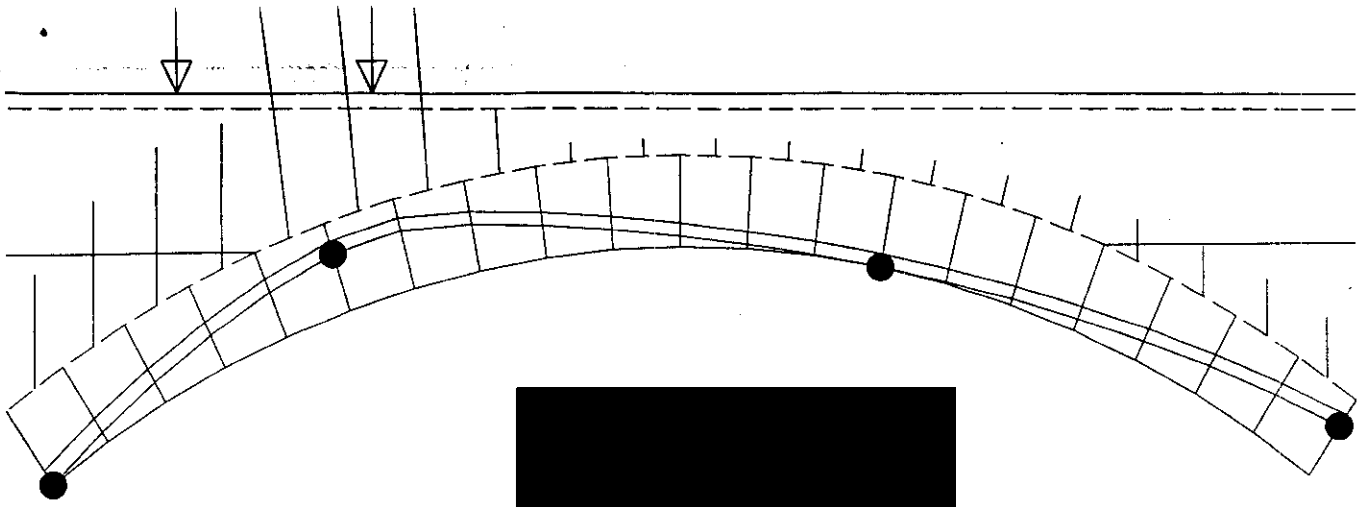
[redacted]

Hinges

1 AT 1 2 AT 6 3 AT 14 4 AT 21

Param(mn).segment

	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.7	-14.8	0	0	0	0
2	-5.8	-13.5	0	0	0	0
3	-5.8	-11.7	0	-.1	0	0
4	-5.8	-9.9	0	-16.3	0	0
5	-5.8	-8.3	1.5	-61.5	7.6	0
6	-5.8	-7	1.1	-77.8	7.8	0
7	-5.8	-5.9	.7	-39.5	3	0
8	-5.8	-5	.4	-3	.2	0
9	-5.8	-4.4	.2	0	0	0
10	-5.8	-4	.1	0	0	0
11	-5.8	-4	-.1	0	0	0
12	-5.8	-4.2	-.2	0	0	-.1
13	-5.8	-4.8	-.4	0	0	-.2
14	-5.8	-5.6	-.6	0	0	-.5
15	-5.8	-6.6	-1	0	0	-.8
16	-5.8	-7.9	-1.5	0	0	-1.1
17	-5.8	-9.4	0	0	0	0
18	-5.8	-11.2	0	0	0	0
19	-5.8	-12.9	0	0	0	0
20	-5.7	-14.2	0	0	0	0



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()

Span	8700 mm	Rise	1460 mm
Depth of fill	390 mm	Depth of surfacing	100 mm
Ring depth	570 mm	Ring depth factor	1
Position of backing	4	Depth of mortar loss	0 mm
Fill density	19 kN/m^3	Masonry density	21 kN/m^3
Surfacing density	23 kN/m^3		
Phi for fill	30 deg	Masonry strength	4.4 N/mm^2
Load	Triple Axle:22.5t:Right Lift-off at 21350		
Lane width	1929mm		
Required ring depth	451 mm	Geometric F.O.S	1.26
H Left	331 kN/m	H Right	346 kN/m
V Left	359 kN/m	V Right	176 kN/m
Comp. zone at hinge 2	84 mm	Factor on pass. press.	.3

[redacted]

Hinges

1 AT 1 2 AT 6 3 AT 14 4 AT 21

Param(mn).segment

	Stone Weight	Vertical Dead Load	Horizontal Deadload	Vertical Live Load	Horizontal Live Load	Additional Pass Press
1	-5.7	-14.8	0	-11.5	0	0
2	-5.8	-13.5	0	-19.1	0	0
3	-5.8	-11.7	0	-23.8	0	0
4	-5.8	-9.9	0	-23.1	0	0
5	-5.8	-8.3	1.5	-44.3	5.5	0
6	-5.8	-7	1.1	-69.8	7	0
7	-5.8	-5.9	.7	-51.9	4	0
8	-5.8	-5	.4	-9.8	.5	0
9	-5.8	-4.4	.2	0	0	0
10	-5.8	-4	.1	0	0	0
11	-5.8	-4	-.1	0	0	0
12	-5.8	-4.2	-.2	0	0	-.1
13	-5.8	-4.8	-.4	0	0	-.2
14	-5.8	-5.6	-.6	0	0	-.5
15	-5.8	-6.6	-1	0	0	-.8
16	-5.8	-7.9	-1.5	0	0	-1.1
17	-5.8	-9.4	0	0	0	0
18	-5.8	-11.2	0	0	0	0
19	-5.8	-12.9	0	0	0	0
20	-5.7	-14.2	0	0	0	0

WS/Atkins

Project ECL ASSESSMENT CONTRACT N03 WELLINDITCH - CHECK

Job ref AI 1877/73

Part of structure MULTI

Calc sheet no / 26 / rev

Drawing ref | Calc by | Date

[redacted]

Ref	Calculations	Output

Worst case load position for all load cases

Axle	Load (T)	Chainage.
SA	11.5 T	12.5
DA	20 T	13
TA	24 T	13
TA	18 T	12.5
TA	22.5 T	13
DA	33 R	13
DA	33 R	12.5
DA	25 R	13
SA	17-33 R	13
SA	10 R	13
SA	3 R	14
DA	20 T	12
DA	20 T	12.5
TA	22.5 T	13
TA	24 T	13
TA	18 T	12.5
DA	33 T R	13
DA	25 T R	13
DA	25 T R	12.5
SA	13 T R	13
SA	7.5 T R	14

[redacted]

MULTI ANALYSIS
TABULATED RESULTS

Loadcase: SA 11.5T at 12500 chainage

Left span		Pier		Right span		Offset	Load	σL	σR
H (kN)	V (kN)	Nr	Force	H (kN)	V (kN)	From L	(kN)	(KN/m^2)	(KN/m^2)
454	151	1	0	506	289	487	570	758	155
522	203	2	0	473	142	825	477	15	749

ABUTMENT REACTIONS

Left H= 454 kN V= 151 kN @ 904 mm from springing
Right H= 473 kN V= 139 kN @ 998 mm from springing

No Tension exists ∴ Satisfactory for 11.5T SA Load.
(Tension is -ve. for σ_L and σ_R)

[redacted] 00

[redacted]

MULTI ANALYSIS
TABULATED RESULTS

Loadcase: DA 20.3T LEFT LIFT OF AT 12500

Left span		Pier		Right span		Offset	Load	σL	σR
H (kN)	V (kN)	Nr	Force	H (kN)	V (kN)	From L	(kN)	(KN/m^2)	(KN/m^2)
301	177	1	0	378	342	436	649	990	49
397	219	2	0	372	172	599	524	472	366

ABUTMENT REACTIONS

Left H= 301 kN V= 125 kN @ 1028 mm from springing
Right H= 372 kN V= 109 kN @ 498 mm from springing

No Tension ∴ Satisfactory for 20.3T D.A. loading with lift off.

[redacted] 16/2/00

MULTI ANALYSIS
TABULATED RESULTS

Loadcase: T.A. 22.5T Right Life Off at 17000 chainage

Left span		Pier		Right span		Offset	Load	σL	σR
H (kN)	V (kN)	Nr	Force	H (kN)	V (kN)	From L	(kN)	(KN/m²)	(KN/m²)
335	155	1	0	366	196	585	483	459	313
349	364	2	0	294	170	765	673	176	902

All positive values

ABUTMENT REACTIONS

Left H= 335 kN V= 146 kN @ 791 mm from springing
Right H= 294 kN V= 113 kN @ 288 mm from springing

∴ No Tension ∴ Satisfactory for T.A. 22.5T with Life Off

[redacted]

[redacted]

[redacted] ℄L.

APPENDIX C

APPROVAL IN PRINCIPLE

AND

INSPECTION FOR ASSESSMENT