



Major works programme 2004/2007

VAR9-1423-01

**BD21/01 Assessment** 

Fenton Bridge, Nr. Luffness, East Lothian

**BRIDGE REF: AGB/5** 



March 2006



#### **Document control sheet**

#### Form IP180/B

Client:

BRB (Residuary) Ltd

Project:

Major works Programme 2004/2007

Job No:

J24110HQ

AGB/5 (BD21/01 Assessment) Title: Prepared by Reviewed by Approved by NAME **ORIGINAL** SIGNATURE 25 January 2006 NAME NAME NAME **REVISION** 6 March 2006 **REVISION** DATÉ SIGNATURE SIGNATURE SIGNATURE NAME NAME NAME REVISION SIGNATURE DATE SIGNATURE SIGNATURE

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#### 1 BD21/01 Assessment

This report presents the BD21/01 assessment for Structure AGB/5.

#### 1.1 Location of Structure

Structure AGB/5 is located on the Gullaine to Longniddry disused railway line at Grid Reference NT487808. The structure carries a public road and is known locally as Fenton Public 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/5").

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<br>Location | Dead<br>load<br>effect | Adjusted HA<br>live load<br>effect | Assessed resistance | C<br>factor | Live<br>load<br>rating<br>(Lg) |
|-------------------------------------|----------------------|------------------------|------------------------------------|---------------------|-------------|--------------------------------|
| Bending Compression flange buckling | Mid-<br>span         | 466.7<br>kN.m          | 606.3 kN.m                         | 1824<br>kN.m        | 2.2         | 40<br>tonnes                   |
| Shear                               | Support              | 216 kN                 | 388 kN                             | 1401 kN             | 3.0         | 40<br>tonnes                   |

Accidental wheel loading from Annex D vehicle D4 (two 10 tonne axles at 1.8m separation)

| Action                                       | Critical<br>Location | Dead<br>load<br>effect | Accidental<br>wheel<br>loading | Assessed resistance | C<br>factor | AWL rating   |
|--|----------------------|------------------------|--------------------------------|---------------------|-------------|--------------|
| Bending<br>Compression<br>flange<br>buckling | Mid-<br>span         | 466.7<br>kN.m          | 572 kN.m                       | 1824<br>kN.m        | 2.3         | 40<br>tonnes |
| Shear  | Support              | 216 kN                 | 132 kN                         | 1401 kN             | 8.9         | 40<br>tonnes |

<u>Element</u>: **Transverse girders T1** - **T5** (T6 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 asses                    | sment live | Restrict | ed assessn | nent live |
|                       | loa                           | ding       | 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<br>Location | Dead load<br>effect     | Live load effect | Assessed resistance | Capacity factor | Live load rating |
|---------|----------------------|-------------------------|------------------|---------------------|-----------------|------------------|
| Bending | Mid-span             | 135.93<br>k <b>N</b> .m | 473 kN.m         | 464.7<br>kN.m       | 0.695           | 7.5<br>tonnes    |
| Shear   | Support              | 68.5 kN                 | 140.2 kN         | 365 kN              | 2.11            | 40 tonnes        |

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

(Bending effect is identical to assessment live load)

| Action | Critical<br>Location | Dead load<br>effect | Live load<br>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      |

7.5 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)     | 46       | 43       | 41      |
| Poor (p)     | 50       | 47       | 44      |

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

| Action                       | Location                 | Dead<br>load<br>effect | Load effect<br>82kN wheel | Assessed resistance | Capacity factor | Live Load<br>Rating<br>(Lg) |
|------------------------------|--------------------------|------------------------|---------------------------|---------------------|-----------------|-----------------------------|
| Axial compression strip load | Applied adjacent to tees | 29.8<br>kN/m           | 517.76<br>kN/m            | 701.04<br>kN/m      | 1.3             | 40 tonnes                   |

#### Element: Buckle plate riveted connection to transverse girders

| Action          | Location                         | Dead<br>load<br>effect | Load effect<br>82kN wheel | Assessed resistance | Capacity factor | Live Load<br>Rating<br>(Lg) |
|-----------------|----------------------------------|------------------------|---------------------------|---------------------|-----------------|-----------------------------|
| Rivets in shear | Buckle<br>plate / main<br>girder | 3.0<br>kN/rivet        | 52.6<br>kN/rivet          | 29.85<br>kN/rivet   | 0.51            | 7.5 tonnes                  |

#### Element: Tee sections connecting adjacent buckle plates

| Action          | Location | Dead<br>load<br>effect<br>(modified) | Load effect<br>82kN wheel<br>(modified) | Assessed resistance | Capacity factor | Live Load<br>Rating<br>(Lg) |
|-----------------|----------|--------------------------------------|---|---------------------|-----------------|-----------------------------|
| Tees in bending | Mid-span | 0.255<br>kN.m                        | 3.123<br>kN.m                           | 1.97 k <b>N</b> .m  | 0.55            | 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.

- 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 bridge 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 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 just passed at this reduced level. It should be noted that if "poor (p)" road surface condition is taken, the rivet connections will technically fail for 7.5 tonnes and would be rated at 3 tonnes.

## Appendix A - Form AA

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FORM 'AA' (BRIDGES)

GC/TP0356

Appendix: 4

ELR/ Bridge No AGB/5

Issue: 1 Revision: B (Nov 2000)

### APPROVAL IN PRINCIPLE FOR ASSESSMENT

| Senior Civil Engineer's Commen  | ts                                    |   |
|---------------------------------|---------------------------------------|---|
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| is decentable:                  | · · · · · · · · · · · · · · · · · · · |   |
|                                 |                                       |   |
| Proposed Category for Inde      | pendent                               | Check   |
| Superstructure                  |                                       | I   |
| Substructure                    |                                       | I.  |
|                                 |                                       | or 3  |
|                                 |                                       |   |
| Category 1                      |                                       |   |
| The above assessment, with amer | ndments                               | shown, is approved in principle:                |
|                                 | Signed                                |   |
|                                 | Title                                 |   |
|                                 | Date                                  | 19/12/05  |
| Category 2 and 3                |                                       |   |
| The above assessment, with amer | ndments                               | shown, is approved in principle:                |
|                                 | Signed                                |   |
|                                 | Title<br>Date                         |   |
|                                 | Date /                                |   |
|                                 |                                       |   |

## Appendix B - Form BA and BAA

Group Standard

FORM 'BA' (BRIDGES)

GC/TP0356

Appendix: 4

ELR/ Bridge No AGB/5

Issue: 1 Revision: A (Feb 1993)

### CERTIFICATION FOR ASSESSMENT CHECK

Assessment Group:

Jacobs Infrastructure

Bridge/Line Name:

Fenton Bridge / Aberlady Gullane Branch

Category Of Check:

- Garage

ELR/ Bridge No:

AGB/5

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 20 December 2005.
- (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

Date

25/1/06

Assessor

Assessment Checker

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

### Group Standard

### FORM 'BA' (BRIDGES)

#### GC/TP0356

ELR/ Bridge No AGB/5

Appendix: 4

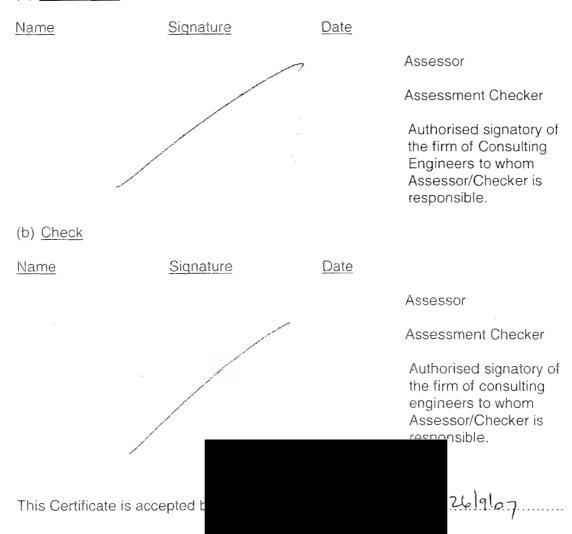
Issue: 1

Revision: A (Feb 1993)

### CERTIFICATION FOR ASSESSMENT CHECK

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

#### (a) Assessment



Group Standard

FORM 'BAA' (BRIDGES)

GC/TP0356

Appendix: 4

ELR/ Bridge No AGB/5

Issue: 1 Revision: A (Feb 1993)

### **CERTIFICATION FOR ASSESSMENT CHECK**

Name
Signature

Date

25/1/06 Assessor

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

This Certificate is accepted by

25/1/06 Assessment Checker

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

Group Standard

FORM 'BAA' (BRIDGES)

GC/TP0356

Appendix: 4

lssue: 1 Revision: A (Feb 1993)

ELR/ Bridge No AGB/5

### <u>CERTIFICATION FOR ASSESSMENT CHECK</u>

#### Notification of Assessment Check

Assessment Group

Jacobs Infrastructure.

Bridge Name/Road No.

Fenton Bridge / unclassified

Line Name

Aberlady Gullane Branch

ELR Code/Structure No.

AGB/5

The above bridge has been assessed and checked in accordance with Standards which are listed on the appropriate for a large the secondary of the results of the concernant in terms of the action to the 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 GVW).

Floor plate connection to transverse girders and connecting tees between buckle plates: 7.5 tonnes Assessment Live Load and Fire Engines Group 2 (as above).

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

#### **Recommended Loading Restrictions**

7.5 tonnes GVW 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.

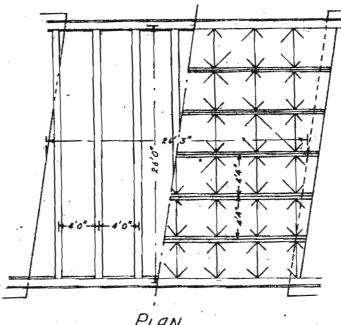
# Appendix C - Calculations

# CALCULATION COVER SHEET

### Jacobs Reading

| Project Ti | Project Title: BRB (Residuary) Ltd - Major Works 2004/2007 Calc. No.: 68.1 |              |             |               |   |                |      |  |        |
|------------|--|--------------|-------------|---------------|---|----------------|------|--|--------|
| Job No:    | ob No: J24110HQ File: R8   |              |             |               |   |                |      |  |        |
| Project M  | Project Manager Subject: AGB/5 - BD21/01 assessment                        |              |             |               |   | Von Town       |      |  |        |
| Designer   | igner Fenton Bridge / Aberlady Gullane Branch                              |              |             |               |   |                |      |  |        |
| Project G  | roup   | 31400        |             |               | Section pro                             | perties        |      |  |        |
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| Original   | 6  |              | Jan-06      |               | Jan-06                                  |                |      |  |        |
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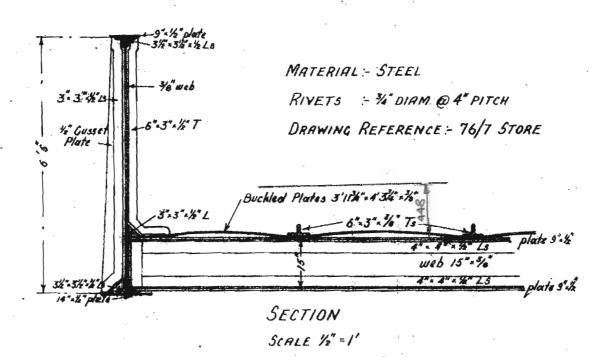
FENTON
BRIDGE Nº 5



PLAN SCALE 16"=1"



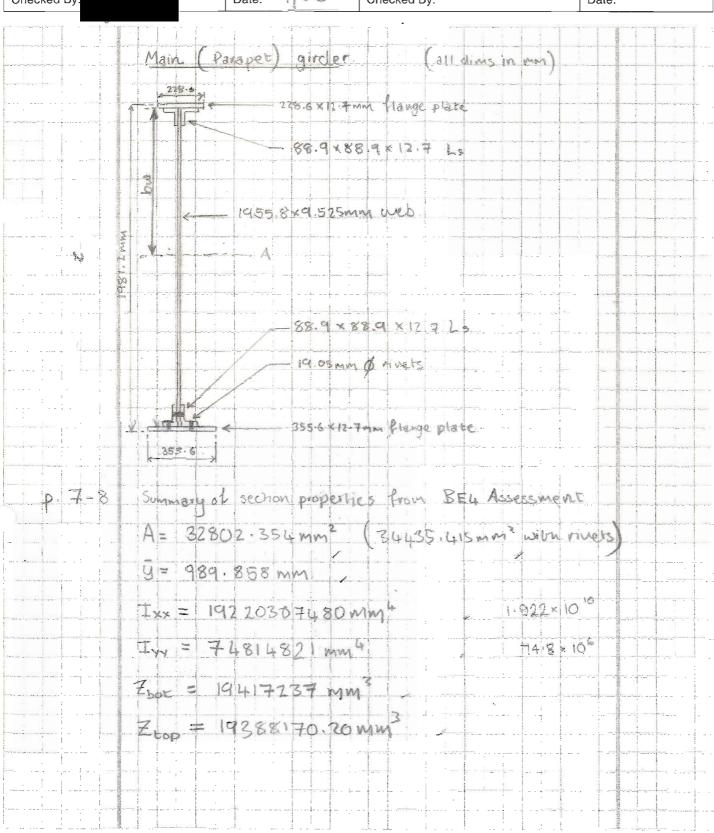
SECTION SCALE 1/8"=1'



Calcsheet1



| Project Title: BRB (Residuary) | BDZI ASSESSMALL | ct          | Sheet No: | 1     |
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| Subject: AGB/5 ~               | Section propert | sies        | Calc No:  | 68.   |
| Job No: J24110HQ               | main girder (   | (MG)        | File:     | RE    |
| Made By:                       | Date: 01/06     | Revised By: |           | Date: |
| Checked By:                    | Date: 1/06      | Checked By: |           | Date: |





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|                | tw = 9.     | 525 mm   | 1           |           |   |           |  |           |
| BD21/01 4.3    | 5hw = 2     | 30 NI    | 7           | 3 mg. an  | 100000000000000000000000000000000000000 |           |  |           |
| 200,000        |             |          |             |           |   |           |  |           |
|                | bw= 198     | 1.2      | 989.8       | 15% - 12  | 7 = 0                                   | 178.64    | 12   |           |
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| Checked By:  | Date: 1/06   | Checked By:            |            | Date:                                    |
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| Balanco  | position.  |                        |            |  |
|  |  |                        |            |  |
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| Top Trans  |  |                        | 2.854      |  |
| Top is how   |  | 970.492                | 2.194      |  |
| Top is ver<br>web (upper   | and the second s |                        | 4.544      |  |
| web (lowe  |  |                        | 4.618      |  |
| Cottom L& M  |  |                        | 1. 796     | 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1 |
| battom Ls h  |  |                        | 2.199      |  |
| button fla   |  | A second to the second | 4.450      |  |
| Deduce   |  |                        | do Cino    |  |
| flange riv   | ets - 2×483.8  |                        | -0.956     |  |
| web rive   | cs - 665.321   | 972.608                | -0.647     |  |
|  |  |                        |            | 555555                                   |
|  |  |                        | 22.857     | MM                                       |
|  |  |                        |            |  |
|  |  |                        |            |  |
|  |  |                        |            |  |
|  |  |                        |            |  |
|  |  |                        |            |  |
|  |  |                        |            |  |
|  |  |                        |            | 1  |



| Project Title:      |               |  |  | Sheet No:   | 4                                    |
|---------------------|---------------|--|--|-------------|--------------------------------------|
| Subject:            |               | SECTION PRO  | PERTIES  | Calc No:    | 68.1                                 |
| Job No:<br>Made By: |               | Transverse e   | firder (TG)  | File:       | R8                                   |
|                     |               | Date: 01/06  | Revised By:  |             | Date:                                |
| Checked By:         |               | Date: 1/06   | Checked By:  |             | Date:                                |
| STEELS IN           |               | *** *** *** ***  | and the state of t |             |                                      |
|                     |               |  |  |             |                                      |
|                     |               | and of a   |  |             |                                      |
|                     | 1 Kansus      | st gilder  |  |             |                                      |
|                     |               |  |  |             | -                                    |
|                     | PA            |  |  |             |                                      |
|                     | 1 不下          | THE STATE OF THE S | 228.6 × 12.7 mm from   | 135 biene   |                                      |
|                     | § 6           | \$8  | .9 x 88.9 x 12.7 Ls  |             |                                      |
|                     | mu)           | 701  | x 9,525 mm web.  |             | imal section loss<br>ted. Site measo |
| N                   | o o           | A Sol  | A 1/5 CS MIR LOUIS   |             | flange thickne                       |
|                     | 7             | 88.0   | 1×88.9×12-71>  | 6.2         | 13 mm : - Use                        |
|                     |               | 19.05 MW   | Ø rivets-  | 05          | iginal 1/2 (12                       |
|                     | ¥             |  | - 228.6 × 12.7 mm from   | ye vilabe   | plate thickness                      |
|                     | 72            | 8.6 mas  |  |             |                                      |
|                     | K             | 7  |  |             |                                      |
| p. 14-15            | Superandura   | of cachina ara   | perties from BEU   | 1           |                                      |
|                     |               |  |  |             |                                      |
|                     | A= 1747       | 9.806mm2 (   | 19112:865 mm W   | ith rivets) |                                      |
| - Hamilton          |               |  |  |             |                                      |
|                     | ÿ= 218.8      | 822 MM   |  |             |                                      |
|                     | IN = 47       | 60,63577 mm4   |  |             |                                      |
|                     | 1 7 7 7 7 7 7 | 200224 4 MM  |  |             |                                      |
|                     | Iv + 46       | 305543 mm  |  |             |                                      |
|                     |               |  |  |             |                                      |
|                     | Z top = 2     | 537950 mm3   |  |             |                                      |
|                     |               |  |  |             |                                      |
|                     | 400k = 2      | 2175575 MM3  | 1 j  |             |                                      |
|                     |               |  |  |             |                                      |
|                     |               |  |  |             |                                      |
|                     |               |  |  |             |                                      |
|                     |               |  |  |             |                                      |
|                     |               |  |  |             |                                      |
|                     |               |  |  | 1-1-1.      |                                      |
|                     |               |  | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  |             |                                      |
|                     |               |  |  |             |                                      |
|                     |               |  |  |             |                                      |
|                     |               | · · · · · · · · · · · · · · · · · · ·  | THE RESERVE TO SERVE THE PROPERTY OF THE PROPE |             |                                      |



| Project Title:                          |                |                   |                   | Sheet No:         | 5         |
|---|----------------|-------------------|-------------------|-------------------|-----------|
| Subject:                                |                | SECTION PROPE     | RTIES (TG)        | Calc No:          | 68.1      |
| Job No:                                 |                | ,                 | ,                 | File:             | R8        |
| Made By:                                | D              | Date: 01/06       | Revised By:       |                   | Date:     |
| Checked By:                             | D              | Pate: 1/06        | Checked By:       |                   | Date:     |
| *************************************** |                |                   |                   |                   |           |
|   | Plackie sech   | ton propulties    |                   |                   |           |
|   | 4140 (84)      | s of equal are    |                   |                   |           |
|   |                |                   |                   | The second second |           |
|   | Top lay        | nge + angles 8    | Ma = 2903 22      | + 4838            |           |
|   |                |                   | = 7741.9          | 4 www             |           |
|   | Bolton of      | iange + angles    | - rivers = 771    | +1.92 -           | 967-74    |
|   |                |                   | -66               | 5 - 37.2          |           |
|   |                |                   | 610               | 8-9381            |           |
|   | Web=           | 3629 075 MM       | [4]               |                   |           |
|   |                |                   |                   |                   |           |
|   | 771            | 41.92 - 6108      | .888 = 1633.0     | 62 mm2            |           |
|   | 1428           | 043               |                   |                   |           |
|   | 196            | 096 - 95          | 25 = 85.73 m      | W # NOV           | e way way |
|   |                | 4                 |                   |                   |           |
|   | 4061           | + + 85.73 =       | 288,93 mm ab      | ove poor          | 044       |
|   |                |                   |                   |                   |           |
|   | Epe is 1st     | movent of and     | a about axis of e | and an            | 48.       |
|   | Element        | A (mm²)           | 1 4(mm) 1         | Ay (x10           | 6 MM 81   |
|   |                |                   |                   |                   |           |
|   | Top Hange      | 2903.22<br>2260.6 | 11).12            | 0.222             |           |
|   | too is vert    | 1935.48           | 53.97             | 0.104             |           |
|   | web (upper)    | 1665.72           | 87.434            | 0.46              |           |
|   | neb / lower    | 1963.31           | 103.061           | 0.202             |           |
|   | Dob Lis ver    | 1935.48           | 155,322           | 0.300             |           |
|   | bob his hor    | 7260.6            | 199.772           | 0.452             |           |
|   | bottom frange. | 2903.22           | 212.472           | 0.617             |           |
|   | Dedoct         |                   |                   |                   |           |
|   | flange rivets  | -967.74           | 206.127           | 0.199             |           |
|   | web rivet      | - 665.321         |                   | 3.103             |           |
|   |                |                   |                   |                   | 1.06 3    |
|   |                |                   |                   | 2.667             | 410° mm3  |



| Project Title:   |                |                 | Sheet No:       | 6                     |
|------------------|----------------|-----------------|-----------------|-----------------------|
| Subject:         | SECTION PR     | OPERTIES (TG)   | Calc No:        | 68.1                  |
| Job No:          |                |                 | File:           | R8                    |
| Made By:         | Date: 01/06    | Revised By:     |                 | Date:                 |
| Checked By:      | Date: 1/06     | Checked By:     |                 | Date:                 |
| Checked By:      | ation of trans | - 28×9.525      | / 355           |                       |
|                  | 406 4 - 218.   | 822-12-4=       | 176 23<br>7 331 |                       |
| 9.3.7.3 Jange (  | Tto VOUR       | = 7×12.7/-      | 355<br>230      |                       |
| b <sub>4</sub> = |                | 2.4 - (88.4-17. |                 | = 63.5 MM<br>\$ 10.45 |
|                  | PENELSEE GRED  | ER IS A COMPA   |                 |                       |

# CALCULATION COVER SHEET

### Jacobs Reading

|  |  |            |             |              |              |             | ricau          | 9      | - manufacture |
|--|--|------------|-------------|--------------|--------------|-------------|----------------|--------|---------------|
| Project Title: BRB (Residuary) Ltd - Major Works 2004/2007 Calc. No.: 68.2 |  |            |             |              |              |             |                |        |               |
| Job No:  | No: J24110HQ File: R8                          |            |             |              |              |             |                |        |               |
| Project I  | ct Manager Subject: AGB/5 - BD21/01 assessment |            |             |              |              |             |                |        |               |
| Designe  | r  |            |             |              | Fenton Bri   | dge / Aberl | ady Gullane    | Branch |               |
| Project (  | Group  | 314        | 00          |              | Section ca   | pacities    |                |        |               |
|  |  |            |             |              |              |             |                |        |               |
|  | Total<br>Sheets                                | Made       | Date        | Checked      | Date         | Reviewed    | Date           |        |               |
|  | Sneets   | by         |             | by           |              | by          |                |        |               |
| Original   | 10   |            | Jan-06      |              | Jan-06       |             |                |        |               |
| Rev  |  |            |             |              |              |             |                |        |               |
| <b>3</b> ∨   |  |            |             |              |              |             |                |        |               |
| Rev  |  |            |             |              |              |             |                |        |               |
| Rev  |  |            |             |              |              |             |                |        |               |
| Rev  |  |            |             |              |              |             |                |        |               |
|  |  |            |             | JI.          |              | 4           |                |        |               |
| Supersede  | d by Calculati                                 | on No.     |             |              | Date         |             | and the second | 200.00 |               |
| For desi   | ign criteria                                   | , refer to | Approval in | Principle (F | Form AA) doo | cument      |                |        |               |
|  |  |            |             |              |              |             |                |        |               |
|  |  |            |             |              |              |             |                |        |               |
|  |  |            |             |              |              |             |                |        |               |
|  |  |            |             |              |              |             |                |        |               |
|  |  |            |             |              |              |             |                |        |               |

| Project Title: |                        |                                 |                               | Sheet No:     | 7        |
|----------------|------------------------|---------------------------------|-------------------------------|---------------|----------|
| Subject: AGB/  | 5 ~ SECTI              | ON CAPACITIES                   | s (Ma)                        | Calc No:      | 68.7     |
| Job No:        | - a                    | ]                               | ( , , , ,                     | File:         | Ro       |
| Made By:       |                        | Date: 01/06                     | Revised By:                   | 4             | Date:    |
| Checked By:    |                        | Date: 1/06                      | Checked By:                   |               | Date:    |
|                |                        |                                 |                               |               | 100      |
|                | M                      |                                 |                               |               |          |
|                | Tan (P                 | arapet) girder                  |                               |               |          |
|                | 4- Hame 8              | iction is provid                | ed at gusset p                | olate connec  | hous     |
|                | only, which            | h is applicable                 | to every connec               | hon @ 1.2     | 19 c/cs  |
|                | beneate t              | a compression                   | ARMAR IS DOUBL                | 14 1 2 20     |          |
|                | connected              | to a stillene                   | lange is provid               | tore 1        |          |
|                | BD56/96 9.,            | 6.5 and BDS                     | 6/96 9112.2 34                | ply.          |          |
| 2056/20 12 15  |                        | - (-+ 15)                       | o.25 but not le               |               |          |
| 3056/96 9.6.5  | LE = 15                | K3 ( E36 K4 0)                  | out hot u                     | as chan lu    |          |
|                | T . Ks = /             | At for unrestra                 | sined beams at                | supports      |          |
|                |                        |                                 |                               |               |          |
| Eucales p.9    | 14-                    | 12.84×10"+                      | 2×3.455 ×10° =                | 19.55 × 109 h | 1M       |
|                | lu=                    | 1219 mm                         |                               |               |          |
|                |                        |                                 |                               |               |          |
|                | $\delta = \frac{1}{2}$ | d <sup>3</sup> uBd <sup>1</sup> | + f d,                        |               |          |
|                |                        |                                 |                               |               |          |
|                | q <sub>1</sub>         | = (78-11-18                     | 1 - 2 - /2 × 25               | .4 + 154      | 3.05 mm  |
|                |                        | ,                               |                               |               |          |
|                | 02                     | = (48 - 14 - 15                 | 2 - 2 - 2) × 25               | 4 = 1+40      | 5.25 MWA |
|                |                        |                                 |                               |               |          |
|                |                        | A A A                           |                               |               |          |
|                | 78.783                 | 76.2×12-71                      |                               |               |          |
|                | 79.47                  | 0.41                            | 57.4×46.2×                    | 12.7 mm       |          |
|                |                        | <b>+</b>                        |                               |               |          |
|                | 1472                   |                                 |                               |               |          |
|                | 中十                     | 4-11-14-                        | =                             |               |          |
|                | H                      | 139 mm > 9.                     | 525mm place                   |               |          |
|                |                        |                                 |                               | ν,            |          |
|                |                        | a= (1943,05)                    | 98 ·2 × 2·5)+ 4.              | 5 = 6.45      |          |
|                | 3 ->                   |                                 |                               |               |          |
|                |                        | of conec in                     | eset projection ember and cov | demuten to    | ange     |
|                | 4-31                   | 11.                             | 5 - 6.45 12 -                 | 5.69/1-12     | 43.      |



| Project Title: |                  |                           | Sheet No:                         | 8                                  |
|----------------|------------------|---------------------------|-----------------------------------|------------------------------------|
| Subject:       |                  | (MG)                      | Calc No:                          | 68.2                               |
| Job No:        |                  |                           | File:                             | R8                                 |
| Made By:       | Date: 01/06      | Revised By:               |                                   | Date: 02/06                        |
| Checked By     | Date: 1/06       | Checked By:               |                                   | Date: 3/06                         |
|                |                  | r T                       | : .                               |                                    |
| I, = (\52      | 4×34,925 1/17    | (12.7×139 <sup>3</sup> )/ | •                                 |                                    |
|                |                  | + (12.7 ×.76.23)          |                                   |                                    |
|                | 541019.56 + 11   |                           | #3                                |                                    |
| : 1            |                  |                           |                                   |                                    |
| 80             |                  | 1873041-415               |                                   |                                    |
|                | 17.53 XID6       | mm4                       |                                   |                                    |
| No concrete    | deck present     |                           |                                   |                                    |
| p. 2   Iz      | = 1476 × 10 6 mm | Cq.                       |                                   |                                    |
| 4=0.5          |                  |                           |                                   |                                    |
| B = 26         | = 7924 8         | nn                        |                                   |                                    |
| £ = 0.9        | 5710-4 rad / KN  | m = 0.5 × 10              | rad / N                           | mun                                |
|                |                  |                           |                                   |                                    |
| RT/CE/6/025    |                  |                           |                                   |                                    |
| 7-9-442        | (Or top cleat    | th                        | onnection<br>rough<br>p or bottom | f<br>×10 <sup>-4</sup><br>RAD/kNm. |
|                | unsumened)       | fla                       | nge                               | 0.5                                |
|                |                  |                           |                                   | 0.5                                |
|                |                  |                           |                                   |                                    |
|                |                  |                           |                                   |                                    |
|                | 3                |                           |                                   |                                    |
|                | 1543.05          |                           | 8 × 1746                          | 25                                 |
| 3 ×            | 205× 1753×10     | 205 × 47                  | 5 ×10 9                           |                                    |
|                | 0 S ×10-4 × 171  | +6.2\$ <sup>2</sup>       |                                   |                                    |
| 5 = 3          | 000341+00        | 000124 + 0.00             | 0152=                             | 0000617                            |



| Project Title: |                     |  | Sheet No:  | 9           |
|----------------|---------------------|--|------------|-------------|
| Subject:       |                     | M.G  | Calc No:   | 68.2        |
| Job No:        |                     |  | File:      | RS          |
| Made By:       | Date: 01/06         | Revised By:  |            | Date: 02/06 |
| Checked By     | Date: 1/06          | Checked By:  |            | Date: 3/06. |
| . , •          |                     |  |            |             |
|                |                     |  |            |             |
|                | 6 = 0.0006 17 mm    | (N   |            |             |
|                |                     |  |            |             |
|                | le= 1 ×1.0 × (20500 | 0 × 19.55 ×10 5 × 1  | 219 x 000  | 00617)      |
| 1              | = 4146 mm           |  |            |             |
|                |                     |  |            |             |
| 9.9.1.3        | MD = Zxc Oil or     | ZXEOYE   | / lesser o | 4           |
|                | om of               | 8m 843   | one bu     |             |
|                |                     |  |            |             |
| 6              |                     |  |            |             |
| y y            | ec)                 |  |            |             |
| 9.7.2          | λ47 = € K47         | <u> D</u>  |            |             |
|                |                     |  |            |             |
|                | le =                |  |            |             |
|                | / 1                 | 1748×106   |            |             |
| SW-1           | 13 = / Evy =        | 34435.415  | = 46.      | 6 m         |
|                |                     |  |            |             |
|                |                     | 40.2   | 5          |             |
|                | Ky = 4-Zpe          | (上载) 10.2  |            |             |
| :              | A                   | The state of the s |            |             |
|                | A                   |  |            |             |
|                |                     |  |            | 0.35        |
|                | = 4 × (2 2.8        | 57×109 (1- 10  | (22)       |             |
|                |                     |  | - Z        |             |
|                |                     | 35.4 x 1968.   |            |             |
|                |                     |  |            |             |
|                | = 0.819             |  |            |             |
|                |                     |  |            |             |
|                |                     |  |            | ,           |
|                |                     |  |            |             |



| Project Title:        |   |                     | Sheet No:  | 10          |
|-----------------------|---|---------------------|------------|-------------|
| Subject:              |   | (MG-)               | Calc No:   | 68.2        |
| Job No:               |   | 1                   | File:      | Ro          |
| Made By:              | Date: 01/06   | Revised By:         |            | Date: 02/06 |
| Checked By            | Date: 1/06  | Checked By:         |            | Date: 3/06. |
|                       |   |                     |            |             |
| $\eta =$              | 10  |                     |            |             |
|                       |   |                     |            |             |
| $\mathbb{D}_{\gamma}$ |   |                     |            |             |
| ,                     | h= le (te)  |                     |            |             |
|                       |   |                     |            |             |
|                       | ry D/   |                     |            |             |
|                       | 1116/3  | 22.6                |            |             |
|                       | - Charles and the Charles and |                     | 1.02       |             |
|                       | 46.6 \ 1  | 981.2/              |            |             |
|                       |   |                     |            |             |
|                       | L= TC+IE  |                     |            |             |
|                       | 104-6   |                     |            |             |
|                       | It = 47584  | 126 may 4 +         | = 12643030 | 4           |
|                       |   |                     | 12343030   | W1W1        |
|                       | L= 12643030   | 03201               |            |             |
|                       |   | 0232156             |            |             |
|                       | = 0.21  |                     |            |             |
|                       |   |                     |            |             |
| Table 9               | 2= 1.5  |                     |            |             |
|                       |   |                     |            |             |
|                       | = 4146 ×0   | 210                 | -          |             |
| $\lambda_1$           | $=\frac{4146}{46.6}\times0$   | 819 × 1.0 ×         |            |             |
|                       |   |                     |            |             |
|                       | = 109.3   |                     | -          |             |
|                       |   |                     |            |             |
|                       | 0 yc = 230 N/   | mmit                |            |             |
|                       |   | <b>-</b>            |            |             |
|                       | $\sqrt{\frac{\sigma_{9c}}{359}} = 1$  | $\frac{109.3}{355}$ | = 87.0     | 18          |
|                       | N 359   | / 359               | 5          | <b>4</b>    |
|                       |   |                     |            |             |



| Project Title:   |                        |                 | Sheet No:     | Section of Contracts of Contrac |
|------------------|------------------------|-----------------|---------------|--|
| Subject:         |                        | (ng)            | Calc No:      | 68.2   |
| Job No:          |                        |                 | File:         | R8   |
| Made By:         | Date: 01/06            | Revised By:     |               | Date: 02/06  |
| Checked By:      | Date: //06             | Checked By:     |               | Date: 3/06.  |
|                  |                        |                 |               |  |
| figure 10 Ozi    | 5yc = 0.54             |                 |               |  |
| O'e:             | = 0.54 × 7.30          |                 |               |  |
| 9.83 Doz         | 2 y <sub>E</sub> = 198 | 51 2 × 124.2    | /<br>2×989.85 | В  |
|                  | 12.4                   | +. 2 Nmm 5 0 xc |               | Ti   |
| BD21. 3.10 8/3 = |                        |                 |               |  |
| table 2 8m=      | 1.2 (compres           | on) = 1.05      | (tension)     |  |
| M=               | 19388170×12            |                 |               |  |
|                  | 1824 KN.N              |                 |               |  |
| M=               | 19417237 x 2           | 230 ×10-6       |               |  |
|                  | 3866 kw m              |                 |               |  |
| Mp =             | 1824 KN.N              | 1               |               |  |
|                  |                        |                 |               |  |
|                  |                        |                 |               |  |
|                  |                        |                 |               |  |



| Project Title:   |  |               | Sheet No:     | 12.  |
|--|--|---------------|---------------|--|
| Subject:   | 18   | (MG)          | Calc No:      | 68.7   |
| Job No:  |  |               | File:         | 128  |
| Made By:   | Date: 01/06  | Revised By:   |               | Date:  |
| Checked By   | Date: 1/06   | Checked By:   | _             | Date:  |
|  |  |               |               |  |
| shear cas  | pacitiu  |               |               |  |
| Name of the second seco | (Institute of the Control of the Con |               |               |  |
| 99.2.2 Vp=   | - I two w-hi   | )   -   -     |               |  |
| 99.2.2   |  |               |               |  |
|  | - Om 843   |               |               |  |
|  |  |               |               |  |
|  | w= 9.525 mm  |               |               | And the state of t |
| d  | WF 1955.8 M  | M             |               |  |
|  |  |               |               |  |
| y  | n=0  |               |               |  |
|  |  |               |               |  |
| R.   |  | 230           | ,             |  |
|  |  | 10/           | .74 N/n       | 1m2  |
|  | J \/3  | V3            |               |  |
|  |  |               |               |  |
|  | P = Idwe   | due = 195     | 5.8 - (2×8    | 9) + 1717 8  |
|  |  | 111           |               |  |
|  | a= 4;  | ×12×25,4 - 2× | 82.55 =       | 1054.1 mm  |
|  | 4-17   |               | 02.53         | 1034,171   |
|  | 050  |               |               |  |
|  | P= 171/1   | 7778 = 0      | ).59          |  |
|  |  |               |               |  |
|  |  | . 2           |               |  |
|  | mfw = Byt Dre  |               |               |  |
|  | 20jwdo   | ue tw         |               |  |
|  | h 10   | /355          | 1, 1, 1, 1, 1 | 355  |
|  | b4 = 10  | 14 / 395 E    | 10×17.7       | 250 = 157, 72  |
|  |  | 91            |               |  |
|  | 0r   | 228 6 /2 =    | 1143 mm       |  |
|  | . 1-   |               |               |  |
|  | USE OI   | mallest value | = 14.5M       | <b>M</b>   |
|  |  |               |               |  |



| Job No:  Made By:  Date: 0106 Revised By:  Date:   | Project Title:  | W                                       |  | Sheet No:  | 13            |  |  |
|--|-----------------|---|--|--|---------------|--|--|
| Job No: Made By: Date: 01 06 Revised By: Date: Checked By: Date: 1 06 , Checked By: Date: $1 06 \cdot 106 \cdot 106$ | Subject:        |   | (MG)   |  | Calc No: 68.2 |  |  |
| Checked By: Date: $1 06$ . Checked By: Date: $Mw = 230 \times 114.3 \times 12 \times 2 = 0.00024$ $2 \times 230 \times 1803.2^{1} \times 9.525$ $4 = 230 \times 1803.2^{1} \times 9.525$ $5 = 150.24$ $5 = 150.24$ $6 = 0.78 \times 132.70 = 103.58 \times 10.72$ $1 = 103.58 \times 10.72$  | Job No:         |   | (, , , )   | File:  | R2            |  |  |
| $M_{10} = \frac{230 \times 114.3 \times 12.7^{2}}{2 \times 230 \times 1803.2^{2} \times 9.525} = 0.00029$ $\lambda = \frac{1772.8}{230} \times \frac{1803.2^{2} \times 9.525}{355} = 150.24$ $L_{10} = \frac{1}{10} = \frac{1}{10$  | Made By:        | Date: OUOS                              | Revised By:  |  | ate:          |  |  |
| $2 \times 230 \times 1803.2^{2} \times 9.525$ $1 = \frac{1}{1772.8} = \frac{1}{230} = \frac{150.24}{1772.8}$ $1 = \frac{1}{1772.8} = \frac{1}{355} =$  | Checked By:     | Date: 1/06                              | Checked By:  |  | Date:         |  |  |
| $2 \times 230 \times 1803.2^{2} \times 9.525$ $1 = \frac{1}{1772.8} = \frac{1}{230} = \frac{150.24}{1772.8}$ $1 = \frac{1}{1772.8} = \frac{1}{355} =$  |                 |   |  |  |               |  |  |
| $2 \times 230 \times 1803.2^{2} \times 9.525$ $1 = \frac{1}{1772.8} = \frac{1}{230} = \frac{150.24}{1772.8}$ $1 = \frac{1}{1772.8} = \frac{1}{355} =$  |                 | nu = 230 × 114                          | 3 12 72  |  |               |  |  |
| $V_{2} = 0.78 \times 132.70 = 103.58 \times 10^{3}$ $V_{3} = 0.78 \times 132.70 = 103.58 \times 10^{3}$ $V_{3} = 0.78 \times 132.70 = 103.58 \times 10^{3}$ $V_{3} = 0.78 \times 132.70 = 103.58 \times 10^{3}$  |                 |   | es de la company | - 0,000  | 29            |  |  |
| Use figure 11 $M_{W} = 0$ $V_{e} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $V_{g} = \int_{0.78}^{0.78} (1455.8-80) \int_{0.78}^{0.78} 103.58 \times 10^{-3}$   |                 | 2/ -00 / / 18                           | 003.2 741323   |  |               |  |  |
| Use figure 11 $M_{W} = 0$ $V_{e} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $V_{g} = \int_{0.78}^{0.78} (1455.8-80) \int_{0.78}^{0.78} 103.58 \times 10^{-3}$   |                 | due 100                                 | 1 1777 0   | 1230   |               |  |  |
| Use figure 11 $M_{W} = 0$ $C_{e} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $C_{e} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $C_{e} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $C_{e} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $C_{e} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $C_{e} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $C_{e} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$   |                 | 7= 1                                    | and the second s | A PROTECTION OF THE PROTECTION | = 150,24      |  |  |
| $V_{g} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $V_{g} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $V_{g} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $V_{g} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $V_{g} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$   |                 |   | 2 4,263 4  |  |               |  |  |
| $V_{g} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $V_{g} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $V_{g} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $V_{g} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$ $V_{g} = 0.78 \times 132.70 = 103.58 \text{ N/mm}^{2}$   |                 |   | Ли   |  |               |  |  |
| $V_{g} = 0.78 \times 132.74 = 103.58 \text{ Almm}^{2}$ $V_{h} = 19525 (14558-80) 1 103.58 \times 10^{-3}$ $V_{h} = 103.58 \times 10^{-3}$  |                 | Use Eigure !!                           | /1/ /w = 0   |  |               |  |  |
| $V_{g} = 0.78 \times 132.74 = 103.58 \text{ Almm}^{2}$ $V_{h} = 19525 (14558-80) 1 103.58 \times 10^{-3}$ $V_{h} = 103.58 \times 10^{-3}$  |                 |   |  |  |               |  |  |
| $V_{g} = 0.78 \times 132.74 = 103.58 \text{ Almm}^{2}$ $V_{h} = 19525 (14558-80) 1 103.58 \times 10^{-3}$ $V_{h} = 103.58 \times 10^{-3}$  |                 | 1 = 0.78                                |  |  | <b>_</b>      |  |  |
| $V_{g} = 0.78 \times 132.74 = 103.58 \text{ Almm}^{2}$ $V_{h} = 19525 (14558-80) 1 103.58 \times 10^{-3}$ $V_{h} = 103.58 \times 10^{-3}$  |                 | 1 Ty                                    |  |  | 1986          |  |  |
| For each p. 43. $h_1 = 80 \text{ mm}$ $V_D = \int \frac{9.525}{1.7} \left( \frac{1955}{1.7} \cdot 8 - 80 \right) \int \frac{103.58}{103.58} \times 10^{-3}$  |                 |   |  |  |               |  |  |
| V3= [ 9525 (1455 8-80)] 103.58 ×10=  |                 | Ce = 0.78 x                             | 132.79 = 103   | 3-58 A   | 1/mm2         |  |  |
| V3= [ 9525 (1455 8-80)] 103.58 ×10=  | BELLevies P.43. | hn = 80mm                               |  |  |               |  |  |
| 1.7 * 1.   |                 | 2                                       | erce & son 7   |  | 4             |  |  |
|  |                 | VD = 1                                  | 1970 007 10  | 3.28 ×10.  |               |  |  |
| = 1401 KN  |                 | 1 . 4                                   |  |  |               |  |  |
|  |                 | ANNO ANNO ANNO ANNO ANNO ANNO ANNO ANNO |  |  |               |  |  |
|  |                 | TAUIRN                                  | ordinanta on   |  |               |  |  |
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| Project Title: |   |               | Sheet No:  | 14     |
|----------------|---|---------------|------------|--------|
| Subject:       |   | 76            | Calc No:   | 68.2   |
| Job No:        |   |               | File:      | R8     |
| Made By:       | Date: 01/06                                       | Revised By:   |            | Date:  |
| Checked By:    | Date: 1/06  | Checked By:   |            | Date:  |
|                | Internal guder (tran                              | sverse)       |            |        |
| 9.9.1.3        | MD = Zpe Ozc<br>dm 863                            |               |            |        |
| 0.7.2          | Dec, 24 = le K4 12                                |               |            |        |
|                | Top frange is bully therefore le =0               | vestrained by | buchtle    | plots. |
| figure 10      | 50/0yc = 10                                       | -) J2 = 23    | 0 × 10 = 5 | 30     |
| 9.8.2          | 5ec = 5e1 = 2                                     | 30            |            |        |
|                | $M_{\rm D} = 2.66 \pm \times 10^6$ 1.2 \times 1.1 | × 230 × 10-6  |            |        |
|                | = 464.7 KD.                                       | vu -          |            |        |
|                |   |               |            |        |
| 13, 100        |   |               |            |        |
|                |   |               |            |        |
|                |   |               |            |        |
|                |   |               | - un.      |        |



| Project Title:   |  |                 |   | Sheet N      | lo: 15          |
|--|--|-----------------|---|--------------|-----------------|
| Subject:   |  | 70              |   |              | 68.2            |
| Job No:  |  |                 |   | File:        | RS              |
| Made By:   | Date   | : 01/06         | Revised By:                             | ·            | Date:           |
| Checked By:  | Date   | : 1/06          | Checked By:                             |              | Date:           |
|  |  | ` `             |   |              |                 |
| and the state of t | Internal gire  | or - show       | Love Capa                               | citu         |                 |
|  |  |                 |   |              |                 |
| 9,9,2.2  | V <sub>2</sub> = [   | tw (dw +h       |   |              |                 |
| 1, 1, 1, 1, 2  | The state of the s | tw (dw th       | 4) (                                    |              |                 |
|  |  |                 |   |              |                 |
|  |  |                 |   |              |                 |
|  |  | 1.525 mm        |   |              |                 |
|  | hh =   |                 |   |              |                 |
|  |  |                 |   |              |                 |
|  | $\sim$   |                 |   |              |                 |
|  | T <sub>e</sub>   | 75 = 050        | 230                                     | =  32:79 1   |                 |
|  | The state of the s | 13 1/3          | 1/3                                     | - 132. + I N | IMM             |
|  | The second secon |                 | V 2                                     |              |                 |
|  |  | 0= 3/           | due = 3                                 | 381 - /2×1   | 01.6) = 177.8 m |
|  |  | aw              |   |              |                 |
|  | The state of the s | a - (227"       | × 25 1.) -                              | (2×713)      | = 8051,8 mm     |
|  |  | 9 343           | 22.3                                    | ( + 0.4)     | - OUDI, S MM    |
|  |  | φ= 8051.        | 8/                                      | = 45.29      |                 |
|  |  | ψ=              | 177.8                                   | - 49.29      | Conservative _  |
|  |  |                 |   | 111          |                 |
|  | M  | w = 5y4<br>20yw | ble Cf                                  |              | 10000           |
|  |  | 20 yw.          | due bw                                  |              |                 |
|  |  |                 |   |              | 1 200           |
|  |  | bye = 101       | of \355 =                               | 10 × 12 7    | 355 = 157 78 MI |
|  |  |                 | 1001                                    | V            | 230             |
|  |  |                 | *************************************** |              |                 |
|  |  | 0*              | 278.6/2                                 | = 1143m      | M               |
|  |  |                 | 1 1 1 1                                 |              |                 |
|  |  | U               | se smallest                             | 11 = susv    | 4.3mm           |
|  |  |                 |   |              |                 |
|  |  |                 |   |              |                 |
|  |  |                 |   |              |                 |

# CALCULATION COVER SHEET

### Jacobs Reading

| Project T  | itle:   | BRB (Res                                | siduary) Ltd | d - Major W           | orks 2004/20                            | 007            | Calc. No.: | 68.3  |    |
|------------|---|---|--------------|-----------------------|---|----------------|------------|-------|----|
|            | Job No: J24110HQ                                    |   |              |                       |   | File: R8       |            | THE W |    |
|            | Project Manager Subject: AGB/5 - BD21/01 assessment |   |              |                       |   |                |            |       |    |
| Designer   |   |   |              |                       | Fenton Bridge / Aberlady Gullane Branch |                |            |       |    |
| Project G  | iroup   | 31400                                   |              |                       | Dead loads                              |                |            |       |    |
|            |   |   |              |                       | 100000                                  | 1              |            |       |    |
|            | Total<br>Sheets                                     | Made<br>by                              | Date         | Checked               | Date                                    | Reviewed<br>by | Date       |       |    |
| Original   | 3   |   | Jan-06       |                       | Jan-06                                  |                |            |       |    |
| Rev        |   | 190000000000000000000000000000000000000 |              |                       |   |                |            |       |    |
| j∌v        |   |   |              |                       |   |                |            |       |    |
| Rev        |   |   |              |                       |   |                |            |       |    |
| Rev        |   |   |              |                       |   |                |            |       |    |
| Rev        |   |   |              |                       |   |                |            |       |    |
|            |   |   |              |                       | Date                                    |                |            |       |    |
| Superseded | by Calculation                                      | on No.                                  | en-          | 138 MIN W 37 - 18 - 6 | Date                                    |                |            | 2     |    |
| For desig  | ın criteria   | , refer to A                            | pproval in I | Principle (Fo         | orm AA) doc                             | ument          |            |       |    |
|            |   |   |              |                       |   |                |            |       |    |
|            |   |   |              |                       |   |                |            |       |    |
|            |   |   |              |                       |   |                |            |       |    |
|            |   |   |              |                       |   |                |            |       |    |
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|            |   |   |              |                       |   |                |            |       |    |
|            |   |   |              |                       |   |                |            |       | 61 |
|            |   |   |              |                       |   |                |            |       |    |



| Project Title:                        |   |             | Sheet No:                             | 16    |
|---------------------------------------|---|-------------|---------------------------------------|-------|
| Subject:                              |   | TG          | Calc No:                              | 68.2  |
| Job No:                               |   | , **        | File:                                 | R8    |
| Made By:                              | Date: 01/06                             | Revised By: | · · · · · · · · · · · · · · · · · · · | Date: |
| Checked By:                           | Date: 1/06                              | Checked By: |                                       | Date: |
|                                       |   |             |                                       |       |
| M                                     | = 230×1143                              | X 1/2-72    | 000                                   |       |
| l lw                                  | 7 x 7 30 x 1 7 1                        | * 12.72 =   | U-U31                                 |       |
|                                       |   | 7           |                                       |       |
| \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ | we / Osw =                              | 778 /230    | = 15                                  |       |
| 1                                     | w V 355                                 | 9.525 / 355 |                                       |       |
|                                       |   | *           |                                       |       |
| tique                                 | e 14 => Ta/T                            | = 10        |                                       |       |
|                                       | 7 / 7                                   | <b>Y</b>    |                                       |       |
|                                       |   | 39 N/100 2  |                                       | +     |
|                                       | Ti= T, = 132                            | 79 N/mm2    |                                       |       |
|                                       | [ c == ( 781 = 0°                       | 4           |                                       |       |
| V <sub>3</sub> =                      | 9.525 381-0                             | × 132.70    |                                       |       |
|                                       | 1.2 7 1.1                               |             |                                       |       |
|                                       | 365 KN                                  |             |                                       |       |
|                                       | AND |             |                                       |       |
|                                       |   |             |                                       |       |
|                                       |   |             |                                       |       |
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|                                       |   |             |                                       |       |
|                                       |   |             |                                       |       |
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|                                       |   |             |                                       |       |
|                                       | <u> </u>                                |             |                                       |       |



| Project Title:   |              |  |  | Sheet No:                               | -          |
|------------------|--------------|--|--|---|------------|
| Subject: AGB /   | Calc No:     | 68.3   |  |   |            |
| Job No:          |              |  |  | File:                                   | 28         |
| Made By:         |              | Date: 01/06  | Revised By:  |   | Date:      |
| Checked By:      |              | Date: 1/06   | Checked By:  |   | Date:      |
|                  |              |  | N THE STREET   | 1 · · · · · · · · · · · · · · · · · · · |            |
|                  | Dead load    | s - Transverse   | dider  |   |            |
|                  |              |  |  |   |            |
| BEU COICS D.10   |              | rolgirder =  | and the control of th |   |            |
| 8 १-५८           | verge seit   |  |  |   |            |
|                  |              | y self weight =  |  |   |            |
|                  | fill self we | mag/F  |  |   |            |
|                  |              |  | = 0.804 KN/M   |   |            |
|                  | SUCKUE Plan  | e self weight =  | 9.200 1001001  |   |            |
| BD21/01 bable 3. | Apply 84     | = 1.05 ( Steel a)  | roller + t-seahon + B  | while pla                               | ite)       |
|                  | Xes          | = 1.2 ( 611 3  | nd vergel  |   | 7          |
|                  | 84           | = 1.75 / Maci  | 3 clam)  |   |            |
|                  |              |  |  |   |            |
|                  | factored de  |  |  |   |            |
|                  |              |  | 1 × 1.05 + 10.   | 811X1'S                                 |            |
|                  |              | = 15.22 KM   | Mr. (UDL 1)  |   |            |
|                  |              |  |  |   |            |
|                  |              | 1.604 x 1.2 =  | 1.9248 FJ/m (UDI   | - 5 0 8 6                               | 3) Laher   |
|                  |              | 1.103 x 1.75 =   | 193 KN/m (UDL  | 9                                       | Durole was |
|                  |              | 0.206 × 1.05 =   | 0.2163 NW (PLG   | (3)                                     |            |
|                  |              |  |  |   |            |
|                  | - A 13       | 0.2163 0.2163 0.21   | 163 0.263 0.263  | -                                       |            |
|                  |              | Annual Control of the | D=15.22 hw/m   | £                                       |            |
|                  | 193 100      |  | 1 = 1.43 W/M UPL 3   | ~1.93 h                                 | ilm        |
|                  | W/m 115      |  | And the second s |   |            |
|                  |              | *  | *  |   |            |
|                  | YA <         | 7.92   | > 10   | Y8                                      |            |
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|                  | Expensed     | Max Dw ge w  | lid-open due to.   | Symme)                                  | My .       |
|                  |              |  |  | 9                                       |            |
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| Project Title:                        |   |               | 10.00  | Sheet No:  | 19.                 |
|---------------------------------------|---|---------------|--|--|---------------------|
| Subject:                              |   | _             |  | Calc No:   | 68.3                |
| Job No:                               |   |               |  | File:  | RS                  |
| Made By:                              |   | Date: 01/06   | Revised By:  |  | Date:               |
| Checked By:                           |   | Date: 1/06.   | Checked By:  | • • •  | Date:               |
|                                       |   |               |  |  |                     |
|                                       |   | 0.2163 0216   | 3 0203 0.21  | 63   |                     |
|                                       |   |               | 132 1132 11  | . OK Lf  |                     |
|                                       |   |               |  | 1-15.22+1.93   |                     |
|                                       | \ \\  | A 6.7         | ,74m   | 1  |                     |
|                                       | renergias de la constitución de |               |  |  |                     |
|                                       | point loa   | applied on    | external gir   | der = Va   |                     |
|                                       |   |               |  |  |                     |
|                                       | VAY 6.3   | 3711 = (15.17 | +193 × 6.324   | $^{2} + 0.263 \times (1.1)$  | 044+2-364+3.684+5.0 |
|                                       |   |               | 7  |  |                     |
|                                       | VA = 50   | 9.2 KN =      | = 76.  |  |                     |
|                                       |   |               |  |  |                     |
| E4 (8 15 D 10                         | self who  | f extend a    | vdov = 20  | 917 KN/m.  |                     |
| 9.6.3                                 | 13:   | MIN = LVIB    |  |  |                     |
|                                       |   | J 55 14.      | N (TZ) (TZ)  | 7  |                     |
|                                       | 50  | 7 2 68.5      |  | >  |                     |
|                                       | A   | 1 1           | L V  | 13   |                     |
|                                       |   | ,             |  | 7-2.917  | talm                |
|                                       | VA T0,953   | 7 1.22   1.22 | 1.22 1.22  |  |                     |
|                                       |   |               |  | 10.447 VB  |                     |
|                                       |   |               |  |  |                     |
|                                       | Max BM t  | specied at T  | 3 .  | A STATE OF THE STA |                     |
|                                       | Reaction  | \ Va          |  |  |                     |
|                                       |   |               |  |  |                     |
|                                       | VA =  | 2.917 ×8 /2 + | · 59.2 × 7.043   | + 68.5 0.967+2.  | K7+3,381+4.607      |
|                                       | VA =  | 200 W         |  | +5-8   | 277                 |
|                                       |   |               |  |  |                     |
|                                       | M = V   | AX 4.617 - 5  | 9.2 × 3.66 -   | 68.5 × 2.64  | +122 1-2.417 ×4.61  |
|                                       |   | 466.48 KNN    | The state of the s |  | 1111111             |
|                                       |   | -100. 40 PN.W |  |  |                     |
| A A A A A A A A A A A A A A A A A A A | Max sh  | ean at suppo  | 1- B   |  |                     |
|                                       |   |               |  |  |                     |
|                                       | V8 = 1  | 2.917 x8 + 5  | 54.2+5×68  | ,5 - 209 =   | 216.0 kg            |

# CALCULATION COVER SHEET

Jacobs Reading

| Project T  | itle.   | BRR (Res    | iduary) I to | d - Major W   | orks 2004/2                             | 007            | Calc. No.:   | 68.4           |      |
|--|---|-------------|--------------|---------------|---|----------------|--------------|----------------|------|
| Project Title: BRB (Residuary) Ltd - Major Works 2004/2007  Job No: J24110HQ |   |             | File:        | R8            |   |                |              |                |      |
|  | Project Manager Subject: AGB/5 - BD21/01 assessment |             |              |               |   |                |              |                |      |
| Designer   |   |             |              | - Cuojoon     | Fenton Bridge / Aberlady Gullane Branch |                |              |                |      |
| Project C  |   | 31400       |              |               | Live loads                              | ago / / 150110 | iay danano i | Branon         |      |
| i rojour c   | aroup   | 01400       |              |               | LIVE IOUGE                              |                |              | 75 % A A A     |      |
|  | Total<br>Sheets                                     | Made<br>by  | Date         | Checked<br>by | Date                                    | Reviewed<br>by | Date         |                |      |
| Original   | 4   |             | Jan-06       |               | Jan-06                                  |                |              |                |      |
| Rev  |   |             |              |               |   |                |              |                |      |
| JV   |   |             |              |               |   |                |              |                |      |
| Rev  |   |             |              |               |   |                |              |                | -    |
| Rev  |   |             |              |               |   |                |              |                | Tall |
| Rev  |   |             |              |               |   |                |              |                |      |
|  |   |             |              |               |   |                |              |                |      |
| Superseded   | by Calculation                                      | in No.      |              |               | Date                                    |                |              |                |      |
|  | gn criteria,  | refer to Ap | proval in I  | Principle (Fo | orm AA) doc                             | ument          |              |                |      |
|  |   |             |              |               |   |                |              |                |      |
|  |   |             |              |               |   |                |              |                |      |
|  |   |             |              |               |   |                |              |                |      |
|  |   |             |              |               |   |                |              |                |      |
|  |   |             |              |               |   |                |              | and the second |      |



| Project Title:        |               |                | Sheet No: | 20    |
|-----------------------|---------------|----------------|-----------|-------|
| Subject: AGB/5 - Live | loading : Ext | cernal girder. | Calc No:  | 68.4  |
| Job No:               |               |                | File:     | KS    |
| Made By:              | Date: 61/06   | Revised By:    |           | Date: |
| Checked By            | Date: 1/06    | Checked By:    |           | Date: |

|           | Carriageway width = 7.925 - 2×1.55 = 4.825m  |
|-----------|--|
| table 5.1 | 1 Notional lane is applied   |
|           | Notional lane width = 2.5 m  |
|           |  |
|           | 1.55 4.825 c/w 1.55  |
|           |  |
|           | $R_1$ $+$ $\frac{2.5m}{2.5m}$ $\frac{3.845m}{2.5m}$ $R_2$  |
|           |  |
|           | $R = \omega(3.875 + \frac{2.5}{2}) = 0.65\omega$   |
|           | 7.925  |
|           | Edge girder I takes up to 65% of live load   |
|           |  |
|           | Loaded length = effective span = 8000mm  |
|           | HA Udl = 336 (1/8)0.67 = 83.42 km/m  |
|           | HA Kel = 120 KU  |
|           | Adjustment factor = 3.65/2.5 = 1.46  |
|           | Adjusted HA load offect (bending)  |
|           |  |
|           | $= \begin{pmatrix} 83.42 \times 8^{\circ} + 120 \times 8 \end{pmatrix} \times = 621.85 \text{ tw.m}$ |
| lig 5,7   | Load reduction factor K for low HG-V flow and good road  |
| U         | condition = 0.76   |
|           | Bridge specific HA load effect with relat mid-span   |
|           | = (83,42 X82   120x8.0) x 0.76 = 472.6 km.m  |
|           | 8 4 / 7.46   |
|           |  |



| Project Title:                          |  |                  | Sheet No:  | 21                             |
|---|--|------------------|--|--------------------------------|
| Subject:                                |  |                  | Calc No:   | 68.4                           |
| Job No:                                 |  |                  | File:  | R8                             |
| Made By:                                | Date: 01/06  | Revised By:      |  | Date: 02/06                    |
| Checked By:                             | Date: 1/06.  | Checked By:      |  | Date:                          |
|   |  |                  |  |                                |
|   | Factored live load   |                  |  |                                |
| Table 3.1                               | = 472,6×1.5 =  | 708 9 HAINA      |  |                                |
|   |  |                  |  |                                |
|   | 65% is carried by a  | ach edge girder  |  |                                |
|   | 708.9× 0.65 = 1  | 460.79 WM        |  | Adjusted HA live               |
|   |  |                  |  | = 460.79/pm 0                  |
|   | = Ultimate live  | coad morrent.    |  | = 606.3 rw.w                   |
|   |  |                  |  |                                |
|   | Maximum shear force.   |                  |  |                                |
|   | 100000   |                  |  |                                |
|   | = (83.42 × 8 + 2   | 120   ×0.76      | x 0.57 x 1.5   | Adjusted HA L<br>Shear Boredge |
|   |  | 1 / 1            |  | = 244.8/0.4                    |
|   | = 294.8 KN   |                  | The state of the s | 388KN                          |
|   |  |                  |  |                                |
|   | live loadings: Transs  | nevel girden     |  |                                |
| Table D1                                | 11-5 tonne axle > 11   | 5×4.81 = 112.8 h | ( Critical   | axle                           |
| D                                       |  |                  |  |                                |
|   | Apply impact factors   | of to chucal as  | 10 3 1.0×112   | ·8 = 20 S.104 T.N              |
|   | 101.5 101.5  |                  |  |                                |
|   | A 4 4 4  | A                |  |                                |
|   | 3.1 1.8  | 3.1              |  |                                |
|   | <b></b>  | I I I            |  |                                |
| 1 | ta=16  |                  |  |                                |
|   |  |                  |  |                                |
|   | $M = \begin{pmatrix} 101.5 \times 3.1 \times 4.9 \\ 7.925 \end{pmatrix}$ | -x 2× 3.9625)    | x 1.5  |                                |
|   | 7.925  | 4.9              |  |                                |
|   | = 472 ku   | n at midspa      | M  |                                |
|   |  |                  |  |                                |
|   | INVENTED TO STATE  | ot 1.45 from     | A CEL TO   | I IS S CO I                    |



| Project Title: |                                  |  | Sheet No: | 22          |
|----------------|----------------------------------|--|-----------|-------------|
| Subject:       |                                  |  | Calc No:  | 684         |
| Job No:        |                                  |  | File:     | RS          |
| Made By:       | Date: 01/06                      | Revised By:  |           | Date: 02/06 |
| Checked By:    | Date: 1/06                       | Checked By:  |           | Date:       |
|                |                                  |  |           |             |
| 5              | hear:                            |  |           |             |
|                | 101.5 101.5<br>1.55m 1.8m 4.5725 |  |           |             |
|                |                                  | m  |           |             |
| A              |                                  | B  |           |             |
|                |                                  |  |           |             |
|                |                                  |  |           |             |
|                | er force at A                    |  | -         |             |
| V =            | 101.5 × (7.925-1.53) +           | (4.925-3.38  | 31        |             |
| (Linux)        |                                  | 7.925  | 1         |             |
|                | = 140.24 th.                     |  |           |             |
| Ma             | in (paraper) girder              |  |           |             |
| p.11 Bending   | section capacity                 |  | 1824 KN.W | 1           |
| p.19           | Dead Load moment                 | PARAMETERS - PROCESSES   | 466.48 KN | .u.         |
|                | Live Load capacity               | Name of Street, Street | 1358 KN.  | M           |
| p.21           | Applied 40t alle                 | Hech =   | 460.19 KN | m           |
| D.16 Shear:    | section capacity                 | Affairspi<br>Augusta   | 1401 KN.  |             |
| p.19           | Dead Load shear                  |  | 216.0 hN  |             |
|                | Line Load capacity               | - Section of the sect | 1185 KN   |             |
| p.21           | Applied 44t a. 1.11              |  | 294.8 KW  |             |
|                | live load varing: Be             | ending =   | 40 tonnes |             |
|                | y sı                             | rear =   | 40 bonnes |             |
|                |                                  |  | - Comment |             |



| Project Title: |            |                     |  | Sheet No:         | 22 A        |
|----------------|------------|---------------------|--|-------------------|-------------|
| Subject:       |            |                     |  | Calc No:          | 684         |
| Job No:        |            |                     |  | File:             | 15.8        |
| Made By:       |            | Date: 01/06         | Revised By:  |                   | Date: 02/06 |
| Checked E      |            | Date: 1/06          | Checked By:  |                   | Date:       |
|                |            |                     |  |                   |             |
|                | Internal   | (Transverse         | ) girder   |                   |             |
| P.14 Bending   | Section    | capacity            | Mentalinity<br>Signification   | 464.7             | kw.m        |
|                | Dead Lo    | ad moment           | equantities (  | 135,925           | tw.m        |
|                | Line Lo    | and capacitu        |  | 328.775           | tw.m        |
| p.21           | Applied    | 40 tallel           | ect =  | 472 KN. see below |             |
| Shuar :        | section    | capacity            |  | 365 tu            |             |
|                | Dead L     | oad shear           |  | 68,5 KJ           |             |
|                | Live ho    | ad capacity         | and the second s | 296.5 KW          |             |
| SW 16          | Applied    | 40 a. 1.1 eff       | ed =   | 140.24 to         |             |
|                |            | live los            | d reliny =   | 40 tonnes         |             |
| Table DZ       | A.L.L leve | 1 of 7.5 bannes     | gives axe is   | ad of 6.06        | onvs        |
|                | ⇒ Apply    | impact facts        | or = 6.0×9   | 61 × 1.8 = 10     | 5.948 tw    |
|                |            | 53 53               |  |                   |             |
|                |            |                     |  |                   |             |
|                |            |                     |  |                   |             |
|                | M = (      | 53×3.1×4.9<br>7.925 | × 2×3.962  | 5 × 1.5           |             |
|                | = 21       | 16.45 Kum           | ₹ 328-77   | \$                |             |
|                |            |                     | rating for t   |                   |             |

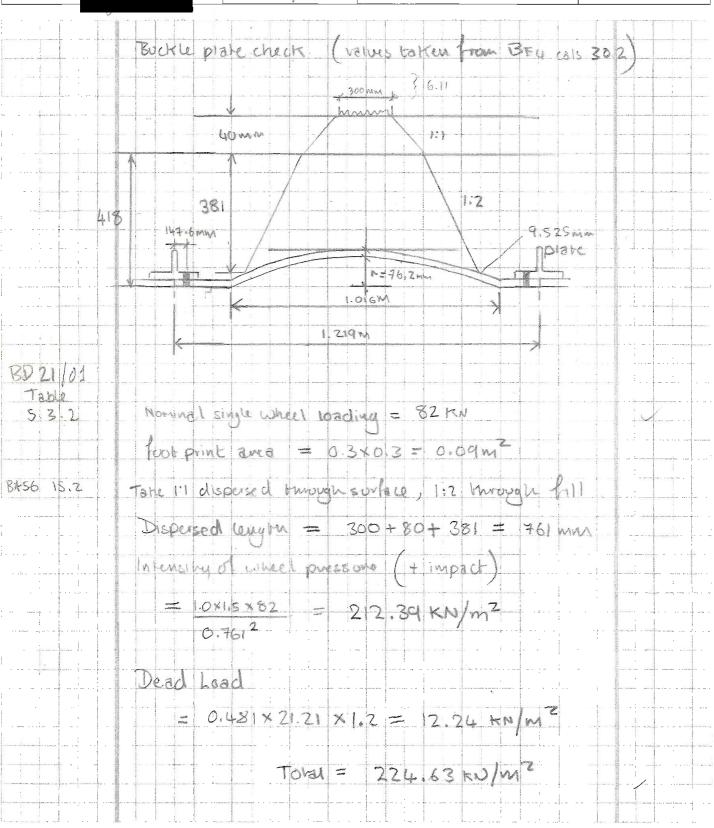
## CALCULATION COVER SHEET

#### Jacobs Reading

|  |                 |            |               |               | Torran .    |                | 11044   | N. S. Y.  |  |
|--|-----------------|------------|---------------|---------------|-------------|----------------|---------|-----------|--|
| Project Title: BRB (Residuary) Ltd - Major Works 2004/2007 Calc. No.: 68.5 |                 |            |               |               |             |                |         |           |  |
| Job No:  | J24110I         | HQ         |               |               |             |                | File:   | R8        |  |
| Project N  | Manager         |            |               | Subject:      | AGB/5 - BI  | D21/01 ass     | essment |           |  |
| Designer Fenton Bridge / Aberlady Gullane Branch                           |                 |            |               |               |             |                |         |           |  |
| Project (  | Group           | 3140       | 00            |               | Buckle pla  | te and rivet   | s check |           |  |
|  |                 |            |               |               |             | 7              |         | 1         |  |
|  | Total<br>Sheets | Made<br>by | Date          | Checked<br>by | Date        | Reviewed<br>by | Date    |           |  |
| Original   | 4               |            | Jan-06        |               | Jan-06      |                |         |           |  |
| Rev  |                 |            |               |               |             |                |         | Laz Reuli |  |
| ev   |                 |            |               |               |             |                |         |           |  |
| Rev  |                 |            |               |               |             |                |         |           |  |
| Rev  |                 |            |               |               |             |                |         |           |  |
| Rev  |                 |            |               |               |             |                |         |           |  |
| For desi   | gn criteria     | , refer to | Approval in I | Principle (F  | orm AA) doo | cument         |         |           |  |
|  | 100000 p. s.    |            |               |               |             |                |         |           |  |



| Project Title:                  |             | Sheet No: | 23.   |
|---------------------------------|-------------|-----------|-------|
| Subject: AGB/S: Buck le plate c | hech        | Calc No:  | 68.5  |
| Job No:                         |             | File:     | Ro    |
| Made By: Date: 01/06            | Revised By: |           | Date: |
| Checked By: Date: 1/06          | Checked By: |           | Date: |





| Project Title: |             |             | Sheet No: | 24    |
|----------------|-------------|-------------|-----------|-------|
| Subject:       |             |             | Calc No:  | 68.5  |
| Job No:        |             |             | File:     | 188   |
| Made By:       | Date: 01/06 | Revised By: |           | Date: |
| Checked By:    | Date: 1/06  | Checked By: |           | Date: |

| BASG 15.2 Take intensity of wheel pressure at the plake as   |  |
|--|--|
|  |  |
| occuping the full span of the place for calculation  | - !  |
| of thast.  |  |
|  |  |
| Trust = WL = 224.63 × 1.219  | -4   |
| 8× 8×0.0762  |  |
| 0"   |  |
| ) 5/7.76 Live  |  |
| = 547,6 KD/m } 29.8 Dead-  |  |
|  | 1  |
| take plate to be acting as a shut with effective   |  |
| Take plate to be some as a sing with expense   | de m   |
| rengin extending from the end of the spain to the  |  |
| inversaction point with the wheel distribution   |  |
|  |  |
|  |  |
| Je= 1.016 - 0.761 = 0.128m   |  |
|  |  |
|  |  |
| Radius of gyrahion for plate:  |  |
|  | The second secon |
| BEU(216, 30.2 = 0.108 in = 2,7432 mm   |  |
| DEG (8102 30 C) 1 = 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  | menter — 1 .   |
| aladed and a second a second and a second and a second and a second and a second an |  |
| Stenderness ratio  | cel P <sub>la</sub>  |
|  |  |
| V = 128 = 46.66<br>2.7432  |  |
| 2.7432   | - i - i - i - i - i - i - i - i - i - i  |
|  |  |
| 15D56 10.6.1 PD = Ae Oc  |  |
| 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7  |  |
| 013  | 1  |
|  |  |
| $A_{c} = \sum K_{c} (K_{n} A_{c})$   |  |
|  |  |
|  |  |
| Vigure 36 to   |  |
| $\lambda = \frac{1}{5} \sqrt{\frac{51}{355}} = \frac{1}{3}$  |  |
| ↑  |  |
|  |  |
| b= 1.219 -(2 x 0.1476) = 0.924 m   |  |
|  |  |
| t= 9.525 mm  |  |
|  |  |



| Project Title: |                                       |                            | Sheet No: 25   |
|----------------|---------------------------------------|----------------------------|----------------|
| Subject:       |                                       |                            | Calc No: 63.5  |
| Job No:        |                                       |                            | File: R8       |
| Made By:       | Date: 0 \ 106                         | Revised By:                | Date:          |
| Checked By:    | Date: 1/06                            | Checked By:                | Date:          |
|                | $\frac{924}{4.525} / \frac{230}{355}$ | = 78.08                    |                |
|                | corve 1 > K=                          |                            |                |
| A = -          | 0.375 in /n                           | = 9525 mm                  | /mm vun        |
| Kn =           | 1.0                                   |                            |                |
| Ae             | = 0.48 (1.0×9.5                       | 2\$) = 4.572               | mm²/mm non     |
| Table 2 8m     | = 1.2 , 843 =                         | 1.1                        |                |
| 06,            | λ= 46.66 × /                          | 230 = 37.56<br>366 = 37.56 | 2              |
|                | r/y = 27432/                          | 4.7625 = 0.576             | i use curve B. |
|                | SE/09 = 0.8                           | \$8                        |                |
|                | : 5= 0.88 x                           | 230 = 202.4 N              | /mm2           |

202.4 × 4.572

: place is satisfactory

701.04 > 547.6

701.04 KN



| Project Title: |           |               |                   | Sheet No:  | 26                  |
|----------------|-----------|---------------|-------------------|------------|---------------------|
| Subject: AGB   | 15 : Buc  | xu plate riv  | ers check         | Calc No:   | 68.5                |
| Job No:        |           |               |                   | File:      | 778                 |
| Made By:       |           | Date: 01/06   | Revised By:       |            | Date:               |
| Checked By:    |           | Date: 1/06    | Checked By:       |            | Date:               |
|                |           |               |                   |            |                     |
|                | Check ri  | vers connecti | My Buchie plate a | nd tersec  | hons                |
|                | Thrust    | from prate    | = 547 6 RU/W      | 1          |                     |
| Bencales P63   |           | igner = "     |                   |            | (52.6 Line          |
|                | shear or  | n rivel = E   | 6 x 0.1016 =      | 55.64      | KN 3.0 Dead         |
|                | River d   | liameter =    | 19.05 mm          |            |                     |
| 14.5.3.4       |           | V > 5a        | 843 12            |            |                     |
|                | n<br>A    |               | = 0.85 x230= 195  | 1 1 1      | Assuming hourd      |
|                | ļ.        |               | 195.23 N/mm²      |            | driven vivets/      |
|                | 50 843 1  | 193.          | 2 4 1-1           |            | 100 /rivels         |
|                | 195       | 23 > 104      | 173 rivers feir   | in she ar. | for 40 bonne bading |
|                | Max t     |               | 73 x 285 = 29     |            |                     |
|                | Total loa |               | 18 × 8×0.076      |            | N/M = 120.52 kN/m   |
|                | 200       |               | ad = 120.52 - 17  |            |                     |
|                | 100       |               | oad ng = 108.28 x |            |                     |



|  | Date:   Date  | Project Title: |  |                  |                    | Sheet No:  | 2 7       |
|--|---|----------------|--|------------------|--------------------|--|-----------|
| Job No:    Made By:  | books by:  Date: $OI/OG$ Revised By:  Date: $OI$  | Subject: AGB   | 15: te   | e section the    | LCK                | Calc No:   | 685       |
| Checked By:  Date: 1)06 Checked By:  Date:  Table 5.3.2 41 hw A.L.L. effect for 7.5 tonne loading 5.0 Dea  Connecting Ts (152.4 × 76.2 × 9.525 MW)  1.32m  1.32m  Applied dead load = 12 24 kJ/m² × $\frac{1}{2}$ × 1.219 × 1.32   | Date: 1) 06 Checked By: Date:  Table S. 3.2 441 fm A. L. L. effect for $7.5$ from the loading $26.3$ Live $3.0$ Dead  Connecting Ts (152.4 x 76.2 x 9.525 MM)  1.32m 1.32m 1.32m 1.32m 1.32m 1.32m 1.32m 1.32m  |                |  |                  |                    | File:  | R8        |
| Table 5.3.2 41 tw A.L.L effect for 7.5 tonne loading 26.3 Liv 30 Dex  Connecting Ts (152.4 x 76.2 x 9.525 MM)  1.32m  1.32m  Applied dead load = 12 24 KJ/m² x /2 x 1/219 x 1/32   | Table S. 3.2 41 km A L.L effect for $7.5$ honne loading $\frac{26.3}{5.0}$ Dead  Connecting Ts $(152.4 \times 76.2 \times 9.525)$ MM)  1.32m  1.32m  Applied dead load = $\frac{12}{24}$ Response $\frac{1}{24}$  | Made By:       |  | Date: 01/06      | Revised By:        |  | Date:     |
| S.3.2 41 hw A.L.L offect for 7,5 tonus loading 30 Dea<br>Connecting Ts (152.4 × 76.2 × 9.525 MM)  1.32m  1.32m  Applied dead load = 12 24 N/m² x /2 × 1.219 × 1.32   | S.3.2 41 th A.L.L. effect for $7.5$ tonne loading $\frac{20.5}{3.0}$ Dead  Connecting Ts ( $152.4 \times 76.2 \times 9.525$ MM).  1.32m  1.32m  Applied dead load = $\frac{12}{24}$ MJ/m² × $\frac{1}{2}$ × $1$ | Checked By:    |  | Date: 1/06       | Checked By:        |  | Date:     |
| S.3.2 41 hw A.L.L effect for 7,5 tonno loading 30 Dea  Connecting Ts (152.4 × 76.2 × 9.525 MM)  1.32m  1.32m  Applied dead load = 12 24 NJ/m² x /2 × 1.219 × 1.32  | S.3.2 At his A.L.L effect for $7.5$ tonne loading $\frac{265}{50}$ Dead  Connecting Ts ( $\frac{152.4 \times 76.2 \times 9.525}{1.32m}$ )  1.32m  Applied dead load = $\frac{12.24}{50}$ kN   |                |  |                  |                    |  |           |
| Connecting Ts (152.4 × 76.2 × 9.525 MM)  1.32m  1.32m  Applied dead load = 12 24 M/m² × 1/2 × 1.219 × 1.32   | Connecting Ts (152.4 × 76.2 × 9.525 MM)  1.32m  1.32m  1.32m  Applied dead load = 12 24 M/m² × /z × 1.219 × 1.32  = 9.85 KN   |                | /11 %  | 4 1 2 0 1 1 - 0  | 1 7 6 1            |  | 26.3 Live |
| Applied dead to act = $12.24 \text{ kJ/m}^2 \times 12.29 \times 1.32$  | Applied dead load = $12.24 \text{ kJ/m}^2 \times 12.29 \times 1.32$ $= 9.85 \text{ kN}$   | 3.2            | 411 100  | A.C.C errect     | 10, 10 1000 A      | 100011   | J 30 Deed |
| Applied dead toad = $12.24  \text{kJ/m}^2 \times \frac{1}{2} \times 1.219 \times 1.32$   | Applied dead load = $\frac{12}{24} \frac{24}{12} \frac{1}{12} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{3} \times \frac{1}{2}$ $= 9.85 \text{ kN}$   |                |  |                  |                    |  |           |
| Applied dead toad = $12.24  \text{kJ/m}^2 \times \frac{1}{2} \times 1.219 \times 1.32$   | Applied dead load = $\frac{12}{24} \frac{24}{12} \frac{1}{12} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{3} \times \frac{1}{2}$ $= 9.85 \text{ kN}$   |                |  |                  |                    |  |           |
| Applied dead load = $12.24 \text{ kJ/m}^2 \times 12.19 \times 1.32$  | Applied dead load = 12 24 N/m² x /z x 1,219 x 1,32 = 9.85 KN  |                | Comectino  | 7 Ts (152        | .4 × 76.2 × 9.52   | s MM)  |           |
| Applied dead load = $12.24 \text{ kJ/m}^2 \times 12.19 \times 1.32$  | Applied dead load = 12 24 N/m² x /z x 1,219 x 1,32 = 9.85 KN  |                |  |                  | 1.27.4             |  |           |
| Applied dead load = 12 24 kJ/m² x /2 x 1.219 x 1.32  | Applied dead load = 12 24 KJ/m² x /2 x 1.219 x 1.32<br>= 9.85 KN  |                |  |                  | 11.34.4            |  |           |
| Applied dead load = 12 24 kJ/m² x /2 x 1.219 x 1.32  | Applied dead load = 12 24 KJ/m² x /2 x 1.219 x 1.32<br>= 9.85 KN  |                | X  |                  |                    |  |           |
| Applied dead load = $12.24 \text{ kJ/m}^2 \times 12.24  k$ | Applied dead load = 12 24 KJ/m² x /2 x 1/219 x 1/32 = 9.85 KN   |                |  |                  |                    |  |           |
| Applied dead load = $12.24 \text{ kJ/m}^2 \times 12.24  k$ | Applied dead load = 12 24 N/m² x /2 x 1,219 x 1,32<br>= 9.85 KN   |                |  |                  |                    |  |           |
| Applied dead load = 12 24 kJ/m² x /2 x 1.219 x 1.32  | Applied dead (pad = 12 24 HJ/m² x /2 x 1.219 x 1.32 = 9.85 KN   |                |  | $\times$         |                    | and the state of t |           |
|  | = 9.85 kn   |                |  |                  |                    |  |           |
|  | = 9.85 kn   |                |  |                  |                    |  |           |
|  | = 9.85 kn   |                |  |                  |                    |  |           |
|  | = 9.85 kn   |                | The second secon |                  |                    |  |           |
| = 985 KN   |   |                | Applied du   | rad load =       | 12 24 KJ/m2 x /2 x | 1.219 x 1  | ,32       |
|  |   |                |  | compan<br>Access | 985 KN             |  |           |
|  | Eucales DIII 26.6 Acidus = 10.446 x 0.005 x 1.510 = 0.188 KM  |                | 5/19   |                  |                    |  |           |

1.5×82 = 123 KN wheel load = 9.85+123+0.188 = 20.27 KNM 1.53 Dead

Assume section is Non-compact 8.74 live Zxx = Ztop = 069in3 = 11.31x103mm3 BE4 COLC 30,2 = 3.125 (m3 = 51, 2 x10 mm)3

0.56

### ALCIII ATION SHEET



| Project Title:     |                             |  | Sheet No:  | 28       |
|--------------------|-----------------------------|--|--|----------|
| Subject:           |                             |  | Calc No:   | 68.5     |
| Job No:            |                             |  | File:  | Rø       |
| Made By:           | Date: 01 (06                | Revised By:  |  | Date:    |
| Checked By:        | Date: 1/06                  | Checked By:  |  | Date:    |
|                    |                             |  |  |          |
| 9.9.1.3 Mo=        | 2x 52 01                    | Zxt Oye  |  |          |
|                    | 8m 8f3                      | Zxt OyE<br>8m 843  | The state of the s |          |
|                    |                             |  |  |          |
|                    | is the lesser of            | the bus  |  |          |
|                    |                             |  |  |          |
| E E A              | are rivered into 1          | puchle plates an   | d ave su   | vrounded |
| ey (4)             |                             |  |  |          |
|                    | le = 0,                     |  |  | 77       |
|                    | X1 = 0                      |  |  |          |
|                    |                             |  |  |          |
| > O <sub>4</sub> ; | 100 = 10                    |  | the control of the co |          |
| 1 5 5hi            | = 230 N/mm2                 |  |  |          |
| 983 Do.            | 3.1×25.4×2                  | 20 6000  |  |          |
|                    |                             | entransportunita   | 8 Ope  | = 230    |
| 24                 | 2×0.56×                     | 29.4   |  |          |
| ·                  | 5/6 = 230 N/M               | w <sup>2</sup>   |  |          |
|                    |                             |  |  |          |
| Ma                 | $= 51.2 \times 10^3 \times$ | 230 + 8  | .92 K  | J.M      |
|                    | 1.1 × 1.2                   | HECK STREET TO SEE BEVOLUDE OF STREET OF STREE |  |          |
| or                 |                             |  | -  |          |
|                    | 10 = 11.31 ×103 ×           | 230 - 1  | 97 KA  | J.W.     |
|                    | 1,1 × 1/2                   |  |  |          |
| <                  | Mr = 1.97 K                 | J.M. J.  |  |          |

Modifing moment applied in accordance with the recommendation of sacrobs FE analysis of buckle plates (Nov os) revised moment = 20.27/6 = 3.38 KN.M

1974 3.38 1. NOT ON & back calculate



| Project Title: |   | Sheet N               | o: 29 .        |
|----------------|---|-----------------------|----------------|
| Subject:       |   | Calc No               | 685            |
| Job No:        |   | File:                 | F8             |
| Made By:       | Date: 01/06                                       | Revised By:           | Date:          |
| Checked By:    | Date: 1106  | Checked By:           | Date:          |
| M = 6 X 1.5    | 1 money = 1.0<br>17 = 11.82 tw. n<br>102d = 11.82 | x 8 = 9,85-0,188 =    |                |
| Max mowinal    | wheel load =                                      | 45 10 (=16            | ). 3 KN,M)     |
|                |   | v a 41 KN nominal sty | ie wheel load. |
|                |   |                       |                |
|                |   |                       |                |
|                |   |                       |                |
|                |   |                       |                |
|                |   |                       |                |
|                |   |                       |                |
|                |   |                       |                |
|                |   |                       |                |
|                |   |                       |                |
|                |   |                       |                |

# CALCULATION COVER SHEET

Jacobs Reading

|            |  |               |   |   |                |                | neat    | anig |                |
|------------|--|---------------|---|---|----------------|----------------|---------|------|----------------|
| Project *  | Project Title: BRB (Residuary) Ltd - Major Works 2004/2007 Calc. No.: 68.6 |               |   |   |                |                |         |      |                |
| Job No:    | J24110   | HQ File: R8   |   |   |                |                |         |      |                |
| Project I  | Manager  |               |   | Subject:                                | AGB/5 - BI     | D21/01 ass     | essment |      |                |
| Designe    | r  |               |   | Fenton Bridge / Aberlady Gullane Branch |                |                |         |      |                |
| Project (  | Group  | 3140          | 31400 Addendum calculations: Accidental Wheel loading |   |                |                |         |      | ading          |
|            |  |               |   |   |                |                |         |      |                |
|            | Total<br>Sheets  | Made<br>by    | Date  | Checked<br>by                           | Date           | Reviewed<br>by | Date    |      |                |
|            |  |               |   |   |                |                |         |      |                |
| Original   | 2  |               | Feb-06  |   | Feb-06         |                |         |      |                |
| Rev        |  |               |   |   |                |                |         |      |                |
| ev         |  |               |   |   |                | 4              |         |      |                |
| Rev        |  |               |   |   |                |                |         |      |                |
| Rev        |  |               |   |   |                |                |         |      |                |
| Rev        | - Commence   |               |   |   |                |                |         |      |                |
|            |  |               |   |   | Date           |                |         |      |                |
| Caporocaci | by Calculati   | OH 140x       |   |   |                |                |         |      |                |
| For desi   | gn criteria  | , refer to    | Approval in   | Principle (F                            | orm AA) doo    | cument         |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
| <br> }     |  |               |   |   |                | 34             |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
|            |  |               |   |   |                |                |         |      |                |
|            |  | In the second |   |   | De La relation |                |         |      | and the second |



| Project Title:   |             |                      |  | Sheet No:      |  |
|------------------|-------------|----------------------|--|----------------|--|
| Subject: A       | GB/S : Acci | dental venic         | 4 loading  | Calc No:       | Addendum 68                            |
| Job No: J        | 24110HQ     |                      |  | File:          | <b>R</b> 8                             |
| Made By:         |             | Date: 02/06          | Revised By:  |                | Date:                                  |
| Checked By:      |             | Date: 3/06           | Checked By:  |                | Date:                                  |
|                  |             |                      |  |                |  |
|                  |             |                      |  |                |  |
|                  |             |                      |  |                |  |
|                  | 72,         |                      |  | R <sub>2</sub> |  |
|                  | 0.114       |                      |  |                |  |
|                  |             | ¥ 1/2                |  |                |  |
|                  |             |                      | 700  |                |  |
|                  |             | 1.8                  | 5.136  |                |  |
|                  | 0.464       | 1.0                  | 3.130  | X              |  |
|                  | % load to   | R.                   |  |                |  |
|                  |             |                      |  |                |  |
|                  | R1 =        | ₩ (5.736+7<br>2 7925 |  | 0.837          |  |
|                  |             | 7,9 4.5              |  |                |  |
|                  | Planuew     | of axle loads        | on dech:   |                |  |
|                  |             |                      |  |                |  |
|                  |             |                      |  |                |  |
|                  |             | 0                    |  |                |  |
|                  |             |                      |  |                | ************************************** |
|                  |             |                      |  |                |  |
|                  |             | Control axle         | The state of the s |                |  |
|                  |             |                      | A Company  |                |  |
|                  |             |                      |  |                |  |
| 3021 Ann<br>D4 8 |             | 81×0,837×1.8         | + 111  |                |  |
| 74 0             |             | 181x0.837            |  |                |  |
|                  |             |                      |  |                |  |
|                  |             |                      |  |                |  |
|                  |             |                      |  | •,             |  |
|                  |             |                      |  |                | 122                                    |
|                  |             | +                    |  |                |  |
|                  |             |                      |  |                |  |
| A A I I I        |             |                      |  |                |  |



| Project Title: |  |                |                       | Sheet No:      | 2                 |
|----------------|--|----------------|-----------------------|----------------|-------------------|
| Subject: A     | CB/5 A   | ccidental He   | hide loading          | Calc No:       | lddenduur 68      |
| Job No: 121    | HIOHQ  |                | J                     | File:          | R8                |
| Made By:       |  | Date: 02 106   | Revised By:           |                | Date:             |
| Checked By:    |  | Date: 3/06     | Checked By:           |                | Date:             |
|                |  |                |                       |                | But in the second |
|                | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | 81.1           |                       |                |                   |
|                |  |                |                       |                |                   |
|                | 4  |                | A                     |                |                   |
|                | 2.2  | 1.8            | 4.                    |                |                   |
|                |  | 1 111          |                       |                |                   |
|                |  | 11.7.20 0      | 11,03,50              | and the second | able 3.1          |
|                | Mondapan   | = 146 ×8 + 8   | 11x22x5.8 x 4<br>8 5. | X1.5.          |                   |
|                |  |                |                       |                |                   |
|                |  | = 572 KN-W     |                       |                |                   |
| calche68       |  |                |                       |                |                   |
| SW 22          | 572 <  | 1358 1.0       | H@ 40 bonnes          |                |                   |
|                |  |                |                       |                |                   |
|                | Shear.   |                |                       |                |                   |
|                | Vandonia -   | 81.1 2 5.8 +   | 146 × 2 = 1:          | 32 KN          |                   |
|                |  | 8              | 140 / 2               |                |                   |
|                | T.,, ,,,,,   | aveler shear c | hacks .               |                | impact            |
|                |  | 7              |                       |                |                   |
| SW 21          | 115 bonus  | corrical axle  | = 203.04 KN           | (11.5 ×        | 3.81.4 (1.8.)     |
| 441            | 101.5  | 101-5          |                       |                |                   |
|                |  | 5.5.5.00       | ₽;                    |                |                   |
|                | 4  | *              | 4                     |                |                   |
|                | 0.464 118  | 574            |                       |                |                   |
|                | 144  |                |                       | <br>: : :      |                   |
|                | shear fire   | at A           |                       |                |                   |
|                | Late 1 to 40 miles and 1 miles |                |                       |                |                   |
| SW+ 22A        | V4 = 1015  | x 7.461 + S    | 5.661 = 168           | X115           | = 252 KN          |
|                |  | 7 425          | 7.925/2-296           | 5 . 0          | K                 |
|                |  |                |                       |                |                   |
|                |  |                |                       |                |                   |