



Major works programme 2004/2007

VAR9/1423-01

**BD21/01 Assessment** 

**Luffness Mains Bridge, Nr. Luffness, East Lothian** 

**BRIDGE REF: AGB/3** 



April 2006



## **Document control sheet**

## Form IP180/B

Client:

BRB (Residuary) Ltd

2004/2007

Project:

VAR9-1423-01 Major works Programme Job No: J24110IS - AGB/3

Title: AGB/	Title: AGB/3 (BD21/01 Assessment)						
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## **JACOBS**

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## 1 BD21/01 Assessment

This report presents the BD21/01 assessment for Structure AGB/3.

#### 1.1 Location of Structure

Structure AGB/3 is situated on the Gullane to Longniddry disused railway line at Grid Reference NT483797. The structure carries a public road and is named Luffness Mains Bridge.

## 1.2 Construction Type

Half through girder type bridge. The edge girders are slender steel riveted plate girders 6'-6" (1.981m) deep with unequal flanges. The transverse girders are riveted steel plate girders  $15" \times 9"$  (381 x 225 mm). The transverse girders connect to the edge girders with a cleated connection on the inside face, each connection has a gusseted web stiffeners on the outside face and a tee section on the inside face. Buckle plates span between the top angles of the transverse girders supporting the deck construction. The buckle plates are two way spanning connected laterally by tee sections. The bridge was constructed circa 1893.

## 1.3 Information used to form the Assessment

The assessment was carried out to BD21 on the bridge in its current state. All dimensions and condition factors were obtained from site measurements and reference to historic data. (See Jacobs report "VAR9-830 BE4 Assessment Programme – Assessment and Inspection Report – Bridge Ref.: AGB/3").

Load distribution in the plates and connecting tees was modified in accordance with the recommendations in Jacobs FE analysis of buckle plates (November 2005).

## 1.4 Results of BD21/01 Assessment

**Element: Parapet girders** 

40 tonne loading K factors for road surface and HGV flow combinations:

	HGV Flow				
Road Surface	High (H)	Med. (M)	Low (L)		
Good (g)	0.81	0.79	0.76		
Poor (p)	0.91	0.90	0.87		

C = Available live load capacity / Live load capacity required for Adjusted HA loading and relates directly to the K factors in Figures 5.2 to 5.7 of BD21/01.

C > K = 0.76 for 40 tonne loading (Lg) Low HGV flow, good road condition.

Action	Critical Location	Dead load effect	Adjusted HA live load effect	Assessed resistance	C factor	Live load rating (Lg)
Bending Compression flange buckling	Mid- span	604 kN.m	865 kN.m	1824 kN.m	1.41	40 tonnes
Shear	Support	209 kN	333 kN	1401 kN	3.58	40 tonnes

Accidental wheel loading from Annex D vehicle 5 (two 10 tonne axles at 1.8m separation)

Action	Critical Location	Dead load effect	Accidental wheel loading	Assessed resistance	C factor	AWL rating
Bending Compression flange buckling	Mid- span	604 kN.m	776 kN.m	1824 kN.m	1.57	40 tonnes
Shear	Support	209 kN	320 kN	1401 kN	3.73	40 tonnes

## **JACOBS**

<u>Element</u>: **Transverse girders 4 – 7** (for transverse girders 1 -3 length and applied dead load are reduced due to skew of bridge)

Assessed for critical road vehicles BD21/01 Table D1 (also refer to clause D4 a.) Critical axle wheel loads for various vehicle gross weights

Axle weights (tonnes)	Vehicle gross weight (tonnes)						
	Full assessment live loading		Restricted assessment live loading				
axle	44	40	26	18	7.5		
W2	11.5	11.5	11.5	11.5	1.5		
W1				6.5	6.0		

Capacity factor = Available live load capacity / assessed live load effects (11.5 tonnes axle)

Action	Critical Location	Dead load effect	Live load effect	Assessed resistance	Capacity factor	Live load rating
Bending	Mid-span	118 kN.m	474 kN.m	464.7 kN.m	0.73	7.5 tonnes
Shear	Support	66 kN	145.3 kN	365 kN	2.06	40 tonnes

Accidental wheel loading from Annex D (single 11.5 tonne axle)

(Bending effect is identical to assessment live load)

Action	Critical Location	Dead load effect	Live load effect	Assessed resistance	Capacity factor	Live load rating
Shear	Support	68.5 kN	252 kN	365 kN	1.17	40 tonnes

£



## **Element: Buckle plates**

Assessed for single wheel loading to BD21/01 Clause 5.30.

40, 26 and 18 tonne loading, single wheel loads for various road surface and HGV flow combinations:

	HGV Flow				
Road Surface	High (H)	Med. (M)	Low (L)		
Good (g)	90	86	82		
Poor (p)	100	95	90		

3 tonne loading, single wheel loads for various road surface and HGV flow combinations:

	HGV Flow					
Road Surface	High (H)	Med. (M)	Low (L)			
Good (g)	22	21	19			
Poor (p)	25	22	21			

Capacity factor = Available live load capacity / assessed live load effects (82 kN wheel)

Action	Location	Dead load effect	Load effect 82kN wheel	Assessed resistance	Capacity factor	Live Load Rating (Lg)
Axial compression strip load	Applied adjacent to tees	26.6kN/ m	612.4 kN/m	1228 kN/m	1.96	40 tonnes

## Element: Buckle plate riveted connection to transverse girders

Action	Location	Dead load effect	Load effect 82kN wheel	Assessed resistance	Capacity factor	Live Load Rating (Lg)
Rivets in shear	Buckle plate / main girder	2.7 kN/rivet	62.2 kN/rivet	29.85 kN/rivet	0.44	3 tonnes

## Element: Tee sections connecting adjacent buckle plates

Action	Location	Dead load effect (modified)	Load effect 82kN wheel (modified)	Assessed resistance	Capacity factor	Live Load Rating (Lg)
Tees in bending	Mid-span	0.23 kN.m	3.125 kN.m	1.97 kN.m	0.56	7.5 tonnes

Bending effects in the connecting tees have been derived in accordance with the findings from Jacobs report on the FE analysis of buckle plates (November 2005).

## Main assumptions:

- Bridge specific live loading was based on "low" HGV usage and "good" road surface, reflecting the current condition.
- The main girders, tee sections and buckle plates were taken as steel. This
  was assumed in the BE4 assessment.

## **JACOBS**

- It was assumed that the transverse girders connecting to the main girders will provide lateral restraint to the compression flange of the parapet girders by U –frame action. The flexibility coefficient f used to calculate δ in BD56: Clause 9.6.5 was obtained from RT/CE/C/025 Fig. A42, which presents a greater range of historical connection types than BD56.
- The buckle plates were checked as an arch catenary, calculating the limiting compressive stress as for a strut with effective length extending from the end of the span (the rivet line) to the intersection point with the wheel distribution, as outlined in BA56: clause 15.2. The rivets were checked for the horizontal thrust imposed by the arch action.

## 1.5 Load Rating

The transverse girders are deficient for 40 tonne assessment live loading in bending. BD21 requires that transverse members failing the 40 tonne loading level and are rated at 7.5 tonnes Assessment Live loading or below, because 26 tonne and 18 tonne vehicles can have 11.5 tonne axles. The rating determined for the transverse girders was 7.5 tonnes and Fire Engine Group 2. This load corresponds to the loading imposed by two axle critical AW vehicles under the road vehicles (Authorised Weight) regulations 1998.

The main parapet girders are robustly constructed and despite some web corrosion, they have sufficient capacity to carry 40 tonne Assessment Live Loading. They are slender sections with a relatively small compression flange. The most critical load effect is bending producing buckling of the compression flange.

Wheel loading in accordance with BD21 is considerably more onerous than BE4, namely a nominal 100 kN wheel with impact as opposed to a 5 ton (50kN) wheel load with a larger contact area in BE4. The plate connections and the supporting tee sections failed to meet the 40 tonne requirements. As with the transverse girders, the next assessment level below 40 tonnes is 7.5 tonnes. The components however also failed to meet 7.5 tonne requirements and were subsequently rated at 3 tonnes and Fire Engines group 2.

The overall bridge rating is governed by the weakest component of the bridge; therefore the bridge is rated at 3 tonnes and Group 2 Fire Engines.

# Appendix A - Form AA

Group Standard

## FORM 'AA' (BRIDGES)

GC/TP0356

Appendix: 4

ELR/ Bridge No AGB/3

Issue; 1 Revision: B (Nov 2000)

## APPROVAL IN PRINCIPLE FOR ASSESSMENT

Bridge/Line Name: Luffness Mains Bridge / Aberlady Gullane Branch

ELR/Bridge No. AGB/3

## Brief Description of Existing Bridge:

(a) Span Arrangement

Single span, simply supported bridge, clear skew span of parapet glirders is 33' – 6" (10.21). Skew angle is about 27°. Transverse girders span between edge girders at 4'–0" (1.219m) intervals. Separation of the edge girders is 26'-0" (7.92m).

(b) Superstructure Type

Half through girder type bridge. The edge girders are slender steel riveted plate girders 6' – 6" (1.981m) deep with unequal flanges. The transverse girders are riveted steel plate girders 15" x 9" (381 x 225 mm). The transverse girders connect to the edge girders with a cleated connection on the inside face, each connection has a gusseted web stiffeners on the outside face and a tee section on the inside face. Buckle plates span between the top angles of the transverse girders supporting the deck construction. The buckle plates are two way spanning connected laterally by tee sections. The bridge was constructed circa 1893.

(c) Substructure Type

The abutments and wingwalls are constructed in coursed sandstone masonry.

(d) Planned highway works/modifications at this site

None known.

(e) Road designation class and whether classed as a heavy load route

The bridge carries a single carriageway unclassified road. Carriageway width is 4.577m (15'-0"), with soft verges of 1.4m and 2.1m wide on each side. It is unlikely to be a heavy load route.

(f) Any other requirements

The bridge has passed BE4 assessment for full C&U loading and is now being checked to BD21.

Group Standard

FORM 'AA' (BRIDGES)

GC/TP0356

Appendix: 4 Issue: 1

ELR/ Bridge No AGB/3 Issue: 1 Revision: B (Nov 2000)

## APPROVAL IN PRINCIPLE FOR ASSESSMENT

#### Assessment Criteria

## (a) Loadings and Speed

Dimensions and condition factors obtained from site measurements and reference to historic data. (See Jacobs report "VAR9-830 BE4 Assessment Programme – Assessment and Inspection Report – Bridge Ref.: AGB/3"). Assessment live loading obtained from and applied in accordance with BD21/01, assuming low HGV flow and good road condition. The bridge is assessed for up to 40/44 tonne live loading, with reduced loading being determined where this capacity is not reached.

#### (b) Codes to be used

BD21/01 - "The Assessment of Highway Bridges and Structures"

BD56/96 - "The Assessment of Steel Highway Bridges and Structures"

## (c) Proposed Method of Structural Analysis

Vehicle loading (kel and udl components) will be applied to the main girders by simple statics. Transverse members will be considered under appropriate single axle loads. Buckle plates will be examined under single wheel loads.

Capacities of the plate girders will be calculated using measurements of the reduced section sizes where corrosion is present. Consequently, a general condition factor is not applied.

It is assumed that the transverse girders connecting to the main girders will provide lateral restraint to the compression flange of the parapet girders by U—frame action. The flexibility coefficient f used to calculate  $\delta$  in BD56: Clause 9.6.5 will be obtained from RT/CE/C/025 Fig. A42, which presents a greater range of historical connection types than BD56.

The buckle plates will be checked as an arch catenary, calculating the limiting compressive stress as for a strut with effective length extending from the end of the span (the rivet line) to the intersection point with the wheel distribution, as outlined in BA56; clause 15.2. The rivets will be checked for the horizontal thrust imposed by the arch action. Load distribution in the plates and connecting tees will be modified in accordance with the recommendations in Jacobs FE analysis of buckle plates (November 2005).

BRB (Residuary) Limited	Group Standard
FORM 'AA' (BRIDGES)	GC/TP0356
ELR/ Bridge No AGB/3	Appendix: 4 Issue: 1
· ·	Revision: B (Nav 2000)
APPROVAL IN PRINCIPLE	FOR ASSESSMENT
Director Structures' Comments	8
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Proposed Category for Inc	dependent Check
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Name of Checker suggest	ted if Cat 2 or 3
Category 1	
The above assessment, with amount	endments shown, is approved in principle:
	Signed
	Title Ovic Bys MESS.
	Date 24/7/06
Category 2 and 3	
The above assessment, with amo	endments shown, is approved in principle:

Title

Date

Signed .....



# Appendix B - Form BA and BAA

**Group Standard** 

FORM 'BA' (BRIDGES)

GC/TP0356

Appendix: 4

Issue: 1 Revision: A (Feb 1993)

ELR/ Bridge No: AGB/3

## CERTIFICATION FOR ASSESSMENT CHECK

Assessment Group:

**Jacobs Infrastructure** 

Bridge/Line Name:

Luffness Mains Bridge / Aberlady Gullane Branch

**Category Of Check:** 

**ELR/ Bridge No:** 

AGB/3

We 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 as recorded on Form AA approved on 24 July 2006.
- (2) It has been checked for compliance with the following principal British Standards. Codes of Practice, BRB (Residuary) Limited technical notes and Assessment standards:

BD 21/01 - "The Assessment of Highway Bridges and Structures"

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

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

Name Signature

4/9/06 Assessor

4/9/06 Assessment Checker

4 1 06 Authorised signatory of the firm of Consulting Engineers to whom Assessor/Checker is responsible.

**Group Standard** 

## FORM 'BA' (BRIDGES)

GC/TP0356

Appendix: 4
ELR/ Bridge No: AGB/3 Issue: 1

Revision: A (Feb 1993)

## **CERTIFICATION FOR ASSESSMENT CHECK**

Category 2 and 3 (Note: Category 1 check must also be signed)

(a) Assessment

Name Signature Date Assessor Assessment Checker Authorised signatory of the firm of Consulting Engineers to whom Assessor/Checker is responsible. (b) Check <u>Signature</u> Name Date Assessor Assessment Checker Authorised signatory of the firm of consulting engineers to whom Assessor/Checker is responsible. This Certificate is accepted by

**Group Standard** 

## FORM 'BAA' (BRIDGES)

GC/TP0356

Appendix: 4 Issue: 1

Revision: A (Feb 1993)

ELR/ Bridge No AGB/3

## **CERTIFICATION FOR ASSESSMENT CHECK**

### **Notification of Assessment Check**

**Assessment Group** 

Jacobs Infrastructure.

Bridge Name/Road No.

Luffness Mains Bridge / unclassified

Line Name

Aberlady Gullane Branch

ELR Code/Structure No.

AGB/3

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

Transverse Girder: 7.5 tonnes Assessment Live Loading and Fire Engines Group 2. This corresponds to the loading imposed by two axle light goods and public service vehicles (restricted to 7.5 tonnes Gross Vehicle Weight).

Floor plate connection to transverse girders and connecting tees between buckle plates: 3 tonnes Assessment Live Load and Fire Engines Group 2.

Other assessed components are satisfactory for 40 tonnes Assessment Live Loading.

#### Recommended Loading Restrictions

3 tonnes Gross Vehicle Weight and Fire Engines Group 2.

## Description of Structural Deficiencies and Recommended Strengthening

There is corrosion of the webs of both external girders and slight section loss on several internal girders. The corrosion in the main girder webs should be treated and maintenance painting is required throughout.

Minor masonry repairs and repointing are recommended throughout the structure as well as the removal of the trees behind the NE wingwall. The vertical fracture at West abutment does not warrant any additional maintenance work, since the pilaster on the top does not show any signs of movement. Although recently resurfaced, the carriageway surfacing is in need of minor maintenance.

The dampness of the abutments and underneath the inverted Tee sections shows that the waterproofing is not effective. Deck re-waterproofing should be considered for the long-term sustainability of the abutment/bridge.

**Group Standard** 

FORM 'BAA' (BRIDGES)

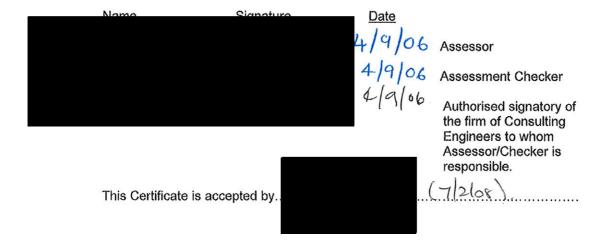
GC/TP0356

ELR/ Bridge No AGB/3

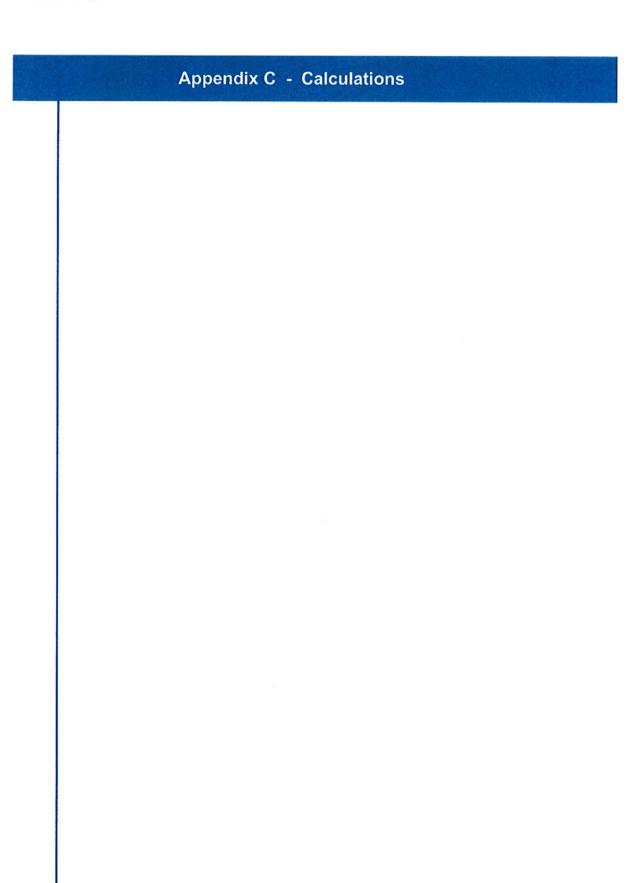
Appendix: 4 Issue: 1

Revision: A (Feb 1993)

## **CERTIFICATION FOR ASSESSMENT CHECK**







# **CALCULATION COVER SHEET**

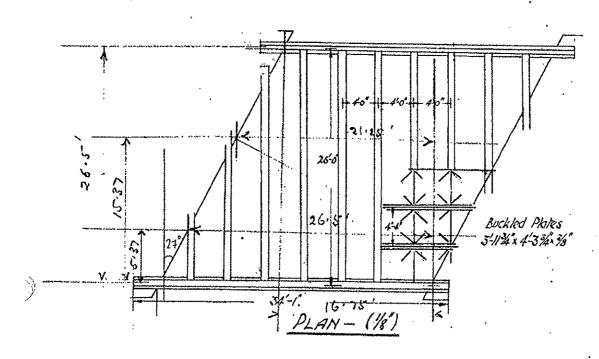
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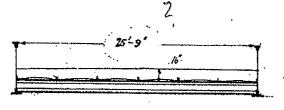
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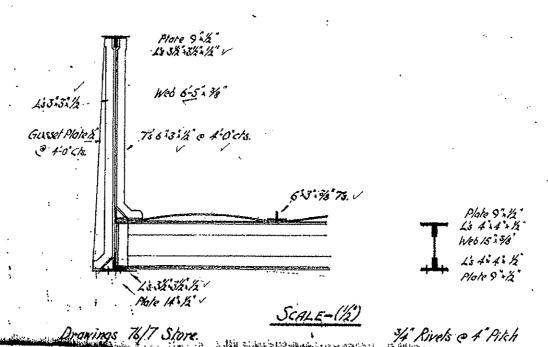
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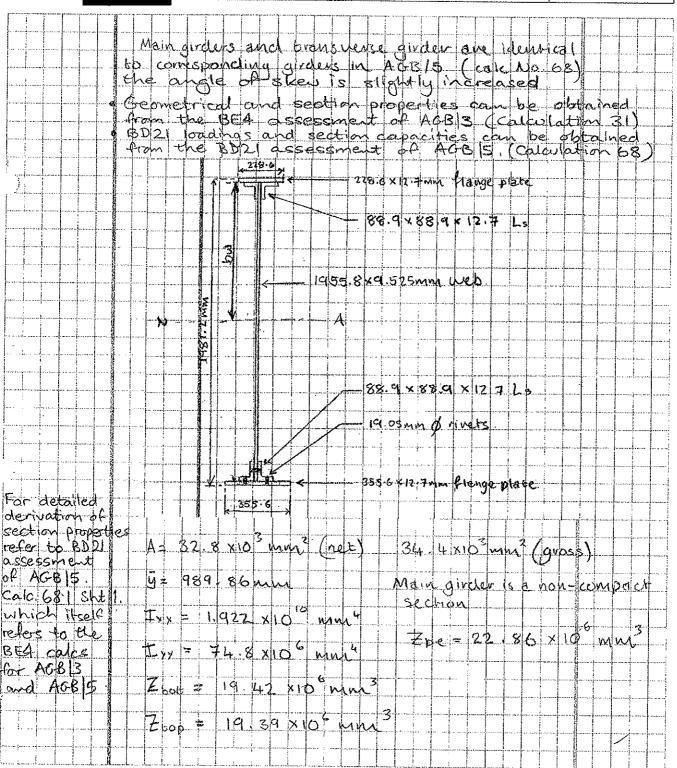


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# **CALCULATION COVER SHEET**

## Jacobs Reading

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Job No:	J241101						File:	R9	
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		Sheet No: 5
ubject:		Calc No: 73.2
ob No:		File:
lade By:	Date: O4/06 Revised By:	Date:
hecked By:	Date: 6/06 . Checked By:	Date:
Transperse gird	le (2)	
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5.4 m/m	3.3 KN/m	
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		21×(21+21642)
		1 2
	133 X 4.7 42 X /2	+ 0.216 x (3 x 0.749 + 2x 1.74.74.74.74.74.74.74.74.74.74.74.74.74.
= (8.4	+1 + 4187 + 150	>+ 1.045) - 4.742
1, 2		
	.46 KN	
Transverse gir	der (3)	
0.216	026 0.216 0.26 0 216	
J. J		
	13.3 KN/m	
5.44V/m	2.41 KV/m 15	F. 4 h2/m
	R <sub>2</sub>	
	7.178	
$R_1 = 2.1$	11 × 5 0 2 8 2 1 1 4 5	
	11 x 5.0782 x 1/2 + 5.1	7 2 1 5 0 7 8
	13,3 x 7, 178 2 x 1/2, 4	026x(5x0.573
	+ 4×1,321 \ + 7.178	and the first of the second se
= (3	11 + 69 5 + 342	2.63 + 1.78 = 7.178
·	52 KN	
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# III JACOBS

Project Title:			Sheet No: 6
Subject: AGB / 3	Dead Loads	: Main girder	Calc No: 43.2
Job No:	& effective	length	File:
Made By:	Date: 04/06.	Revised By:	Date:
Checked By:	Date: 6/06.	Checked By:	Date:
length	s of girder =	= 34.083 h	5 = 10.389 m
BD56 963 effect	ive length =	1.0 x 1.0 x	0 389
		10.389 m	
		19:089 W	
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	4 4 4		
	10.38	GI 184	
		> (3) ave vedi	sced in length
e AGB 3   due 60.	skeud		
31 sh = 19 Lo =	2.305 m		
" " 18 143 =	4.742 m		
" " 17 L <sub>3</sub> =	7.178m		
	3 kw/m		
5: Hrw/up 7	2.41 KN/M		
R. C.	A R		
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	ы x 0.205 2 x /	+ 5.4 × 2.1 ×	1/2,1 + 0.205\
	+ 12 2 2 2 2 2	2	
	dan sandan da filipanda sanda sanda sanda sandan bi sanda da l	$(2 \times 1)_2 + 0.21$	6 x 0.984) / 2 305
	-1.63 KN		



Project Tit	lle:																	She	et l	Vo;				7-	;		
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Job No:											,							File	:				~~~				
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## **CALCULATION COVER SHEET**

## Jacobs Reading

Project Title:	BRB (Residua	гу) Ltd - Мај	or V	Vorks 2004/2007	Calc. No.	: 73.3
Job No: J24110I	S				File:	R9
Project Manager		Subje	ct:	AGB/3 BD21 Asses	ssment	
Designer				Luffness Mains Brid	dge / Aberlady	Gullane Branch
Project Group	31400			Section Capacites		

	Total Sheets	Made by	Date	Checked by	Date	Reviewed by	Date	
Original	1		Aug-06		Aug-06			
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Superseded by Calculation No. Date

For design criteria, refer to Approval in Principle (Form AA) document



Project Title:					Sheet No:	8
Subject: A G	B 3 :	Section	L CAP	acivies	Calc No:	73.3
Job No: 521	INOIS	]			File:	R9
Made By:		Date: 🔿 🖞	06	Revised By:		Date:
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section	the com	DIMESSION	Pia	inge on the	10 0 61 1 10	
pacities.	8	Liil	ll:			
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# **CALCULATION COVER SHEET**

## Jacobs Reading

	Title:	BRB (Re	siduary) Li	iduary) Ltd - Major Works 2004/2007 Calc. No.: 73.4										
Job No:	J24110	)IS					File:	R9						
Project Designe Project		3140	0	Subject:				dy Gullane Branch						
	Total Sheets	Made by	Date	Checked by	Date	Reviewed by	Date							
Original	3	JDC	Aug-06	JLR	Aug-06									
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For desi	gn criteria	a, refer to A	pproval in I	Principle (F	orm AA) doo	cument								



Project Title:		Sheet No:
Subject: AGB/3 %	Live hoads	Calc No: 73.14
Job No: J24110 IS		File: I29
Made By:	Date: Oはんら Revised By:	Date:
Checked By:	Date: 6/06 Checked By:	Date:
Carriau	eway width = 7 925-	2.1-14
	1 4.425	
BD21 tabley 1 Notic	natane applied	
Notion	al lone width = 2.5m	
	25 n 2 1 m	
	4425 n c/w   1 R	
	1 Agr	
	Wx(14025+2.5)	
	7.925	1.670
	1 7 9 6	
Edge give	len 1 takes up bo 67%	of the load
1 and all	length = effective span	
		= 10.389m
HA DUL	= 336 ( 10389) 067 =	\$ 70.02 tulm
HA KEL	= 120 KW,	
Adjustini	uv follow = $3.65/2.5$	= 146
Adjusted	I HA load effect (in ber	iding) (factored)
Table 3.1 = / 70	02 × 10 389 2 20 × 10 3	84 1 4 4
	0   4	11.46
= 86	5 KD.M	



Project Title:			Sheet No:
Subject:			Calc No: 43. Lp
Job No:			File:
Made By:	Date: 04/06	Revised By:	Date:
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		+ 120	) x 15 x a.67
	2		/ 1.46
32	3 KU		
	<b>A</b>		
Stidge	specific H	load effect	he L@ support.
3	33 X Q.76		
	2 4.	= V	
$\parallel \parallel $	33 44	<del></del>	



Subject: A (-B / 3 : Live Loads  Job No: Transverse girder    Date:   Date:   Date:   Date:   Date:	Project Title:		Sheet No:	11
Job No:  Transverse gircler File:  Made By:  Checked By:  Date: Oh / O6 Revised By:  Date:  Checked By:  Date:  AGB 5 BDD As per AGB 5, an 11.5 tonnic Critical case for example of a xie is a policed to description to example years effects  B. 4. She 21 M = 4.73.8 KN, M  She ar:  101.5 101.5  She ar:  She ar:  She ar:  She ar:  101.5 x (4.871.+6.687) + 8.077	Subject: AGB / 3	: Live Loads	Calc No:	43.4
Checked By:  Date: 6/06. Checked By:  Date: 6/	Job No:	· Transverse girde	ע File:	
2 AGB 5 8021 As per AGB 5 , an 11.5 tonne Critical control of laxe is applied to determine transverse effects 8.4 she 21 M = 4.73 8 KN.nc  Shear:  101.5 101.5  Shear force V Q A  101.5 x (4.877 + 6.687) + 8.047	Made By:		Dat	ie:
	Checked By:	Date: 6/06 . Checked By:	Dat	e:
Shear:    Shear:   Sh	AGB 5 ROPI AS	Dow ACR TO an II who	na Chaileire	1
Shear:    101.5   101.5   10.5	GS TOTAL S			it
3.4 $shk 21$ $M = 4.73.8 kN, M$ Shear:  101.5 101.5  4.877 m  Shear foru, $V \otimes A$ = 101.5 $x(4.877 + 6.687) + 8.047$	vation of axle	is applied to determine	Evansueuse	effect
Shear:  101.5 101.5  8.4 Shr 21 A B  4.877 M  5hear forw V Q A	d effects			
Shear:  101.5 101.5  8.4, Shr 21 A B  4.877 m  5hear foru V 8 A  = 101.5 x (4877 + 6.687) + 8.047	3.4 she 21 1	1 = 473 8 KN, h		
101.5 101.5 8.4.546 21 A A A A A A A A A A A A A A A A A A				
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Shean forus V & A  = 101.5 x (4877 + 6.687) + 8.047	81,01,7			
Shean force V & A = 101.5 x (4877 + 6.687) 78.047	0 4 500 2 7			
5hean force VQA = 1015 x (4877 + 6.687) 78.047		m 18m 18th		
7 101.5 × (4877 + 6.687) + 8.047				
7 101.5 × (4877 + 6.687) + 8.047				
7 101.5 × (4877 + 6.687) + 8.047	Shert	wtere VBA		
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	IIIVI	= 145, 32 KN		
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# **CALCULATION COVER SHEET**

Rev Rev Rev

## Jacobs Reading

		17.30					Read	ding	
Project	Title:	BRB (F	Residuary) Lt	d - Major V	Vorks 2004/2	2007	Calc. No.	: 73.5	
Job No:	J24110	IS			100		File:	R9	
Project Designe	Manager er			Subject:		21 Assess Mains Bridg		Gullane Bra	anch
Project	Group	314	00					heel Loadin	
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Superseded by Calculation No. Date

For design criteria, refer to Approval in Principle (Form AA) document



Project Title:	,		Sheet No:	12
Subject:			Calc No:	43.5
Job No:			File:	
Made By:	Date: 04/06	Revised By:	Date:	
Checked By:	Date: 6/06.	Checked By:	Date:	
	Summary			
	<u> </u>			
	Main girder			
5N+ 8	Benching copaciti	187	24 KDin	
sw 7	Dead Load Mon	nent = 60	JU KNV	4
	Live Load capa	c/ry = 127	20 10 1	
surio	Applied 404 a. 1	, = 6.	57 60,1	M
			7	
sn 8	shear foru capa	140 = 140	) KN	
sut 4	Dead hoad swea	y = 2¢	)4 KN	
:			7	
	Live Load capa	4149 = 119	2 KN.	
5M-10	Applied hot a !	1   1   25	3 KN	<b>,</b>
	The second secon			
	transversa girden		1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
5W 8		, 461	4,7 tw.m	
	Bending capacity			
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	Live Yoad Capaci	tu = 346	5,7 KUN	,
c) 6 4 3 3 3		<u> </u>		
SW=11	Applied 40 6 8.1.	473	3. 8 KN, W	
				See nettip
\$17k 8	shear force capa	city = 365	i kn	tating.
SW L	Dead Load she ar	17 = 65	ا دیم اور	
,			500	
	Live Hoad Capacit	4 299		
SW-11	Applied 40E a	1.1. = 145	3 40	



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Project Title:		Sheet No:	136
Subject: AGB/3 : Ac	ccidental whee	I loading Calo No:	73.5
Job No:		File:	
Made By:	Date: 66/06 Revis	ed By:	Date:
Checked By:	Date: 6/06 Check	red By:	Date:
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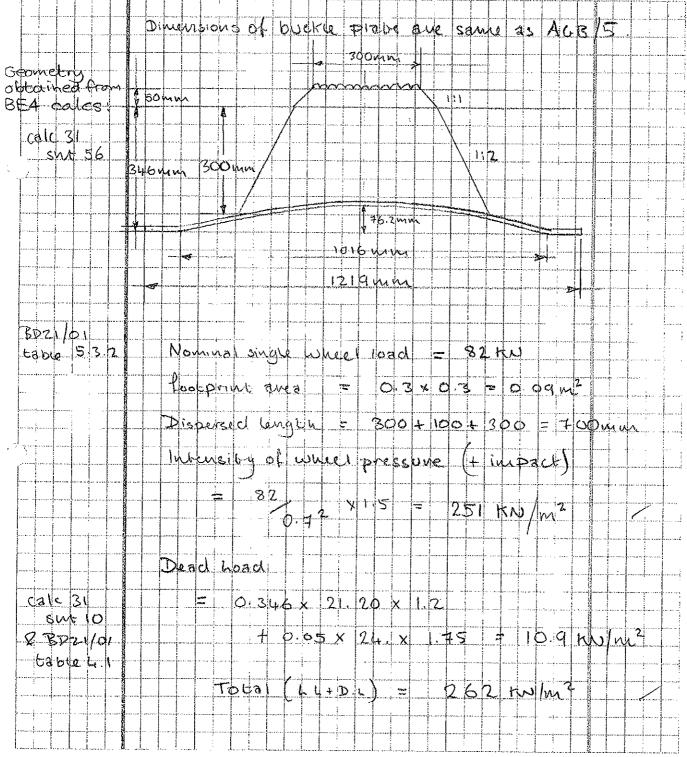
# **CALCULATION COVER SHEET**

## Jacobs Reading

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Designer Project Gro		-	1.7	Subject	10000				
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	bup	3140	0		Buckle pla	te and com	ponents (ri	vets and tee	es)
		100000	Sept Dir	147347					K. S. C.
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Project Title:			Sheet No:	14
Subject: AGB/3:	Buckle phal	re check	Calc No:	73.6
Job No: 124110IS			File:	
Made By:	Date: 04/06	Revised By:		Date:
Checked By:	Date: 6/06	Checked By:		Date:
Dinension	rs of buckle	From our sa	me as A	68/5





Proje	ect <sup>-</sup>	Title	);																							She	et l	No:			15				
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Project Title:		Sheet No: 16
Subject:		Calc No: 43.6
Job No:		File:
Made By:	Date: O4/06 Revised By:	Date:
Checked By:	Date: 6/06 Checked By:	Date:
	2.74 = 0596 !	Usa CUVILE B
	4.76	
hy 37 04	= 0,44	
19 1 1 100		
)	L = 230 x 0.74 = 170.	7 1 1/1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
		Frank J. E. S. C. C. C. C. C. C. C. C. C. C. C. C. C.
	170.2 x 9 925	
	170,2 x 9 325 = 12	28 1/21 1 11/1
	1 · 2 × / )	01 P13W
	+ + + + + + + + + + + + + + + + + + + +	28 N/nm with 28 KN/M of Plane
	28 > 639	
	take is sails factory for u	Proums



Project Title:		Sheet No:	17
Subject: ACB/3 : Bucker plake rive	rs check	Calc No:	73.6
Job No:		File:	
	ed By:		Date:
Checked By: Date: 6/06 Check	ed By:		Date:
Those from Plane = (	339 KN/W		
3 sut 60 must spacing = 4,	/ = /0.1	016 W	
shear ou rived = 6	37 x 0 10	) 64 ==	65 ku   ,
31 sht 6 met diameter = c	). 619 m		2 7 Dead
			62.2 Live
BD56	79		
	V868 V2		
	968 12		
V= 65 hw			
n = 1			
Aey = # X 192)	1/4 = 2	83.5	
0.85 6y 3	0.85 x 23	70 = 19	15,5 2/mm²
			ring bond diver
3			rivate;
7 = 65 x 10 <sup>3</sup> =	229.3 N	Jun 2	
- 283.5			
195 195	5 5	100	
	12 x /2		r= 73 N/m/n <sup>2</sup>
		;   !	85 mu/muc
729 3 > 104 73 mines	s tailin s	near	
Max Chrost = 104.73 x	282 5 =	2012	- Kulviver
+ 24 <del>+</del> /0	.1016 =	292	2 ho/m
TOTAL LOAD = 292.3 x			12 + 100
totalload - Dead toad =		! [ 1	
Mloudor Nominal single wheel loadin	y = 109 I	× D. I	1/15 = 35 6 KN.
	3 bonne a.		(32.4 Dead)
	group 2	* * •	(32,4 time.)
	J. AM. T.	r Lung hola	541



Project Title:			Sheet No: 8
Subject:			Calc No: 73.5
Job No:	],	<u></u>	File:
Made By:	Date: 6/06	Revised By:	Date:
Checked By:	Date: 6/06 .	Checked By:	Date:
Connecti	ny T's		
		132m	
	1;37 m	13500	
1319m			
Applied o	lead load #	0.9 x /2 x 1.3	2 x 1.210
7		8.74 KN	
68.5 sw 27 self hujo	jht = 0	2.1881N	
Table 5.3.2 Uneel 10	ad = 1	5 x 82 = 123	FW
Asudu	M = 8	77 + 0,188 +	173) x + 219
		8	
	= 20	11 hs.n. 7	1.36 Dead)
			18,75 hime
Tees are	identical to	tees in ACTS	1/5
685 sur 28 MD	1.97 KU.		
	( p ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) (		
Market	marghiller a list	on in accord	GIAACO LISTE
Jacobs	FE BLALL	sis of buent.	plates (Novos)
	1 7		
- I New Sea	monunt =	26.11/6 -	3.35 M.M
1.19	4 4 3 35		-> back calculate



Pro	ect	Title	9:										-															Sh	eet	No	:	***************************************	1	9			
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Job												~~~											~~~~					File	 ):	···			_			,	
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